UNIVERSIDADE DE LISBOA
INSTITUTO SUPERIOR TÉCNICO

Careers, Wages, Promotions and Demotions in Sports Industry
Professional Football Players in Portugal

António Sérgio Constantino Folgado Ribeiro

Supervisor: Doctor Francisco Miguel Garcia Gonçalves de Lima

Thesis approved in public sessions to obtain the PhD Degree in Engineering and Management

Pass with Distinction

Jury

Chairperson: Chairman of the IST Scientific Board

Members of the Committee:

Doctor Mário José Gomes de Freitas Centeno, Visiting Full Professor, Instituto Superior de Economia e Gestão, Universidade de Lisboa

Doctor José Rui de Matos Figueira, Associate Professor, Instituto Superior Técnico, Universidade de Lisboa

Doctor Francisco Miguel Garcia Gonçalves de Lima, Associate Professor, Instituto Superior Técnico, Universidade de Lisboa

Doctor Miguel Simões Torres Preto, Assistant Professor, Faculdade de Economia, Universidade de Coimbra

Doctor Fátima Suleman, Assistant Professor, Escola de Ciências Sociais e Humanas do ISCTE, Instituto Universitário de Lisboa

2015

TBW

ABSTRACT

In this work we use a matched employer-employee data set covering the Portuguese private sector to apply research that focuses on the career of top employees, taking the pay ranks in football teams as a special case of the tournament theory.

We want to analyze the possible influence that performance and promotions or demotions have on wages. Consequently, in a first stage, Data Envelopment Analysis (DEA) is used to measure the efficiency of Portuguese Football clubs in the First League for several seasons regarding the wage distribution. It is demonstrated that a higher wage spread tends to be related with an increase in efficiency.

In a second stage and following the study of wages and already knowing their importance for organizations, we examine the relationship between football players' wages and their performance and human capital. We consider minutes played as a performance indicator and we show that sweats pays off. Players who play more minutes earn a wage bonus and those at the top of the effort distribution face a convex relationship, which suggest the setup of an internal tournament.

In a third stage, we want to show if there is an internal progression within teams, or not, for those players who decided to change clubs and leagues or for those o decide to stay in the same club. We look over players' career path and understand how wage rank varies with moves between clubs and leagues.

The last stage is similar to the previous one, but we look for wage levels instead of wage rankings and quantify the wage premiums associated with each step of players' careers.

Keywords: Wages, Careers, Professional Football, Performance, Promotions, Motivation, Incentives, Prize; Tournaments

RESUMO

Neste trabalho usamos dados de empresas e empregados que cobrem o sector privado Português. A pesquisa centra-se na carreira de trabalhadores de topo, considerando os níveis de salários das equipas de futebol como um caso especial da teoria dos torneios.

Assim sendo, este trabalho propõe descrever o efeito que o desempenho e as promoções/despromoções têm nos salários. Numa primeira fase, é o usado o método *Data Envelopment Analysis* (DEA) para medir a eficiência dos clubes de futebol portugueses na primeira liga ao longo de várias épocas desportivas tendo em conta a distribuição de salários. É demonstrado que uma maior dispersão de salário tende a estar relacionada com um aumento da eficiência relativa.

Numa segunda fase, e na sequência do estudo dos salários e sabendo já a sua importância nas organizações, examina-se a relação entre desempenho e capital humano e salários dos jogadores de futebol. Para tal, consideramos os minutos jogados por cada jogador ao longo de uma época como um indicador de desempenho e os resultados mostram que o trabalho recompensa. Jogadores que jogam mais minutos ganham um prémio salarial e os que estão no topo da distribuição apresentam uma relação convexa, o que sugere a implementação de um torneio interno.

Em terceiro lugar, queremos mostrar se existe uma progressão interna, ou seja se a posição relativa de salário dentro da equipa se altera, nos jogadores que decidem mudar de clube e de liga, ou para aqueles que o decidir ficar no mesmo clube. Queremos olhar para o plano de carreira dos jogadores e entender como nível relativo de salário varia de acordo com as mudanças entre clubes e ligas.

A última fase desta dissertação é semelhante à anterior. Desta vez olhamos directamente para as alterações de salário e não para a posição relativa de que os jogadores podem esperar ao longo da carreira.

Palavras chave: Salários, Carreiras, Futebol Profissional, Desempenho, Promoção; Motivação, Incentivos; Prémio; Torneios

Acknowledgements

This work and thesis would not have been possible without the support and encouragement that I received over the last years from numerous people.

First of all, I would like to thank my advisor, Professor Francisco Lima, for the opportunity he gave me of working in something that I really like which allows me to say every days that I love my job. I want also to thank the availability, incentive, friendship and expertise that contribute to my enrichment as a person and researcher. Without him this thesis would have never been possible.

I would also to express my gratitude to Professor Miguel Torres Preto and Professor Miguel Amaral for their contributions as Principal Investigators in the projects that supported my research.

The Center for Management Studies of Instituto Superior Técnico (CEGIST) and the Engineering and Management Department (DEG) provided me all the necessary conditions to develop my research and I would like to share my appreciation.

My gratitude also goes to all the papers reviewers for their helpful comments and recognition of this work. Also to all the researchers that I had the opportunity to share ideas in the conferences attended.

A special thanks to my parents António and Maria José, and to my sister Salomé and niece Maria Clara. Also to my grandparents, brothers-in-law and all my great family for what they have done for me, make me what I am today.

Last but not least, I would like to dedicate this work to my lovely wife Teresa, my little daughter Maria Teresinha and Tété. Their support, tolerance and patience were the source of energy and motivation to realize this work and pursue the dream to make the world a better place to live.

Table of Contents

1. INTRODUCTION 1

1.1. RESEARCH OBJECTIVES 5

1.2. WORK DEVELOPED 9

2. PORTUGUESE FOOTBALL LEAGUE EFFICIENCY AND PLAYERS' WAGES 11

2.1 INTRODUCTION 11

2.2 METHODOLOGY 13

2.3 DATA 15

2.4 RESULTS 20

2.5 CONCLUSIONS 25

3. TOURNAMENTS WITHIN FOOTBALL TEAMS: PLAYERS' PERFORMANCE AND WAGES ..27

3.1 INTRODUCTION 27

3.2 TOURNAMENTS 29

3.3 DATA AND VARIABLES' DEFINITION 34

3.4 EMPIRICAL FRAMEWORK 42

3.5 RESULTS 45

3.6 CONCLUSIONS 51

4. PROFESSIONAL FOOTBALL PLAYERS' MOBILITY AND WAGES: TRANSFERS, PROMOTIONS AND RELEGATIONS 55

4.1 INTRODUCTION 55

4.2 BACKGROUND 57

4.3 HYPOTHESES AND EMPIRICAL STRATEGY 61

4.4 PORTUGUESE FOOTBALL LEAGUES 67

4.5 DATA 69

4.6 MOBILITY AND PAY RANK 74

4.7 Results and Discussion 79

4.8 Conclusions 88

5. Football players' career and wage profiles 91

5.1 Introduction 91

5.2 Theory: Wage Determination 93

5.3 Data on Portuguese Football Leagues 99

5.4 Results and Discussion 108

5.5 Conclusions 115

6. Main Conclusions and implications 117

References 119

List of Figures

FIGURE 2.1 - Variation (difference) in the efficiency rank from Model 1 to Model 2 for clubs with the wage ratio higher than 15 (five higher wages divided by the five lower)**....25**

FIGURE 2.2 - Change (difference) in the efficiency rank from Model 1 to Model 2 for clubs with the wage ratio lower than 15 (five higher wages divided by the five lower)**.....25**

FIGURE 3.1 - Monthly Wage distribution, 2008-2009 Season **.....37**

FIGURE 3.2 - Player's Heterogeneity within Teams and Wages **.....38**

FIGURE 3.3 - Player's Heterogeneity across Teams and Wages **.....39**

FIGURE 3.4 - Minutes Contribution to Log Wage (estimated coefficients from model IV, Table 3.3)**.....48**

FIGURE 4.1 - Distribution of wages between 0 and 50.000€ by league **.....73**

FIGURE 4.2 – Cumulative wage quartile before and after movement **.....77**

List of Tables

TABLE 2.1 – Players' characteristics for 2002-2008 seasons (data from QP) **19**

TABLE 2.2 – League rank and wage ratio for season 2008/2009 (data from QP) **20**

TABLE 2.3 – DEA results with total wages as input and League rank as output **22**

TABLE 2.4 – DEA results with the sum of the five highest wages, five lowest wages and remaining wages as inputs and League rank as output **24**

TABLE 3.1 - The Wage Distribution, 2008-2009 Season **37**

TABLE 3.2 - Players' Descriptive Statistics, 2008-2009 Season **40**

TABLE 3.3 - Wage Equations for Football Players, 2008-2009 Season **46**

TABLE 3.4 - Wage Equation for Football Players, 2008-2009 Season, with Categories for Percentage of Minutes Played **49**

TABLE 3.5 - Ordered Logistic Regression for Wage Quartiles, Marginal Effects **50**

TABLE A1 - Teams, players, and minutes played, 2008-2009 season **53**

TABLE A2 - Correlation matrix for wage, age, tenure, total minutes played and schooling **54**

TABLE 4.1 - Professional and Semi-Professional leagues summary: number of clubs, relegations promotions, and divisions **68**

TABLE 4.2 - Descriptive statistics **71**

TABLE 4.3 - Players changes between 2002-03 and 2009-10 ..... **72**

TABLE 4.4 - Players' wages **73**

TABLE 4.5 – Players' wage quartile after one and two years **78**

TABLE 4.6 – Hazard of changing club or leaving the football market – multinomial logit (odd ratios) **80**

TABLE 4.7 – Hazard of moving to another club across leagues or leaving – multinomial logit (odd ratios) **82**

TABLE 4.8 - Likelihood to enter in a certain wage quartile considering the previous wage quartile and move – ordered logit (marginal effects) **85**

TABLE 4.9 - Likelihood of enter in a certain wage quartile considering the previous wage quartile; move and former club league position in year before move – ordered logit (marginal effects) **87**

TABLE 4.10 - Likelihood of enter in a certain wage quartile considering the previous wage quartile; move and new club league position in year before move – ordered logit (marginal effects) **88**

TABLE 5.1 - Players' descriptive statistics, 2002-2003 to 2009-2010 seasons **102**

TABLE 5.2 - Career events: players' moves between 2002-2003 and 2009-2010 seasons **103**

TABLE 5.3 - Career events across leagues: players' moves between 2002-2003 and 2009-2010 seasons **105**

TABLE 5.4 - Wage change (%) between seasons by career event **106**

TABLE 5.5 - Wage change (%) between seasons by career event and across leagues **107**

TABLE 5.6 - Correlations of wage variation after moves **108**

TABLE 5.7 - Wage growth and career events **111**

TABLE 5.8 - Wage growth and career events across leagues **113**

List of Acronyms

CAED-COST – Comparative Analysis of Enterprise Data

DEA – Data Envelopment Analysis

DEA-CCR – Data Envelopment Analysis based on Charnes, Cooper & Rhodes

DMUs – Decision Making Units

FCT – Fundação para a Ciência e a Tecnologia

FIFA – Fédération Internationale de Football Association

GEP – Gabinete de Estratégia e Planeamento

IASE – International Association of Sports Economists

QP - Quadros de Pessoal

SMS – Strategic Management Society

UEFA – Union of European Football Associations

WEAI – Western Economic Association International

1. INTRODUCTION

Sport organizations are nowadays large business operations associated with the growth of commercial and broadcasting revenues over the last two decades (Deloitte and Touché 2014). The top 20 European clubs revenue reached more than € 5.4 billion in 2012/2013 season and the tendency is to keep growing despite the economic problems felt across Europe. In 2012/2013 season, Portuguese club SL Benfica was the 26th club in Europe in revenue with almost € 110 million. Being one of the most popular sports in European countries, football clubs face the challenge to achieve the objectives defined by the Union of European Football Associations (UEFA) Financial Fair Play concept (UEFA 2009). Clubs managers will be required to guarantee clubs sustainability while at the same time balance the desire of supporters to win trophies instead of reaching profit (Sloane 1971). The disregard of UEFA rules can lead to the exclusion from internationals competitions organized by UEFA, which are responsible to share € 1.34 billion in 2012/13 season, especially in UEFA Champions league which has a significant impact on clubs revenue (Pawlowski *et al.* 2010).

The sports labour market analysis, with the seminal Rottenberg (1956) study on players' labour market and industry organization of baseball competitive balance, offers an opportunity to study issues related with incentives and human capital accumulation. Sport industry is an example in which the organization outcome depends strongly from human capital, in particular, from players' skills. Sports are in theory the case where wages are largely determined by the players' performance, a phenomenon observable by the employer (Kahn 2000).

The thesis proposes to use data from Quadros de Pessoal (QP), a longitudinal matched employer-employee data set with information on Portuguese workers and

firms, collected yearly by the Portuguese government. The QP information is matched with club statistics collected between 2002/2003 and the 2009/10 seasons. During this period, we identify almost 7000 players, an average of more than 800 players each year. The objective is to analyze players' career path, from lower leagues to Portuguese first league and the associated wage profile, before being eventually transferred to other country or even retire from football. Football clubs spend a considerable amount of resources and money, therefore they should seek an optimal pay ranking for inducing effort and further development of individual abilities in order to achieve maximum efficiency.

The management of sport organizations is peculiar since there are few workers, young and highly paid. We start to ascertain the role that pay scales have in team's efficiency. We then proceed to ascertain the relationship between players' performance on wages in the context of tournaments as incentive devices within teams. Assuming that those who perform better are the ones who get higher wages within each team, we use the relative wage of each player in each team to ascertain the player's probability to move to other clubs in the same league or in different leagues, the probability to stay in the same club after the club gets promoted or relegated and the probability to be transferred to a new club in the same league compared with players who stay in the same league and in the same club. Knowing that a player changed his status we use past information to examine players' relative position within the new club. Finally, we inspect the relationship between different career events and the wage progression.

We use Data Envelopment Analysis (DEA) in Chapter 2 of the thesis to measure the efficiency of Portuguese Football clubs in the First League for seasons 2002/2003 to 2008/2009. Clubs spend different amounts of money on their players and use different configurations to achieve their aims for each season. Our first objective is to find out

whether clubs are spending more money than they need to. Our second purpose is to ascertain the relationship between the players' wage distribution and the clubs' efficiency.

Are football players encouraged to constantly improve their performance and to be a regular first choice of the coach? Are wage spreads within teams set to motivate players, as in a rank-order tournament? In Chapter 3, using the Portuguese First League data, we propose to study the relationship between wages and players' performance and human capital during one season.

In Chapter 4, we look to pay ranks changes along players' career path, from lower leagues to Portuguese First League. Should a professional football player expect an internal wage promotion when staying several years in the same club, or should a player leave the club? We estimate the probability of changing clubs conditional on the previous position within the pay ranking. Upon club change, we further estimate the probability of being hired to specific pay rank. With this line of research we aim to answer questions as: Does the current wage profile influence the future wage? A better team now defines better wages in the future?

And what happens to players' salaries when they move to new clubs in the same league or in different leagues? Can a professional football player expect a reward when he changes club? In Chapter 5 we use data on professional football players during eight seasons. The objective is to follow players' careers path and understand associated wage profile.

We aim to go deeper in the study on organizations with the thesis: to test the tournament theory and the wage-career profile. Football clubs spend a considerable amount of resources seeking an optimal pay ranking for inducing effort and further development of individual abilities in order to achieve maximum efficiency. Therefore,

this thesis must be a useful tool for sport organizations decision makers when defining the wage of new players or renewing a contract.

1.1 RESEARCH OBJECTIVES

The initial objective of the doctoral program was to survey the existing results on tournament theory and other theories on incentives within organizations. This objective was also crucial to identify the advantages and disadvantages of the theory and to compare it with other theories on internal labor markets and firm personnel policies.

In their seminal paper, Lazear and Rosen (1981) consider a setting characterized by tournaments. The worker's output is a random variable whose distribution is controlled by the worker himself. Employers may observe output but cannot ascertain the extent to which it is due to investment expenditure, to good fortune, or both. Given this context, a firm cannot base compensation on the effort choices of its workers. Instead, the firm establishes a rank-order tournament. It commits to prizes for the winner and the loser, where the winner is the worker who produces more and the two prizes are independent of the difference between the absolute levels of the outputs. The spread – difference between the winning and losing prizes – serves as an incentive for effort. The equilibrium spread is the one that generates efficient effort levels.

A number of authors have produced empirical studies testing some implications of tournament theory. Ehrenberg and Bognanno (1990a) use data from professional golf tournaments and find evidence consistent with tournament theory's prediction that larger prize gaps induce higher effort, but an alternative explanation of their findings is that the level of prize gaps as opposed to the size of the gaps induces higher effort. Knoeber and Thurman (1994) use data from the broiler chicken and find that effort (the measure of performance used is the weight of chickens) is positively related to the size of prize gaps but independent of the level of prizes. Bognanno (2001) examines aspects of pay and promotion in corporate hierarchies. Evidence supports the tournament

perspective in that most positions are filled through promotion and pay rises strongly with hierarchical level. Furthermore, the winner's prize in the CEO tournament increases with the number of competitors for the CEO position.

Some papers are focused on the prediction that worker's effort should be positively related to the spread. Supportive evidence is found on various papers, such as Becker and Huselid (1992), who study professional NASCAR drivers and Audas, Barmby and Treble (2004) who study promotion at a large British financial employer.

Another line of research focus on predictions concerning firm behavior, namely that the spread or wage increase due to promotion should be positively related to the number of workers at the job level from which the promoted worker is drawn (for example: Main, O'Reilly, and Wade, 1993; Eriksson, 1999). Another prediction concerns the convexity of the wage structure derived in Rosen's (1986) paper, which finds supporting evidence in the work of Lambert, Larcker, and Weigelt (1993) and Eriksson (1999). A third prediction is that tournament-type settings will favor insiders versus outsiders in deciding upon promotions (Malcomson, 1984; Chan, 1996; Waldman, 2003). Oyer (2007) tests this prediction by looking at tenure decisions in economic departments and finds results consistent with it. Recent empirical evidence considers both worker effort and these two firm-side predictions of tournament theory, using a structural estimation approach that treats promotions, wage spreads, and performance as endogenous variables and finds support for both (DeVaro, 2006a, 2006b).

Waldman (2007) and Lazear and Shaw (2007) present recent surveys of these literatures. On the one hand, tournament theory presents some strong positives, such as basic plausibility of the argument and most studies that tested implications of the tournament approach have found supportive evidence. On the other hand, tournament

theory has not been developed in ways that makes clear the extent to which the approach is capable of capturing various internal labor market findings (Baker, Gibbs and Holmstrom, 1994a) such as: early wage increases at one job level predicting subsequent promotions; wage increases upon promotion being small relative to wage differences across adjacent levels, and serial correlation in promotion rates. In this context, during the first part of the doctoral program it was possible to survey and identify of the main characteristics and results on professional sports teams.

The survey QP is mandatory to all private firms with at least one employee. It contains detailed information concerning all employees of each firm, namely: age, education, tenure, wages, occupation, and job level. One of the advantages of the data is that all firms have to use a common definition of job levels. The information for firms includes location, size, age, industry, and sales. The data cover most of the private economy – around two million workers and 300.000 firms on average each year – from 1985 to 2009. Such amount of information was critical for the development of the applied work of the doctoral plan and setup several samples for the research work.

We start to study sports firms as a special case of internal labor market. First we propose an efficiency measure in order to assess whether firms spend more resources than they actually should in search of sports results and to discuss strategies that would improve their results, more specifically with regard to payment schemes (Ribeiro and Lima, 2012). The study demonstrates that a higher wage spread tends to be associated with an increase in clubs' efficiency in the Portuguese First League. The implication is that clubs should structure wages so as to have the optimal pay ranking for inducing player's effort (Chapter 2).

The pay structure of football teams is considered one of the most appropriate settings to test the tournaments theories and other competing theories. Pay is clearly

structured in ranks and these organizations spend a considerable amount of resources in order to have the optimal pay ranking for inducing effort and further development of individual abilities. We got the information at the player level (from First League) and team levels matched with external sources in order to construct measures of performance. Therefore we want to study if performance has any relationship with the wage determination (Chapter 3).

The last objective is to study players' progression and transfers throughout their careers and the impact that some decisions can have on wages within teams and wage growth. The QP allows following the player during a significant part of their career and therefore we can study his career path. We analyze two different issues: the wage internal ranking in each team (Chapter 4) and the wage-career profile (Chapter 5).

The issues analyzed will be a starting point for further research, given the richness of the data at hand. Lazear and Rosen (1981) argue that their results explain the large compensation increases associated with promotions. The idea is that promotions and the associated higher compensation serve as prizes and lower level workers increase their effort to increase the prospects of collecting the prizes. Tournaments only require an ordinal ranking of the workers. The conditions, in which labor-market tournaments are preferable to alternative ways to stimulate workers, when effort is not directly observable, are open to discussion and empirical evaluation. The way incentives are set in a hierarchical structure or in a pay rank (given that in sports, the ranking is synonymous of reward for ability and not necessarily associated with a responsibility level) will shed light on the validity of the tournament theory and provide new paths to further theoretical development. Inducing effort and the acquisition of human capital is one of the major challenges firms (and governments) face today.

1.2 WORK DEVELOPED

At the beginning, the work covered the understanding of the problem and learning how it could be studied and answered. During the last years, the work was presented and lead to one publication in an international journal and seven presentations in international conferences.

A different version of the first work (Chapter 2) is already published in and was presented in the Strategic Management Society Special Conference in Finland and in the CAED-COST conference in the Imperial College Business School. The publication has eight international citations[1].

The second research work (Chapter 3) was presented in one international conference organized by the North American Association of Sports Economists Conference in San Francisco and was submitted to the Economic Inquiry.

The third work (Chapter 4) was presented in five international conferences. We highlight the conference of North American Society for Sport Management and the European Conference in Sport Economics. The target journal to submit the paper is Organization Science. The paper has one international citation[2].

The last work (Chapter 5) was presented in the European Conference in Sport Economics.

The research work presented here benefited from the participation in four research projects supported by Fundação para a Ciência e a Tecnologia (FCT): "The Influence of Higher Education on the Dynamics of Entering and Exiting Entrepreneurship: A Longitudinal Study of Portuguese Business-owners" (ref.

[1] http://scholar.google.pt/scholar?oi=bibs&hl=pt-PT&cites=5963501496537712959

[2] http://scholar.google.pt/scholar?oi=bibs&hl=pt-PT&cites=14056898367332613066

PTDC/ESC/71080/2006); "Minority Groups in Entrepreneurship: A Longitudinal Study for Portugal" (ref. PTDC/EGE-ECO/101493/2008); "Impact of Entrepreneurial Human Capital on Careers, Earnings and Hiring Decisions" (ref. PTDC/EGE-ECO/118070/2010); and lastly "Job polarization within and across firms: skills, organizational change and innovation" (ref. PTDC/IIM-ECO/5123/2012).

Parts of the research results were also disseminated to a wider audience with articles published on-line by invitation on "Football Perspectives" and "Dividida".[3]

[3] http://footballperspectives.org/labour-mobility-effect-wages-professional-footballers-case

http://issuu.com/dividida/docs/revista_dividida__02/65?e=8756434/7427093

2 PORTUGUESE FOOTBALL LEAGUE EFFICIENCY AND PLAYERS' WAGES[4]

2.1 INTRODUCTION

In the past 20 years, football clubs have become more than simple sport organizations – they are large companies with high revenues, associated with the increase of ticket prices, transfer fees and prize moneys. The top 20 European clubs' revenue in 2008/2009 was over € 3.9 billion (Deloitte, 2010)[5]. However, some clubs accumulate losses year after year, which can lead to bankruptcy. Clubs became attractive to stakeholders because most of them are present in the stock market. In Europe, especially in England, clubs are increasingly subject to stock market operations. This requires managing the club as a business, where profit is important, although not always the main goal. There are only three Portuguese clubs in the stock market, nevertheless the new Union of European Football Associations (UEFA) Financial Fair Play concept (UEFA, 2010) will require that European clubs be more rigorous in managing their assets in order to be allowed to play in UEFA competitions. In this context, this work endeavours to measure the efficiency of Portuguese clubs in managing their resources, and to discuss strategies that would improve their results, more specifically with regard to payment schemes.

[4] A different and shorter version published in: Applied Economics Letters, 2012, 19(6), 599-602. Presented in the following international conferences: Strategic Management Society Special Conference, Finland, and CAED-COST Conference in London.

This research was partially supported by the Portuguese Foundation for Science and Technology (FCT). We are indebted to the Ministry of Labour (Gabinete de Estratégia e Planeamento – GEP) for giving us access to the data. We also thank the participants of the Strategic Management Society (SMS) conference in Finland and the Comparative Analysis of Enterprise Data (CAED) conference in London for their comments and suggestions.

[5] More recently data is available. However, we present here the European revenues for the season studied.

We use data from the Portuguese First League. This league's top-ranking clubs are present in major European competitions, are subject to fierce competition and regularly hire star players. Portuguese clubs have won the UEFA Champions League, the UEFA Cup and the former Intercontinental Cup, now known as the FIFA Club World Cup. Portuguese players and coaches have played important roles in top European clubs. In the last eight years, Portugal has been represented in the UEFA team of the year, the UEFA coach of the year and the FIFA world player of the year. Two of the ten highest transfer fees in the world were associated with Portuguese players, with the first place (€ 93.5 m) occupied by the Portuguese player Cristiano Ronaldo. At the same time, several historical clubs no longer play professional football as they were unable to cope with the need to transform clubs into businesses and ended up in bankruptcy.[6]

Clubs hiring star players usually have a pay scale where top players earn substantially more than other players. Such skewed pay scales are also found in other business and sports environments, like in golf tournaments (Ehrenberg and Bognanno 1990a) and baseball (Einolf 2004) or the managerial pay in firms (DeVaro 2006b; Wade *et al*. 2006; Gabaix and Landier 2008). Concerning football clubs, the extant literature on is also growing. There are studies about club performances (Haugen and Hervik 2002), clubs revenue and economic situation (Kesenne 2007), and the professional players' wages (Taylor 2001). According to the tournament theory (Lazear and Rosen, 1981), firms establish a convex wage structure to induce effort.[7] Football offers an

[6] One of the most prominent cases was Boavista: the Portuguese champion in 2000-2001 and semi-finalist of the UEFA Cup in 2002-2003, ceased to have professional football in 2008. Boavista played in regional leagues until 2014. Due to a League decision, after a court decision, the club returned to First League. Other cases of bankruptcy were Salgueiros and Estrela da Amadora, historical Portuguese clubs.

[7] It has also been suggested that wage dispersion can induce lower team performance (Akerlof and Yellen, 1988). Recently, San and Jane (2008) present evidence of this theory, though applied to the professional baseball league in Taiwan, a young and small sports market.

opportunity to test this prediction in a special setting: players are a club's main resource, and teams are relatively homogenous in size and individual demographic characteristics. Moreover, the market is competitive, which indicates that players' wages are to some extent linked to their individual marginal contribution to team performance.

We first propose to apply Data Envelopment Analysis (DEA) to assess whether clubs are spending more resources than they need to achieve efficiency. If this is the case, this circumstance, coupled with the higher competitive level and the stringent financial conditions, means that clubs should revise their overall pay strategy. Secondly, we aim to ascertain whether players' wage spread plays a role in inducing effort and has implications for club efficiency. This new element introduces a contribution to literature that uses DEA to measure efficiency in football.

We proceed as follows. Section 2.2 describes the methodology and Section 2.3 presents the data used. We analyse the results in Section 2.4. The last section concludes the chapter.

2.2 METHODOLOGY

Data Envelopment Analysis (DEA) is a non-parametric broadly used to measure the relative efficiency using decision making units (DMUs) over the estimation of the best production frontiers, involving multiple inputs and outputs. DEA was first introduced by Farrel (1957) and used by Charnes *et al.* (1978) and Banker *et al.* (1984) as a linear programming model. The linear programming enables us to use inputs and outputs in order to measure efficiency. Efficiency is achieved once no more input can increase the output. Recent applications include: banks (Chiu *et al*., 2010), public universities (Kempkes and Pohl, 2010), telecom branches (Kritikos *et al*., 2010), small and medium

enterprises (Reverte and Guzman, 2010), pharmaceutical firms (You *et al*., 2010), public sector resources (Afonso *et al*., 2010; Benito *et al*., 2010), basketball (Cooper *et al.*, 2009) and football (Barros and Leach, 2006).

We used a DEA-CCR model. The CCR model measures the relative technical efficiency of a club by calculating the ratio of the weighted sum of its outputs to the weighted sum of its inputs. DEA does not have limits on the number of inputs and outputs. We evaluate club performance with one output, the league rank, but with different inputs. The first input used, in Model 1, is the total wage spent by the club in one single variable (monthly budget spent by the club with players' wages, the standard frequency of pay in Portugal). The second input used, in Model 2, is the total wage spent, but divided into three variables: the sum of the five highest wages, the sum of the five lowest wages and the remaining sum of salaries (subtracting the first two variables). The aim is to ascertain whether the wage distribution, captured by the distance between these three variables, has any impact on club efficiency. The use of wages as an incentive device would explain why some clubs are able to increase their efficiency by structuring the pay scale so as to induce effort, thereby increasing efficiency.

We define output as rank in the First League, which attributes the league title, qualification to UEFA tournaments, and relegation to the Second League. In order to emphasize the importance of a high ranking, especially to gain access to UEFA tournaments, we use a logarithmic scale (the inverse of the League rank).[8]

[8] This scale gives more prominence to a rise at the top of the table than to a rise at the bottom. Therefore, there is a significant difference between climbing one position from second to first (which allows the club to be champion) and climbing one position from seventh to sixth.

The DEA concept can be easily explained as:

$$\text{Performance(Efficiency)} = \frac{\text{Outputs}}{\text{Inputs}}$$

We evaluated the efficiency of each season, for seven years. We did not consider investments in new players, and neither received transfer fees in outputs. The output is defined as the placement in the First League, which attributes the league title, the qualification to UEFA tournaments in next season, and the relegation to Second League. As a result, it is important to sum as many points as possible during the season. This is a common goal for all clubs in the beginning of the season. However, some clubs know their weaknesses and establish a certain number of points as season objective, the number of points that should ensure the coveted position. The league points are not used as an output to measure efficiency in our model because we could have three teams in the top of the table with the same number of point and only one would be champion, as well as five clubs at the bottom of the table with the same points and only two would be relegated.

2.3 DATA

The Portuguese football national championships are separated in four different leagues: two professional leagues and two semi-professional leagues: First League or *Liga Sagres*; Second League; Second Division and Third Division. In this study we only use data from First League. The clubs that are at the top ranks of this league are present in the major European competitions and so are subject to fierce competition and regularly hire star players. In recent years, there has been a change in the organization of the

professional and semi-professional leagues. The two professional leagues, First League and Second League, had 18 clubs until 2005-2006 season, since 2006-2007 they have 16 clubs. As such, the competitive level increased.

During the seven years studied, only two clubs won the Portuguese League, Porto and Benfica. Porto won six in seven, including the last four. The Portuguese Cup had four winners: Porto (three times); Sporting (twice) and V. Setubal and Benfica (one win for each).

Benfica is the club in Portugal with more titles and more supporters. However, in the last 20 years, Porto won 14 titles, Benfica three, Sporting two and Boavista one. In European competitions, Benfica and Porto each won the UEFA Champions League twice (named European Champions' Cup until 1992). Porto is the only Portuguese club that won the UEFA Cup. Porto won two European trophies during the years studied, UEFA Cup in 2003 and Champions League in 2004. Sporting won the extinct UEFA Cup Winners' Cup once. Portuguese clubs were also in eight other European finals, five of them in the UEFA Champions League. In FIFA club competitions, namely in the former Intercontinental Cup Final, Benfica lost twice and Porto won twice.

At the same time, several historical clubs in Portugal no longer have professional football. Clubs could not keep up with the evolution consisting of the transformation of clubs into businesses and ended up in bankruptcy. One of the most significant cases was Boavista. The club was the Portuguese champion in 2000-2001 and semi-finalist of the UEFA Cup in 2002-2003, and ceased to have professional football in the summer of 2008.

Portugal and Portuguese athletes and coaches have been a source of resources for top European clubs and championships. In the last eight years, Portugal had seven presences in UEFA team of the year and two times the coach of the year. In the last nine

years, Portugal had four presences in the last three candidates to win the FIFA World Player of the Year, having won two. The highest transfer fee paid in football history was for Cristiano Ronaldo in 2009. Real Madrid paid around € 93.5m for the Portuguese player. In the last seven seasons, Portuguese clubs have reached three UEFA tournaments finals and won two. Since 2001, only one club, from Portugal, has been able to cope with clubs from England, Spain and Italy in UEFA Champions League. In the last decade, Portugal occupied the top ten places in UEFA country ranking, based on clubs' performances in UEFA tournaments.

These facts show that Portuguese clubs are subject to the same competing environment as other major European clubs. There are frequent transfers of players between Portuguese clubs and other European clubs. Such competition and players' mobility indicates that players' wages should vary within the same range of values, especially when considering the top Portuguese clubs. A top Portuguese club is forced to have similar pay scales, at least for the best players of the team. Otherwise, clubs are not able to retain the best players or to hire new ones. Of course, the clubs at the bottom half of the Portuguese league are not subject to this competition from other European clubs, and the pay scales are not as wide.

We use *Quadros de Pessoal* (QP), a longitudinal matched employer-employee data set collected by the Ministry of Labour. The survey is mandatory and includes over 300,000 firms and two million individuals on average each year (1986-2012). We only considered clubs from the First League with more than 12 players appearing in the last seven years of the survey (2002-2008), as this period provides a stable setting in terms of the rules governing competitions and clubs' internal organization.

The analysis only uses football players in this study for two reasons. First, not all clubs in the database have data on the entire coaching staff: head coach, assistant coach,

fitness coaches, technical assistants, doctors, physiotherapists and scouts. Second, we consider only those who are actively involved in the team's results – the players. In spite of the coaching staff being an important element in the club, only players take part in the game.

We collect monthly wages from QP and match that information with club statistics for seasons 2002/2003-2008/2009. We obtain information for 19 clubs, corresponding to 2,630 players and 79 clubs occurrences (not a balanced panel).

Table 2.1 presents the players' statistics in the seven seasons. Players are on average almost 25 years old, stay one or two years in each club, and the percentage of foreigners has been increasing from 17% in 2002 to almost 42% in 2008. The majority of foreigners are Brazilians, enjoying an exceptional condition due to historical relations between Portugal and Brazil. Some players become professional at the age of 16, and some only retire when they are 45 years old. The highest wage is always more than ten times the average wage and the lower value of maximum wage is almost 200 times the higher value of minimum wage, these two observations indicate a wide pay scale.

TABLE 2.1
Players' characteristics for 2002-2008 seasons (data from QP)

Year	2002	2003	2004	2005	2006	2007	2008
Total Players	300	243	349	381	379	488	490
Maximum - Age	42	43	44	45	38	45	39
Minimum - Age	16	17	16	16	17	16	16
Average - Age	24.51	25.44	25.15	24.78	24.76	24.18	24.43
S. Deviation - Age	4.66	4.61	4.65	4.47	4.27	4.73	4.53
Average - Tenure	1.42	1.67	1.21	1.03	1.39	1.35	1.45
S. Deviation - Tenure	1.9	2.12	1.72	1.61	1.82	1.88	2.15
Tenure = 0	120	79	161	201	151	229	216
Tenure = 1 or 2	114	109	137	132	149	174	173
Tenure = 3 or 4 or 5	39	44	44	35	64	70	77
Tenure > 5	24	11	7	13	15	15	24
Maximum - Wage	141,658.6	141,658.6	141,658.6	197,889	197,889	127,620	138,500
Minimum - Wage	342.86	250	642.86	224.82	385.9	234	403
Average - Wage	10,383.3	12,368. 8	11,042.8	10,973.9	12,460.3	11,601.5	12,232.6
S. Deviation - wage	18,365.82	19,016.54	19,128.71	21,738.72	22,408.77	19,176.31	20,870.02
Portuguese	249	169	242	223	223	299	285
Brazilian	30	44	67	93	95	104	112
African	13	10	13	19	16	23	25
Other European	7	17	25	42	32	44	44

We divide each team's yearly wages into total wages, sum of the five highest wages, sum of the five lowest wages and the total minus the previous two. Table 2.2 presents the ratio of the five highest to the five lowest wages (season 2008/2009).

Notice that the top three clubs have ratios higher than 70. The question is how this relationship translates into efficient use of resources. The wage difference is particularly evident for clubs with a better average performance, traditionally those with more financial resources. This may be taken to suggest that clubs set up an internal tournament among players as an incentive device. The empirical analysis will also ascertain to what extent these incentive devices are related to the measure of clubs output.

TABLE 2.2
League rank and wage ratio for season 2008/2009 (data from QP)

Team	League Rank	Wage ratio
Nacional	4	4.28
Guimaraes	8	15.55
Academica	7	6.09
P.Ferreira	10	6.56
Rio Ave	12	6.35
Sporting	2	95.69
Braga	5	19.77
Porto	1	70.51
V.Setubal	14	3.85
Belenenses	15	15.27
Benfica	3	73.57
Maritimo	9	3.068
Leixoes	6	15.99
Naval	12	4.73

Note: wage ratio is equal to divide the sum of five higher wages by the sum of five lower wages.

2.4 RESULTS

We apply DEA to all seven seasons (79 clubs occurrences). In table 2.3 are presents all values of efficiency in the seven seasons studied and on the right of each value of efficiency is the difference between efficiency rank and league rank. Data for all teams are not available; therefore in Tables 2.3 and 2.4, we do not use the real league table

position, but the relative ranking among the present teams. Maximum efficiency is one and the number is detached for each year.

From the seven years tested, the second value of efficiency is greater than 0.5 only in three years. This indicates that there is a large difference between clubs' efficiencies. There are even teams whose efficiency is less than 0.1. The average difference between the efficiency rank obtained with the DEA and the actual League rank during the years in which they are present, shown in the last column of Table 2.3, reveals that there are teams with positive values in all years and high average (Nacional, Moreirense, Penafiel, Naval, and P. Ferreira). There are also teams with negative values in all years (Porto, Benfica, and Sporting). There are three teams that only appear once; therefore they are not used in the previous consideration.

The results from Model 1 show that for some clubs the efficiency rank is higher than their League position, while for others the opposite occurs. Notably, clubs that spend more on players and are successful in achieving top positions in the League are also the poorest performers in the efficiency ranking, that is, those with the highest difference between League rank and efficiency rank. Smaller clubs with less valuable players seem to get comparatively more out of their resources (Naval and P. Ferreira).

TABLE 2.3
DEA results with total wages as input and League rank as output

Club	2002		2003		2004		2005		2006		2007		2008		Average difference
Nacional	1.00	4	1.00	2	0.48	4	0.25	2	0.11	1	0.16	2	0.72	0	2.14
Maritimo	0.36	1	0.41	3	0.55	1	0.11	-1	0.06	-1	0.24	0	0.81	7	1.43
Porto	0.30	-2	0.38	-2	0.27	-8	0.15	-4	0.14	-3	0.22	-5	0.26	-6	-4.29
Moreirense	0.29	2			0.28	1									1.50
Belenenses	0.22	-1	0.14	2	0.48	1	0.05	-1	0.12	0	0.09	-1	0.09	0	0.00
Benfica	0.13	-4	0.12	-5	0.43	-7	0.03	-11	0.02	-9	0.04	-9	0.09	-10	-7.86
Braga	0.12	0	0.28	-1	0.67	1	0.15	-1	0.08	-3	0.08	-5	0.14	-7	-2.29
V.Setubal	0.08	0		2			0.13	-1	0.34	9	1.00	5	0.70	8	3.83
Rio Ave			0.34		0.46	-1	0.07	1					0.22	2	0.67
Academica			0.09	-1	0.16	-2	0.04	-3	0.03	-1	0.08	0	0.26	-1	-1.33
Penafiel					1.00	6	0.10	5							5.50
Estoril					0.44	4									4.00
Naval							1.00	7	0.29	6	0.05	6	0.80	9	7.00
Guimaraes							0.21	9			0.75	1	0.14	-3	2.33
Gil Vicente							0.08	-2							-2.00
P.Ferreira									1.00	5	0.51	10	1.00	9	8.00
Beira-Mar									0.05	2					2.00
Sporting									0.06	-6	0.11	-6	0.15	-8	-6.67
Leixoes											0.09	2	0.36	0	1.00

Note: On the right of each value of efficiency is the difference between efficiency rank and league rank.

Table 2.4 is similar to the previous one, but instead of using the total wages as input, this variable is divided in three input variables: sum of five highest wages, sum of lowest five wages, and the sum of remaining wages. In this model (Model 2) the

objective is to ascertain if the wage distribution, captured by the distance between these three variables, has any impact on club efficiency. The use of wages as an incentive device would explain why some clubs can increase their efficiency by structuring a pay scale with the objective of inducing effort. Table 2.4 shows that the previous efficiency leaders, in Table 2.3, are again leaders with Model 2. However, with these inputs, there are at least two leaders each year, and even four in 2007. Only in 2004 the league champion has maximum efficiency, in all other years the champion has failed to achieve maximum efficiency.

In order to have a better picture of the changes that occurred in the efficiency when the total wage is separated into the three wage variables, we computed in Figures 2.1 and 2.2 the changes in the efficiency ranking resulting from the application of the two specifications of the inputs (Model 1 and Model 2). In particular, in Figure 2.1 we plot the change in the efficiency ranking for those clubs with a ratio between the highest five wages to the five lowest wages higher than 15. In Figure 2.2, we perform the same exercise, but for those clubs with the ratio lower than 15. As can be observed, the majority of the clubs in Figure 2.1 increase their relative efficiency when we separate the total wage variable. The reverse happens in Figure 2.2, where the clubs with the lowest ratios decrease their efficiency. This evidence indicates that the wage distribution within the team is relevant to the efficient use of the resources. As such, the strategic use of the pay ranking by the club management improves the results of the team.

TABLE 2.4
DEA results with the sum of the five highest wages, five lowest wages and remaining wages as inputs and League rank as output

Club	2002		2003		2004		2005		2006		2007		2008		Average
Nacional	1.00	3	1.00	1	0.68	2	0.75	0	0.17	-1	0.19	-1	0.78	-2	0.29
Maritimo	1.00	-1	0.61	-3	0.86	-2	1.00	-1	1.00	-1	1.00	-3	1.00	-2	-1.86
Porto	0.43	-2	0.44	-1	0.81	-1	0.30	-4	0.09	-3	0.35	-2	0.95	5	-1.14
Moreirense	0.45	3			0.33	-1									1.00
Belenenses	0.32	-2	0.85	5	0.52	-3	0.12	-3	0.18	-2	0.19	-1	0.14	0	-0.86
Benfica	0.44	-2	1.00	0	1.00	-1	0.31	-7	0.21	-3	0.17	-7	0.33	-6	-3.71
Braga	0.15	0	0.33	-3	0.96	0	0.44	-2	0.10	-5	0.21	-1	0.27	-6	-2.43
V.Setubal	0.13	0					0.34	-1	0.41	7	1.00	2	0.80	8	3.20
Rio Ave			0.48	1	0.67	-2	0.26	0					0.23	-1	-0.50
Academica			0.10	-1	0.44	-1	0.13	-3	0.08	-2	0.12	-2	0.27	-3	-2.00
Penafiel					1.00	5	0.32	6							5.50
Estoril					0.56	3									3.00
Naval							1.00	6	0.41	4	0.53	4	1.00	9	5.75
Guimaraes							0.88	9			1.00	-1	0.22	-5	1.00
Gil Vicente							0.32	-1							-1.00
P.Ferreira									1.00	4	0.58	8	1.00	7	6.33
Beira-Mar									0.09	2					2.00
Sporting									0.93	-1	1.00	-2	0.64	-5	-2.67
Leixoes											0.15	0	0.54	-2	-1.00

Note: On the right of each value of efficiency is the difference between efficiency rank and league rank.

FIGURE 2.1
Variation (difference) in the efficiency rank from Model 1 to Model 2 for clubs with the wage ratio higher than 15 (five higher wages divided by the five lower)

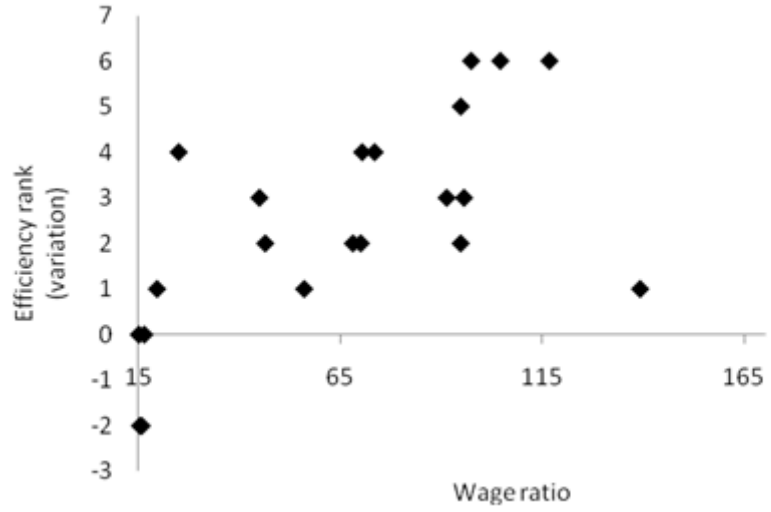


FIGURE 2.2
Change (difference) in the efficiency rank from Model 1 to Model 2 for clubs with the wage ratio lower than 15 (five higher wages divided by the five lower)

2.5 CONCLUSIONS

We have shown that some clubs are spending more on wages than they should, given that more spending does not translate into efficient use of the resources in every case. In

addition, a wider wage distribution within each team is associated with a better performance in terms of efficient use of resources. These findings agree with the predictions of several human resource management theories, and in particular the tournament theory: the size of the difference in pay rank increases as contestants approach the top, resulting in a convex wage curve, which happens in clubs with a higher ratio of the top five wages to the bottom five wages.

Clubs with higher financial capabilities, which define the title as the season objective, have less efficiency, given that only one can be the champion. Clubs that were promoted and achieved maintenance have high efficiencies, such as: Penafiel, Naval, and P. Ferreira. One possible reason for this result is due to the fact that those clubs signed players when they were in the second league; after promotion, the club keeps the players and pay wages similar to those used in the second league. Therefore, the club spent less compared with clubs that were already in the first league for a few years. Moreover, the analysis showed that there are players who earn more than the sum of all the players in another team. However, this other team gets better results than the player's team.

There are cases of Portuguese clubs that no longer play professional football because they became insolvent. These cases should serve as a warning for sports institutions. Clubs must rigorously manage their resources to guarantee the sustainability of their existence. Although in recent years Portugal has experienced slow economic growth in comparison to other European countries, this country's top football clubs manage to reach the highest ranks in European competitions. This is partly explained by their strategic use of players' wages, not only to stimulate individual effort, but also to hire higher quality players.

3 Tournaments within Football teams: Players' Performance and Wages[9]

3.1 INTRODUCTION

In the last 20 years, football clubs have become more than simple sport organizations, they became large companies with high revenues associated to the increase of ticket prices, transfer fees, broadcasting and prize moneys. The top 20 European clubs revenue in 2012/2013 reached more than € 5.4 billion and is expected to keep growing in the coming years (Deloitte and Touché 2014). The Financial Fair Play concept (UEFA 2009) of the Union of European Football Associations (UEFA) will require clubs to manage rigorously their assets to maintain access to competitions organized by UEFA.

The participation in UEFA competitions, especially the Champions League, is one of the objectives of the top teams in Europe since it has a significant impact on revenues (Pawlowski *et al.* 2010). Though professional clubs can be seen as a community service (Sloane 1971) and profit may not always be the main goal, it is crucial to ensure good management results in order to guarantee club sustainability.[10] Some Portuguese clubs spend more in wages than their season revenues and therefore the majority of clubs, including the three at the top, accumulate debt every year (Mourao 2012). We may question the rationale of this wage policy when taking into

[9] Presented in North American Association of Sports Economists and IASE Sports Economics Sessions, 87th Annual WEAI Conference in San Francisco.

This work was partially supported by the Portuguese Foundation for Science and Technology (PTDC/EGE-ECO/101493/2008 and PTDC/EGE-ECO/118070/2010). We are also thankful to the Portuguese Ministry of Labour and Social Solidarity for giving us access to the data used in this research.

[10] Some European clubs accumulated losses year after year, which led to their bankruptcy and almost disappearance (e.g.: Servette FC, ACF Fiorentina and Rangers FC).

account UEFA's requested sustainability. Clubs should seek to manage their resources in order to ensure maximum efficiency (Ribeiro and Lima 2012).

The sports labour market analysis, that lead us to the 50s with Rottenberg's (1956) study on players' market and industry organization of baseball competitive balance, offers an opportunity to study issues related with incentives and human capital accumulation. Sports are the case where wages are essentially determined by players' performance, largely observable by the employer (Kahn 2000). Clubs' success is the outcome of team work where each player's contribution is difficult to quantify – the production function is non-separable (Alchian and Demsetz 1972). True that the final score is most influenced by the forwards and the goal scorers, but the success rests ultimately on team performance. Each team has slightly more than 24 players, though presenting wide pay dispersion: the top 10% can receive ten to thirty times the wage of the bottom 10% within the team. There is no difference between marginal productivities that can explain such pay dispersion.

In this vein, our contribution is to ascertain how players' wages are settled by performance, controlling for individual and club characteristics. First, we inspect the form of the wage-performance relationship. The method uses minutes played during the season by each player as a proxy for performance. We should expect that when minutes played in the season increase, wages should rise less than proportionally due to decreasing players' marginal productivity. However, it is conceivable that clubs device wage policies to elicit effort. In particular, for the top players, the structure of wages should resemble what would come out from setting a rank-order tournament within the team (Lazear and Rosen 1981; Rosen 1986). For the top performers, wages should increase more than proportionally with performance – a convex wage-performance relationship. Second, we test the relationship between wages and different forms of

human capital accumulation – general (schooling), industry-specific (age) and club-specific (tenure) human capital.

Our paper contributes to the literature with two main points: (i) use a sole and homogenous measure of performance – how much time players where selected by the coach to be in the playing field; (ii) explicitly recognises the discrete nature of the pay structure within football teams, what would derive from designing the wage policy as a rank-order tournament.

In the next section, we focus on the literature on tournaments, explaining the mechanism design behind this incentive device and discuss the main empirical results available. In the third section, we provide a brief account of the First League competition context in Portugal, present the data set and discuss the variable definition. We detail our empirical framework in the fourth section and present the results in the fifth section. Section six concludes.

3.2 TOURNAMENTS

The seminal paper by Lazear and Rosen (1981) show how a rank-order tournament is a superior way of compensating workers when compared with piece rates in settings where the individual contribution (performance) is difficult to observe without error. Assume that workers are risk neutral and that their output is the combination of effort and a random component. The worker's effort has a cost that is positive and increasing with the level of effort. The random component can be interpreted as luck or a constant ability factor. It represents a productivity risk that the worker cannot diversify.

The firm can implement a compensation scheme based on piece rates, where the wage is equal to the value of each worker's (marginal) contribution to production. The

pay scheme is optimal in a competitive environment, but the firm needs to observe each individual contribution. Even when production is additively separable and only uses labour, firms cannot distinguish the random component from the effort each worker puts into production. The complexity of firms' decision increases when production is not separable, the outcome of joint production where workers are complements as in a football team.

Consider the alternative of setting a prize structure that awards the highest prize to the worker with the largest realization of performance. In this case, the firm only has to observe the rank order of individual performance. The largest the spread between the winning and losing prize, the higher the worker's incentive to invest in effort. The cost of effort is increasing at a rising rate, limiting the spread in equilibrium. In football, what matters is team performance and the rank order of each player's performance, not the individual level of performance – the quantitative realization of each player's contribution to the outcome of the match.

The optimal spread increases with the value of production. Thus, we should expect to find larger wage spreads within teams belonging to richer leagues. Furthermore, the level of the prize only matters for the decision to enter the game, a possible explanation on why entry wages at first league football teams are relatively higher when compared with entry wages in other industries. Under this discussion, tournaments within football teams will convert a continuous distribution of performance into a discrete distribution of compensation, a high non-linear transformation (Lazear and Rosen, 1981).

Rosen (1986) extends the original model to games with sequential stages.[11] The core assumptions are the same as in Lazear and Rosen (1981), but there are more than two workers to compare. The progression to the top is associated with an increasing wage rise – an increasing wage spread between ranks of the hierarchy. The mechanism design of the tournament rests on the incentive provided by the future interrank prize spreads that the worker can win by climbing to higher ranks. At the top, the prize has to be disproportionally higher to compensate the disincentive effect of no more ranks to climb – it acts as extending the horizon of the game for the winner of the last round.

Top players are decisive to the outcome of a football match, as in a pyramidal hierarchy where top managers decisions have a higher impact on firm's performance than decisions taken at the bottom. It implies that the compensation in each rank contributes to induce effort to win a position in that rank, but also has incentive effects to all ranks bellow. This result from Rosen's (1986) model explains the concentration of compensation at the top players, as is typical in higher leagues.

Risk aversion implies a rising interrank spread, that is, a convex prize structure across ranks, like a pyramidal hierarchy with a decreasing proportion of winners who climb to the next rank. Increasing effort becomes more difficult for players, not only by the convexity of the cost of effort function, but also due to performance also becoming less sensible to players' effort. Rosen (1986) defines a performance function – a response function to effort – that can be considered concave to high values of effort (decreasing marginal productivity) Both these effects – convex cost function and concave performance function – act to decrease the level of effort. As a consequence,

[11] In addition to Rosen (1986), a large set of papers on tournament theory followed the seminal paper by Lazear and Rosen (1981). The most relevant comprise Holmstrom (1982), Green and Stokey (1983), Nalebuff and Stiglitz (1983), Carmichael (1983), Malcomson (1984), O'Keeffe, Viscusi, and Zeckhauser (1984), Dixit (1987), McLaughlin (1988), Moldovanu and Sela (2001) and Zabojnik and Bernhardt (2001), or more recently Eriksson *et al*. (2009), Brown (2011) and Moldovanu *et al*. (2012).

the spread between successive ranks has to increase, generating a convex compensation structure.

At the initial stage, the existence of different ability workers will undermine the efficiency of the rank order tournament (Lazear and Rosen, 1981). The solution is to impose an entry barrier based on player's performance. In football, first league players have first to demonstrate their quality in inferior or junior leagues. These leagues specialize in running contests among young players to screen the best ones to superior leagues. The same argument can be made for first leagues competitions in countries with different maturity levels. Rosen (1986) arrives to the same result as the marginal effect of effort on the probability of winning is decreasing in the players' heterogeneity. Furthermore, as players climb the prize ladder, the set of winners in each rank becomes more homogeneous – "the survival of the fittest" (Rosen, 1986).

A number of authors tested several implications of tournament theory in sports industries. Ehrenberg and Bognanno (1990a, 1990b) use data from professional golf tournaments and find that larger prize gaps induce higher effort. The tournament theory has also been put to test in different settings and industries, especially those directed to firms' top management levels (for example, Eriksson 1999; Gabaix and Landier 2008). The estimation of compensation functions in sports has also been the subject of research with diverse objectives. For example, Scully (1974) estimate wage equations for baseball players, along with marginal revenue products to discuss the effect of restrictions to the functioning of the labour market (later contested by Krautmann (1999)). Idson and Kahane (2000) study the relationship between team attributes and

players' compensation. Among numerous studies on discrimination (for the US market), Kahn and Shah (2005) estimates wage equations for NBA players.[12]

Lucifora and Simmons (2003) find evidence of the Rosen's (1981) superstar effect in the case of the season 1995-1996 Italian professional league players. The authors find a convex relationship between pay and performance measures such as goal-scoring rates. Rosen (1981) contended on the inequality of earnings distribution in professional sports among other industries characterized by individual performance. The rewards function exhibits a convexity that amplifies even small differences in talent. The presence of scale economies and talent scarcity (along with poor substitution between talent levels) in sports, particularly in football, with large and global audiences to the top leagues and competitions, explains such high concentration of pay on few players and of revenues on a small number of clubs.

Rosen's superstar effect offers an additional reason for the wage convexity. It explains the high pay level for those players who outstand in a game, such as forwards and goal-scorers. It does not, however, explains the provision of incentives prevalent in the football industry. Franck and Nüesch (2012) are exemplary in analysing the Rosen's superstar effect. The authors' setup allows to distinguish talent (Rosen, 1981) from popularity (Adler, 1985) in German football premier league.[13] The main result comes from a players' market value (not wages) equation estimated at the 95% percentile by quantile regressions and using performance measures such as goal-scoring and career. Our study is close to Lucifora and Simmons (2003) and Franck and Nüesch (2012) studies, but we focus on the wage policy within clubs and use a comprehensive measure of player's performance.

[12] Reviews on the particular economics of sports can be found at Khan (2000), Rosen and Sanderson (2001), Siegfried and Sanderson (2006), Sloane (2006) and Frick (2007).

[13] Relying on the idea of capturing popularity by the residuals from regressing player's press citation on his performance indicators.

3.3 DATA AND VARIABLES' DEFINITION

The Portuguese football championships include four leagues: two professional and two semi-professionals. We use data from First League (*Liga Sagres)*. Portuguese clubs are subject to the same competing environment as other major European clubs with frequent player transfers.[14] Portuguese players have two of the ten highest transfer fees ever, with the first place (£ 80 m) occupied by a Portuguese (Cristiano Ronaldo). The highest transfer fee paid for a coach is also for a Portuguese (€ 15 m).[15]

We use players' and clubs' information for the 2008-2009 First League season. The players' demographics and wages come from a matched employer-employee dataset – the *Quadros de Pessoal* (QP) survey, an employers' mandatory survey collected yearly by the government.[16] More than 350,000 employers covering more than three million workers answered the survey in 2008 (October), including football clubs. We are able to identify 14 of the 16 First League clubs and 359 players, an average of 26 players for each club. The two missing clubs occupy the bottom places of the First League. The QP provides information on players' wage, age, schooling and tenure. We use as players' wage the monthly salary and regular benefits paid to each player. The QP does not provide information about other fringe benefits given to players as cars,

[14] In past European competitions, SLBenfica and FCPorto each won the UEFA Champions League twice (named European Champions' Cup until 1992); FCPorto is the only Portuguese club that won (twice) the European League (named UEFA Cup until 2009); and SportingCP won the extinct UEFA Cup Winners' Cup. Since 1995 just one club – FCPorto in 2004 – was able to beat the powerful clubs from the four top leagues in Europe (England, Spain, Italy and Germany) based on the annual country ranking list in UEFA Champions League. In the last ten years, Portuguese players won three times the FIFA World Player of the Year by Luís Figo and Cristiano Ronaldo (twice). The coach José Mourinho also won the first FIFA Ballon d'Or Best Coach of the year, in 2010.

[15] In the summer of 2011, Chelsea Football Club paid € 15 m to hire the at the time 33-year-old André Villas-Boas coach, only two years after starting his career as head coach in Portugal.

[16] The QP survey is an administrative census of Portuguese employers and it has been used in research since the late eighties in a diversified range of applied fields, predominantly on labour (recent examples include Baptista *et al*., 2012; Buhai *et al*., 2014), but also on policy evaluation, industrial organization, entrepreneurship, and immigration (e. g. Martins, 2009; Branstetter *et al*., 2014; Gerosky *et al*., 2010; Carneiro *et al*., 2012),.

house rents or future fee percentages. We match the QP information with official clubs statistics for minutes played by each player during the season (Liga Portuguesa de Futebol Profissional, 2009). The QP information is confidential, so we cannot disclose players' identification.

We use minutes played during the season to capture each player's contribution to the team. The variable can be considered a proxy for performance: those players used more often by the coach are the ones performing better within the season. Elite players are more tolerant to fatigue and have more aerobic power (Reilly *et al.* 2000) and coaches use the best performers more frequently (Mohr *et al.* 2003), therefore best players are more likely to play more minutes during the season. There are other characteristics and statistics used to measure football players' performance; however the common characteristic for all 11 players who start the game is that they can play 90 minutes each game, providing a simple and consistent proxy for performance.[17] The maximum number of minutes that a player can participate throughout the season is 2700 (30 games x 90 minutes).

Table A1 in the Appendix presents the number of players available in QP for each club, the sum of the minutes played in the season by all players, and the percentage of the total possible minutes played (29700 minutes = 11 players x 30 games x 90 minutes), considering that no player was sent off during the 90 minutes game. The extra-time minutes are not considered and when a player is replaced by another in the extra time, the sum of the two players' minutes is always 90. The number of players per club identified with the QP ranges from 19 to 29. The corresponding percentage of

[17] The issue of performance measurement and talent identification in football has been subject to various approaches. For example: Franck and Nüesch (2012) use 20 performance indicators, along with team performance and popularity measures (derived from press citations); Reilly *et al*. (2000) and Mohr *et al*. (2003) offer examples from a sports sciences perspective; Duch *et al*. (2010) attempt to quantify individual contribution to team performance in football using a network approach.

minutes played, out of the total season minutes, ranges from 60.6% to 99.6%, with an average of 86.7%. There is no evidence of sample selection, if we compare players under analysis with the players left outside the study due to missing information in the QP database. There may be several reasons for non-observed players: players hired in January 2009; loan players who are not part of club's staff; or players who could not be identified due to missing records.

Figure 3.1 shows wage (monthly salary plus monthly fixed bonus) distribution in the 2008-2009 season. The average monthly wage 18.000 Euros per month (the average monthly wage is 1.010 Euros for all workers in the database). The majority of players earn less than 50 thousand Euros per month, almost the average monthly salary in the three biggest clubs (SLBenfica, FCPorto and SportingCP). The wage distribution is skewed and the highest wage is almost nine times the average wage. There are clubs where the maximum wage is more than 50 times the value of minimum wage in the same club indicating a wide pay scale.

As we move up in the wage distribution, minutes played also increase (Table 3.1). As in Figure 3.1, there is evidence of a wide pay scale: those players at the 90% percentile receive 30.1 times the wage of those at the 10%; those at the 50% percentile receive 4.2 times the wage of those at the 10%. For minutes played, the figures are 1.7 and 1.4 for the 90/10 and 50/10 ratios. Thus, the wage dispersion is much wider than the corresponding distribution of minutes played, suggesting a convex wage-performance relationship, at least at the upper part of the wage distribution. The wage spread is particularly evident at clubs performing better on average.

FIGURE 3.1
Monthly Wage distribution, 2008-2009 Season

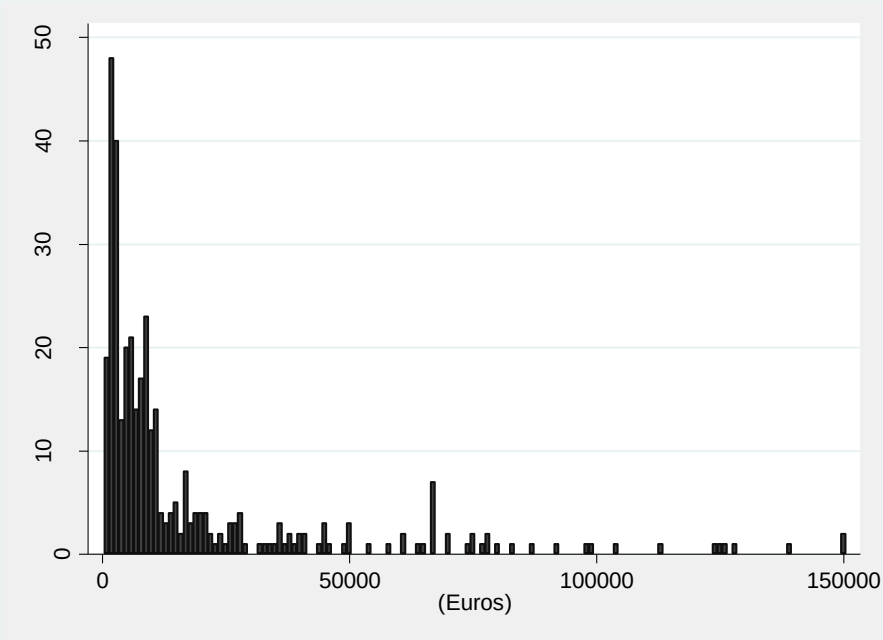


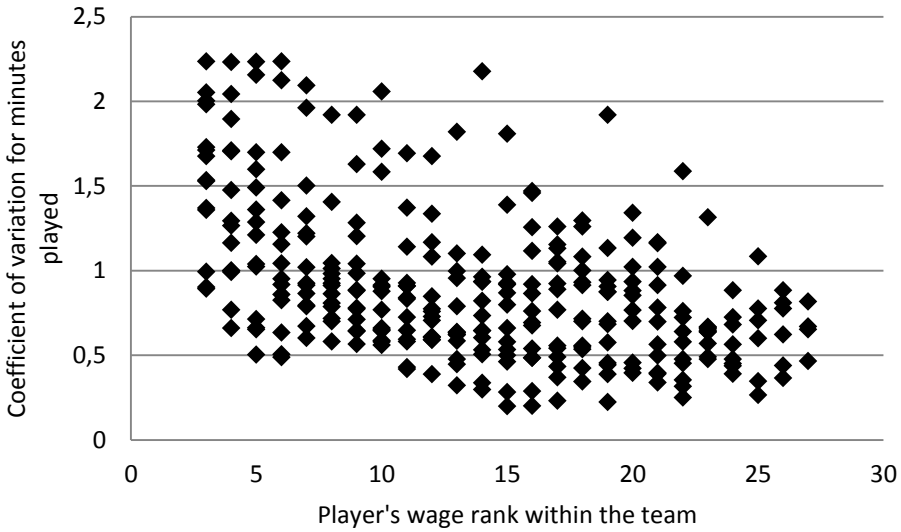
TABLE 3.1
The Wage Distribution, 2008-2009 Season.

Percentile	Wage (€)	Average minutes played (for the corresponding wage percentile)
1%	600	80
10%	1800	570
25%	3000	650
50%	7500	810
75%	18400	880
90%	54100	960
99%	127600	1000
90% / 10%	30.1	1.7
50% / 10%	4.2	1.4

In our empirical setting it is difficult to obtain robust estimation results concerning players' heterogeneity and their position within the wage distribution. We only have 30 observations at maximum per club. We should expect that as we move up in the wage distribution within the club, the pool of players would become more homogenous – the survival of the fittest (Rosen, 1986). We can, however, present descriptive evidence pointing to that direction. Within each team, we order players from the smallest to the highest wage to identify their relative position. We calculate the

coefficient of variation (standard deviation divided by the mean) for minutes played of each group of five players and assign the statistic to the middle player. It provides a measure on how close the player's performance is to his co-players. Smaller coefficient of variations signals that the player performs similar than co-players in the same pay range. We would expect a decreasing coefficient of variation as we move up in the pay ranking. Figure 3.2 graphs the coefficient of variation versus the relative position of each player with the team wage ranking. The statistic seems to be concentrated at lower values for the top of the wage scale.

FIGURE 3.2
Player's Heterogeneity within Teams and Wages

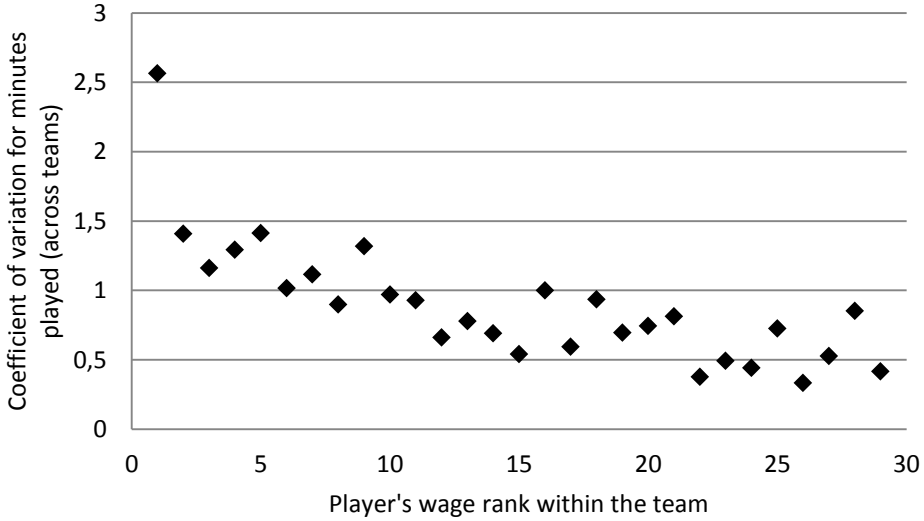


Notes: players ranked by the wage within the team, from the lowest to the highest; coefficient of variation calculated for each group of five players and assigned to the middle player of the group.

Should the same kind of evidence be present across teams: top players' performance similar to their counterparts in other football teams? Again, we calculate the coefficient of variation, but now for each player position within the same teams' pay rank: for all least players' wage across the 14 teams (in position one), the same for those in position two, and so on until the highest players' wage (Figure 3.3). Again, the

coefficient of variation decrease as we move to the top of the wage scale, indicating that there is a selection of best players to the top, observable across teams.

FIGURE 3.3
Player's Heterogeneity across Teams and Wages



Notes: players ranked by the wage within the team, from the lowest to the highest; coefficient of variation calculated for players in the same wage rank across teams.

Table 3.2 shows players' statistics. Players' age ranges from 16 to 38 years old with a 25.5 average. We define a dummy for each two-year age interval. Half of players are between 23 and 28 years old (49%), 27% are less than 23 years old, and 24% are more than 28 years old. Age captures industry-specific human capital as most players start the professional (or semi-professional) career at roughly the same age, between 16 and 19 years old. Tenure captures club-specific human capital, though its accumulation seems modest as the majority of players (71%) do not stay more than two years in the same club, 10% stay for two years and only 19% stay for more than two years.

Schooling captures general human capital. We define dummy for schooling around nine years of completed enrolment – the compulsory level until 2012 (12 years afterwards): 37% hold less than nine years, 33% hold nine years and 30% more than

nine years. Only three players who hold a college degree, more than 130 did not complete six years of schooling and the average is less than nine years. In general, football players leave school prematurely to dedicate themselves entirely to football, despite being in compulsory schooling age.

TABLE 3.2
Players' Descriptive Statistics, 2008-2009 Season

Variable	Mean	Std. Dev.
Wage (Euro)	17899.8	26640.7
Age (years)	25.549	4.213
Dummies for Age		
Age < 21	0.125	0.332
21<= age <=22	0.142	0.350
23<= age <=24	0.150	0.358
25<= age <=26	0.170	0.376
27<= age <=28	0.167	0.374
29<= age <=30	0.109	0.312
31<= age <=32	0.072	0.260
age >=33	0.064	0.245
Tenure (years)	1.443	2.328
Dummies for Tenure		
Tenure = 0	0.485	0.500
Tenure = 1	0.228	0.420
Tenure = 2	0.097	0.297
Tenure > 2	0.189	0.392
Schooling (years)	8.448	2.966
Dummies for schooling		
Schooling < 9 years	0.373	0.484
Schooling = 9 years	0.329	0.470
Schooling > 9 years	0.298	0.458
Minutes played	1004.0	880.1
Dummies for Minutes played		
Minutes played <= 5%	0.248	0.432
5% < minutes played <= 40%	0.318	0.466
40% < minutes played <= 80%	0.293	0.456
80% < minutes played <= 95%	0.103	0.304
95% < minutes played <= 100%	0.039	0.194
Number of players		359

The average number of minutes played in the 2008-2009 season was 1004 with a standard deviation of 880. We gather players into five different groups of minutes played and define a dummy for each group[18]. We aggregate all players who played less than 5% of the total minutes possible in the season in the first group: players who almost never play, on average, unless at the last couple of minutes in few games during the season. In the next group are those who play between 5% and 40% of minutes during the season: players typically used by the coach during the game if the result is not the expected, probably because they are the coach's second choice. The following group includes players who play between 40% and 80%: players who are regularly the first choice for the coach, but for several reasons (injuries, discipline, technical) they do not play more than 80% of the possible minutes. The last two groups cover players who play between 80% and 95% of the time and more than 95%: the best players of the team. They play almost all games as first option and finish the majority of the games. Those players who play more than 95% are the top players: coaches trust them during all the season; they probably do not get red cards or get injured; they are weekly motivated and committed to practice; and achieve the coach's standards in order to play in the weekend game. Near 25% of players play 5% or less. Typically there are more than 25 players in each club and at most 14 players play in each game, implying that a significant number of players have a small contribution to the club's season. The distribution of players across the remaining groups resembles a pyramid: 32% (for the 5-40% group), 29% (40-80% group), 10% (80-95% group) and 4% (> 95% group).

The correlation matrix for the variables used (Table A2 in the Appendix) shows that most correlations are within a reasonable range, indicating that we do not face a

[18] Different groups were also made and tested. The trend of the results is similar although not all results are significant. Even though, the groups presented seem to make more sense.

serious problem of possible collinearity among the variables that could reduce the precision of the estimates.

3.4 EMPIRICAL FRAMEWORK

We content that football clubs device a wage policy resembling the rank-order tournament proposed by Rosen (1986). The club commits to prizes for the winner and the loser, where the winner is the player who produces more and the two prizes are independent of the difference between the absolute levels of the outputs. The spread – difference between the winning and losing prizes – serves as an incentive for effort. The equilibrium spread generates efficient effort levels and only requires an ordinal ranking of the players. In this setting, players' wages rise more than proportionally with successful effort, originating a convex wage curve.

We start by defining a standard wage equation where the player's wage in logarithm is a (linear) function of his individual attributes, such as various forms of human capital (Becker 1962, 1975; Mincer 1974):

$$\log(wage) = \beta_0 + \beta_1 schooling + \beta_2 tenure + \beta_3 age + \beta_4 min + \beta_5 club + \varepsilon \quad (1)$$

where *schooling*, *tenure* and *age* are vectors of dummy variables; *min* is a vector for minutes played in the season; *club* is a vector of dummies for each club and ε is the error term. The schooling dummies are defined for less than nine years of schooling, nine (the compulsory level in 2008), and more than nine. Tenure is defined by three dummies (one, two and more than two years) and age is defined using dummies for every two-year interval. We include dummies for each club to capture fixed effects that

could influence wages in each club and that are not observable to the researcher (Idson and Kahane, 2000).

We use minutes played within the season as a proxy for performance as discussed in the previous section. The total minutes in each season is fixed: defined by the 90 minutes of each game times 30 games of each season. Therefore, minutes played can be considered a measure of relative performance – those players used more often are the ones who perform better.

We specify a cubic function on minutes played, which seems flexible enough to capture possible non-linearities. If we observe that wages rise with minutes, but at a decreasing rate (decreasing marginal productivity within a match and within the season), it will originate first a concave wage-minutes relationship. However, if a tournament is set for the best players, we expect wages to rise at an increasing rate for those players intensively used within the season, originating a convex wage-minutes relationship at higher wages. Even though a cubic function is a flexible polynomial, it still is linear in its parameters. As an alternative specification, we use the defined set of dummies for minutes: 5% or less, 5-40%, 40-80%, 80-95%, more than 95%.

Rosen (1986) suggests that the progression across sequential stages of the tournament could be modelled with a Poisson, as in a patent rate, for example. Such count model assumes a port of entry at the bottom pay rank. In football teams, we do not expect to observe such a rigid use of ports of entry, apart from junior players entering the profession. Furthermore, players' mobility between clubs suggests that we cannot think of a strict sequence of stages within a team. To further address these issues and not adhere strictly to a linear model as wage equation (1) we define an ordered logistic model, a discrete model in line with the Lazear and Rosen's (1981) and Rosen (1986) argument that tournaments transform a continuous distribution of performance

into a discrete distribution of pay. This highly non-linear transformation, raising discontinuities (instead of piece rates), explains why tournaments are superior.

We divided the continuum of wages within each team into four equal size ranks with 25% of players in each rank. We could use any pyramidal pay distribution, but the particular form is arbitrary, not defined a priori as with job levels inside a firm or elimination rounds in a golf tournament. The equal size distribution is the least disrupting – it offers a lower bond and will probably underestimate the coefficients. Consider the probability of a given observed wage rank $Q = j$, $j = 1,\ldots,4$, within the team for each player defined as

$$\Pr(Q = j) = \Pr(\mu_{j-1} < \mathbf{x\theta} + u < \mu_j), \qquad (2)$$

where $\mathbf{x}$ is a vector of regressors defined as in equation (1) , $\boldsymbol{\theta}$ is the vector of coefficients to be estimated and μ_j the cut points with $\mu_0 = -\infty$ and $\mu_4 = +\infty$. If the error term *u* follows the logistic distribution, then equation (2) can be written as

$$\Pr(Q = j) = \frac{1}{1+\exp(-\mu_j + \mathbf{x\theta})} - \frac{1}{1+\exp(-\mu_{j-1} + \mathbf{x\theta})}, \qquad (2')$$

and can be estimated by maximum likelihood. We present the results by computing the marginal effects.

We could also use a quantile regression (Koenker and Basset, 1978). However, it continues to be a linear model, tough more flexible than the regression to the mean used to estimate equation (1). In addition, contrary to the ordered logistic model in equation (2), it does not allow to explicitly consider the player's relative rank within his team.

These reasons, coupled with the limited number of observation available, preclude the use of the quantile regression model.[19]

We use two alternative methods to ascertain the robustness of the estimated relationships. First we use the difference between the smallest (log) wage of the team and the (log) wage of each the player. We explicitly consider the wage spread within the team, though given the use of club fixed effects, the results should be similar to the ones obtained with the wage level. Second, we exclude from the regression players who participate less than 10% of the total time during the season. These players are the worst performers, but other reasons can lead to less use by the coach, like serious injuries or business considerations (asset management). With this cut we exclude those players who never played or just play a few minutes during the season, typically at the end of the season and at the end of some games when the final classification or the results are virtually guaranteed. We took two variations of this restriction: those who played less than 10% of total minutes, corresponding to less than 270 minutes, and those 10% who played less in each team.

3.5 RESULTS

We estimate the wage equation (1) by least squares with four different specifications, presented in Table 3.3. The first specification (Model I) includes only the dummies for age. The second (Model II) adds schooling and tenure. Model III only considers the cubic function for minutes played. Model IV considers the whole set of variables.

[19] For the sake of completeness, we did apply the quantile regression, but were unable to obtain meaningful results.

TABLE 3.3
Wage Equations for Football Players, 2008-2009 Season.

Variable	Model I	Model II	Model III	Model IV
Total minutes/1000			1.528***	0.930***
			(0.363)	(0.287)
(Total minutes/1000)^2			-0.879***	-0.561**
			(0.327)	(0.264)
(Total minutes/1000)^3			0.165**	0.108*
			(0.080)	(0.065)
21<= age <=22	1.131***	1.128***		1.035***
	(0.146)	(0.146)		(0.139)
23<= age <=24	1.398***	1.366***		1.211***
	(0.149)	(0.150)		(0.149)
25<= age <=26	1.490***	1.484***		1.281***
	(0.133)	(0.133)		(0.136)
27<= age <=28	1.643***	1.642***		1.429***
	(0.132)	(0.132)		(0.136)
29<= age <=30	1.772***	1.769***		1.566***
	(0.152)	(0.152)		(0.152)
31<= age <=32	1.526***	1.499***		1.373***
	(0.157)	(0.159)		(0.161)
age >=33	1.451***	1.437***		1.289***
	(0.169)	(0.177)		(0.177)
Tenure = 1		-0.034		-0.032
		(0.092)		(0.090)
Tenure = 2		-0.208*		-0.196
		(0.123)		(0.124)
Tenure > 2		0.028		-0.021
		(0.095)		(0.098)
Schooling = 9 years		0.046		0.039
		(0.099)		(0.095)
Schooling > 9 years		0.145		0.079
		(0.088)		(0.081)
Constant	7.235***	7.216***	7.765***	7.072***
	(0.152)	(0.162)	(0.106)	(0.160)
Number of observations	359	359	359	359
Adjusted-R2	0.79	0.79	0.70	0.81
F	69.7	57.7	55.2	57.3

* p<0.10, ** p<0.05, *** p<0.01. Standard errors between brackets. Dependent variable: log players' monthly wage. Estimated by least squares. All regressions include club dummies.

Schooling and tenure are not significant in any model (except for tenure = 2 in Model II). Therefore, general human capital, measured by schooling, and club-specific human capital, measured by tenure, seems to play no role on players' wage formation,

contrary to what happens in other industries. The set of age dummies are significant in all models. We would expect to have a positive, but decreasing wage-age relationship, given the likely decreasing marginal productivity as players get older. The changes induced on wages (in Model IV) is 0.176 log points when age increases from 21-22 years old to 23-24 and 0.70 log points from 23-24 to 25-26, which confirms the assumption of decreasing marginal productivity. However, the next age change induces a wage increase of 0.148 log points (from 26-27 to 27-28 years old), which contradicts the assumption of decreasing marginal contribution to the team with age. Wages peak at the age of 29-30 years (an increase of 0.137 log points from the previous age interval) where players seem to reach the top of their careers regarding wages. Thus, the relationship between wages and age is not concave in its entire domain, contrary to what happens in most Mincerian wage equations estimated for the whole economy or for specific industries other than football. It suggests the use of performance incentives among team's players just before the peak of their productivity (if we assume a positive relationship with age), explaining the convex wage-age profile within the 27-28 age range.

Minutes played by each player in the season exhibit a cubic relationship with wages: the three coefficients are significant in Model III (only with minutes played) and in Model IV (with all variables). The quadratic term has a negative coefficient and the cubic term a positive one. Figure 3.4 presents the implied relationship with wages (coefficients from Model IV). First, it shows that players who play more minutes earn more at the end of the month, controlling for age, tenure, schooling and club fixed effects. Second, the function is concave until 1350 minutes played, corresponding to 50% of the season total. After that point, the function is relatively flat until 75% of

minutes played (2025 minutes). For more than 75% of minutes played, wages rise again, but at an increasing rate – the wage-minutes played relationship becomes convex.

FIGURE 3.4
Minutes Contribution to Log Wage (estimated coefficients from model IV, Table 3.3)

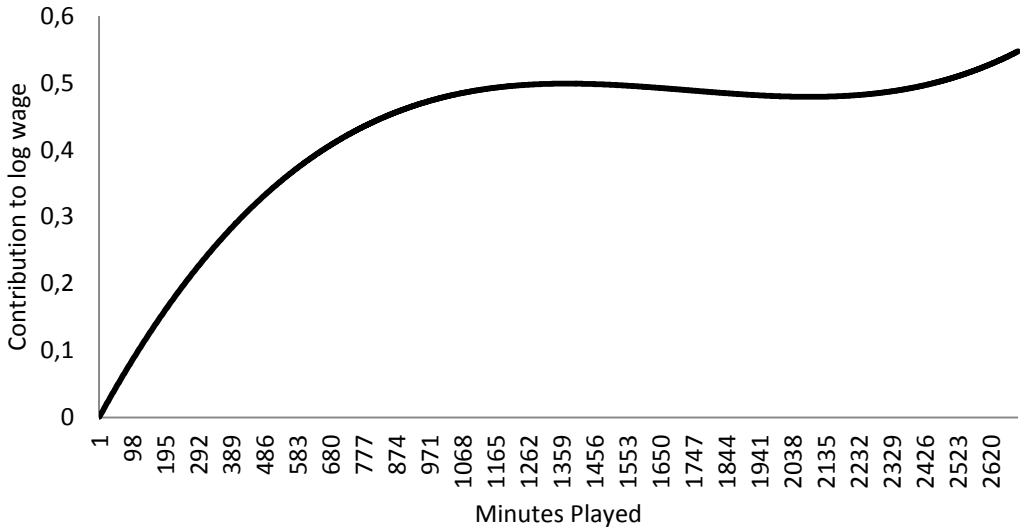


Table 3.4 presents the wage estimation with the dummies for minutes played (<5%, 5-40%, 40-80%, 80-95%, >95%) instead of the cubic function. Model V includes all player attributes (age, tenure and schooling) and the club fixed effects as in Model IV (Table 3.3). The estimated coefficients for the minutes played dummies are all significant at the 1% level. The positive and increasing coefficients confirm the positive wage-minutes played relationship found in our previous regressions at Table 3.3. Concerning the specific form of that relationship, there is a high wage change for those who play 5 to 40% during the season (0.292 log points) and 40 to 80% (0.403 log points). The next group of players, in the 80-95% interval of utilization, experience a wage change of 0.452 log points, but for players who participate more than 95% of game time during the season, the wage change is 0.505 log points, with a change of just five percentage points (p.p.) in the time played. Given the different ranges for

percentage time intervals, the results for the top players suggest that they receive disproportionally higher wages. As in the previous cubic specification for minutes, the wage-minutes played relationship can be associated with an incentive device – a rank-order tournament – to induce performance.

TABLE 3.4
Wage Equation for Football Players, 2008-2009 Season, with Categories for Percentage of Minutes Played

Variable	Model V
5% < minutes played <= 40%	0.292***
	(3.31)
40% < minutes played <= 80%	0.403***
	(4.35)
80% < minutes played <= 95%	0.452***
	(4.26)
95% < minutes played <= 100%	0.505***
	(3.90)
Constant	7.070***
	(44.50)
Number of observations	359
F	52.30
Adjusted-R2	0.82

* p<0.10, ** p<0.05, *** p<0.01. Standard errors between brackets. Dependent variable: log players' monthly wage. Estimated by least squares. Regression includes club, age, tenure and schooling dummies as defined in Table 3.3.

We apply the ordered logistic regression, defining wage quartiles within each club, as in equation (2). We define the vector of regressors as in Model V: age, tenure, schooling, minutes played and club fixed-effects. Table 3.5 presents the results. For each time category, the marginal probability of being in each wage quartile increases with minutes played. Across time categories, the more minutes played, the higher the probability of being in a top quartile. For example, the change in the probability of being in the fourth quartile is 9.1 p.p. for range 5-40% of time played, 20.2 p.p. for 40-80%, 19.6 for 80-95%, and then jumps to 32.2 p.p. for more than 95% of season time

(when compared with those least used: <5%). For the first (bottom) quartile, the probability changes from –10.3 p.p. for those less used (5-40%) to -22.4 for the most used players.

Across quartile, the vector of marginal effects for the less used (5-40% of playing time) ranges from -10.3 in the first quartile to 9.1 p.p. in the fourth quartile; and from -22.4 to 32.0 p.p. for the most used (>95%). The gradient defined by the coefficients of each time category becomes stepper across quartiles as we move towards the best players. The results from the ordered model seem to confirm the claim that clubs set a rank-order tournament within players such that the wage-performance relationship is positive and convex – wages raise disproportionately for the top performers within each team.

TABLE 3.5
Ordered Logistic Regression for Wage Quartiles, Marginal Effects

	MODEL VI			
	Q_1	Q_2	Q_3	Q_4
5% < minutes played <= 40%	-0.103**	-0.036**	0.049**	0.091**
	(2.19)	(2.22)	(2.04)	(2.40)
40% < minutes played <= 80%	-0.174***	-0.091***	0.063***	0.202***
	(3.72)	(3.96)	(2.62)	(4.54)
80% < minutes played <= 95%	-0.171***	-0.088**	0.063***	0.196***
	(3.15)	(2.53)	(2.63)	(2.81)
95% < minutes played <= 100%	-0.224***	-0.142***	0.045	0.320***
	(3.86)	(3.13)	(1.26)	(2.94)
Chi^2	164.78	164.78	164.78	164.78
N	359	359	359	359

Notes: Standard errors between brackets. Dependent variables: Wage quartiles defined within each club. Estimated by ordered logistic regression. Regression includes age, tenure, schooling and club dummies.
* p<0.10, ** p<0.05, *** p<0.01.

When we use as dependent variable the difference between the (log) wage of a player and the (log) wage of the least paid player of each team in the linear regression, the results are similar (as expected). We also explore variations to the pool of players

included in the linear and in the ordered logistic models. We first considered only players who played at least 10% of total minutes possible in one season (i.e. 270 minutes). In a second variation, we remove just the 10% players who played less in each team. In both cases, the results are similar to those presented in Tables 3.3; 3.4 and 3.5.

3.6 CONCLUSIONS

Our objective was to analyse the relationship between players' wages and their performance. The observation that extremely high wages exert a disproportionate pressure on clubs' financial structure, raising sustainability issues in the Portuguese first league and in other European leagues triggered our research questions. Even if a club can recover the money invested in the player by selling him to another club, the value of the transfer is contingent on player's performance. We also inspect the possible influence of different kinds of human capital on wages.

Our results ascertain that general (schooling) and club-specific (tenure) human capital do not play a significant role on wage formation. Industry-specific human capital – players' age – seems to be a determinant of wages. The shape of the wage-age relationship follows the expected concave profile. However, for ages reaching the maximum variation on wages, around the age 28-29, when players are expected to be near their maximum productivity, the relationship becomes convex. It indicates that players earn disproportionally more than the spread of their productivity would suggest.

Using minutes played within the season as a proxy for performance, the estimation result shows that sweat pays off: a player who plays for more minutes earns a wage bonus; and those at the top of the effort distribution face a convex relationship – wages rise with minutes played at an increasing rate. Theoretically, that is the prediction

of tournament theory: the size of the difference in the pay rank increases as the contestants approach the top. In our case, the player is encouraged to push hard in training in order to be called to participate in the game.

Appendix

Table A1 – Teams, players, and minutes played, 2008-2009 season.

Club	Number of players	Sum of minutes played	% of total possible in the season
CDNacional	26	25,996	87.5%
VGuimarães	29	25,530	86.0%
AcadémicaC	29	28,299	95.3%
FCPFerreira	28	26,383	88.8%
RioAveFC	28	23,829	80.2%
SportingCP	24	29,557	99.5%
SCBraga	29	29,564	99.5%
FCPorto	26	29,442	99.1%
VSetúbalFC	21	23,863	80.3%
Belenenses	29	22,820	76.8%
SLBenfica	25	29,571	99.6%
CSMarítimo	21	17,988	60.6%
LeixõesSC	25	28,087	94.6%
ANaval	19	19,515	65.7%
Total	359	360,444	86.7%

Note: The 30 season games (and 11 players) correspond to 29,700 minutes.

Table A2 – Correlation matrix for wage, age, tenure, total minutes played and schooling.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Wage (Euro)	1.00																
(2) Minutes played	0.22	1.00															
(3) Age < 21	-0.17	-0.24	1.00														
(4) 21<= age <=22	-0.05	-0.09	-0.15	1.00													
(5) 23<= age <=24	0.01	-0.02	-0.16	-0.17	1.00												
(6) 25<= age <=26	0.00	0.10	-0.17	-0.18	-0.19	1.00											
(7) 27<= age <=28	0.05	0.10	-0.17	-0.18	-0.19	-0.20	1.00										
(8) 29<= age <=30	0.18	0.11	-0.13	-0.14	-0.15	-0.16	-0.16	1.00									
(9) 31<= age <=32	-0.03	0.04	-0.11	-0.11	-0.12	-0.13	-0.13	-0.10	1.00								
(10) age >=33	0.02	-0.01	-0.10	-0.11	-0.11	-0.12	-0.12	-0.09	-0.07	1.00							
(11) Tenure = 0	-0.07	-0.14	0.00	0.08	0.14	0.01	-0.05	0.02	-0.16	-0.12	1.00						
(12) Tenure = 1	-0.03	0.00	0.03	0.03	0.05	-0.07	0.06	-0.04	-0.05	-0.03	-0.53	1.00					
(13) Tenure = 2	-0.02	-0.04	0.02	-0.05	-0.11	0.08	-0.02	0.07	0.09	-0.05	-0.32	-0.18	1.00				
(14) Tenure >2	0.13	0.21	-0.05	-0.09	-0.14	0.01	0.01	-0.03	0.19	0.22	-0.47	-0.26	-0.16	1.00			
(15) Schooling < 9	-0.24	-0.10	-0.05	0.11	0.01	-0.01	0.01	0.01	-0.13	0.01	0.22	0.01	-0.18	-0.15	1.00		
(16) Schooling = 9	0.27	0.01	0.08	-0.08	-0.13	0.03	0.07	-0.07	0.03	0.11	-0.19	0.00	0.13	0.15	-0.54	1.00	
(17) Schooling > 9 years	-0.02	0.09	-0.03	-0.04	0.12	-0.02	-0.08	0.07	0.10	-0.12	-0.03	-0.01	0.05	0.01	-0.50	-0.46	1.00

4 PROFESSIONAL FOOTBALL PLAYERS' MOBILITY AND WAGES: TRANSFERS, PROMOTIONS AND RELEGATIONS[20]

4.1 INTRODUCTION

Sport organizations over the last decades have become large companies with high revenues due to the growth of commercial and broadcasting revenues (Deloitte and Touche 2014). The top 20 European clubs revenue reached more than € 5.4 billion in 2012/2013 season and the tendency is to keep growing despite the economic crisis in Europe. In 2010/2011 season, Portuguese club SL Benfica was the 21st club in Europe in revenue slightly passing € 100 million. Being one of the most popular sports in European countries, football clubs face the challenge to comply with the Union of European Football Associations (UEFA) Financial Fair Play concept (UEFA 2009). Clubs managers will be required to guarantee clubs sustainability while at the same time balance supporters' desire in winning trophies instead of reaching profit (Sloane 1971). The disregard of UEFA rules can lead to the exclusion from internationals competitions organized by UEFA, which are responsible to share € 1.34 billion in 2012/13 season, especially in UEFA Champions league which has a significant impact on clubs revenue (Pawlowski *et al.* 2010).

This study proposes to use data from Quadros de Pessoal (QP), a longitudinal matched employer-employee data set with information on Portuguese workers and

[20] Presented in the following conferences: Druid Academy Conference in Aalborg; North American Society for Sport Management Conference in Austin; Association for Public Economic Theory in Lisbon; and European Conference in Sport Economics in Esbjerg.

This work was partially supported by the Portuguese Foundation for Science and Technology (PTDC/EGE-ECO/101493/2008 and PTDC/EGE-ECO/118070/2010). We are also thankful to the Portuguese Ministry of Labor and Social Solidarity for giving us access to the data used in this research.

firms, collected yearly by the Portuguese Government. The QP information is matched with club statistics collected between 2002/2003 and the 2009/10 seasons. During this period, we identify almost 7000 players, an average of more than 800 players each year. The objective is to look over the players' career path, from lower leagues to Portuguese first league and the associated wage profile, before being eventually transferred to another country. Pay is clearly structured in ranks and football clubs spend a considerable amount of resources on players' wages, therefore they should seek an optimal pay ranking for inducing effort and further development of individual abilities.

Assuming that those who perform better are the ones that get higher wages within each team we use the quartile wage position within each team to ascertain the probability of players to move to other clubs in the same league or in different leagues and the probability to stay in the same club after the club gets promoted or relegated. Knowing that a player changed his status, we also use past information to examine his entry pay rank at the new club.

The data used in this study and the reports available from clubs all over Europe shows that the largest item on expenditure is the staff wages. Players' wages are the overwhelming majority of human resources expenditures. Therefore this study is crucial better understand the ambitions of each player in each wage quartile position and why players move and get transfer between teams and leagues.

Once we describe the national competition structure, the statistical information contained in the datasets, and the econometric model, we estimate the relationships taking into account the wage change occurring for each type of transition. We consider five types of movements: when a player moves to a new club of a higher league; when a player moves to a new club of a lower league; when the player moves to a new club in

the same league; and when a player stays in the same club that was promoted or relegated.

We present the theoretical background and the empirical strategy in the next section. Section 4.3 describes the hypotheses and empirical strategy. Section 4.4 refers to the Portuguese Football leagues. Section 4.5 presents the data used in this research. In section 4.6 we show the mobility and pay rank. Results and discussion are presented in section 4.7 and in Section 4.8 we conclude our work.

4.2 BACKGROUND

In the 50s (Rottenberg 1956) started the study of sports economics with a research on baseball players' labor market. A few years latter Neale (1964) showed that contrary to the majority of other industries where less competition means more profit in sports industry with more competition there are more profit. The professional sport labor market were again revisited in 80s (Rosen 1981) with a study on the inequality of earnings distribution among players and recently, following the earnings distribution topic, Zimbalist (2010) showed that leagues without salary cap distribute less earnings than leagues with salary cap. In Europe, there are not salary cap, contrary to North American professional leagues.

Since last decade football literature grew as football began to move large sums of money and the several examples of historical clubs that faced bankruptcy after years of losses, some were rescued by multi-millionaire investors and others simply felt into forgetfulness in lower leagues. We can find examples of football studies relating to economic situation and revenue (Kesenne 2007), players' wages (Kuethe and Motamed 2010), superstar effect (Franck and Nüesch 2012; Lucifora and Simmons 2003), club

performance (Haugen and Hervik 2002), clubs efficiency (Ribeiro and Lima 2012), players' labor market (Frick 2007) and the revenue impact of clubs' promotions and relegations (Noll 2002).

Financial teams' results are largely related with players' costs through salaries and to transfers fees. In this context, we propose to study salary changes with moves of players during several seasons. We try to understand if Portuguese professionals and semi-professional leagues behave as an internal organization were workers are promoted and demoted. In several ways, we can consider the football industry as functioning with specific rules that separate it from other sports markets. Players' wages will reflect those rules. The low tenure observed for most workers and the frequent moves between clubs suggest a context close to a spot market. However, the particularities of the market, with wide pay scales and extremely high wages at the top indicate that we can face something resembling an internal labor market in line with the concept developed by Doeringer (1967), Doeringer and Piore (1971) and Osterman (1982, 1984).

Football teams do not present a hierarchical structure, with lines of progression where workers advance to higher job levels though promotions. In spite of a specialization within the playing field, there no such movement as a player's promotion from goal-keeper to forward. However, during his career, a player climbs a pay ladder if is able to show his value. That ladder is present within clubs, within leagues and across leagues. If we consider leagues and clubs are internal rankings of an organization we can compare players' moves to workers moves inside a firm during their careers. Thus, we do not have job assignment within a hierarchical structure as modeled by Gibbons and Waldman (1999), where workers accumulate human capital and employers learn about workers' ability. We have, however, a learning component as proposed by Farber

and Gibbons (1996) in a spot market and where employers learn symmetrically – the public-learning model. The learning process leads to the formation of a specific value to the match club-player (Jovanovic 1979), inducing the efficient allocation of players to clubs where the match value is higher. Higher value matches survive and low value matches are destroyed, arising a negative relationship between worker's tenure and the hazard of leaving the firm.

Within companies, managers seek to device the best incentive devices to induce workers' performance. Lambert, Larcker and Weigelt (1993) show that a unique theory cannot explain the way companies structure incentives for middle and top managerial levels. Baker, Jensen and Murphy (1988) present an earlier discussion on the ability of economic models to explain compensation and incentive practices within organizations. Gibbons (2005) discuss the agency theory and introduces career concerns in the context of companies' provision of incentives.

One way to set workers' wages is by rank-order tournaments. Lazear and Rosen (1981), Rosen (1986), and more recently DeVaro, J. (2006a), show that companies cannot base salary just on workers effort choices. The company must establish a rank-order tournament between workers and determines prizes to winners and losers, independently of the absolute difference between outputs. This prize spread, or pay scales, works as an effort incentive, because the winner is the worker who achieves the highest output, even if it is not possible to know if the output has been reached due to luck, to effort, or both. The tournament theory has been studied in several industries considering firms' top executive levels (Eriksson 1999) and in sports (Kahn 2000). There are few sports example like golf tournaments (Ehrenberg and Bognanno 1990a,b), and professional NASCAR drivers (Becker and Huselid 1992). Orrison, Schotter and Weigelt (2004) show that the prize structure of tournaments has an effect

on participants' effort, favoring fewer prizes over a more generous promotion policy. The concentration of pay implied by the tournament theory has also been studied under the Rosen's (1981) superstar effect and in particular in the football market (Lucifora and Simmons 2003; Franck and Nüesch 2012).

Employee mobility is an important issue for organizations. Campbell *et al.* (2012) claim that employees with higher salaries are less likely to leave comparing with employees with lower salaries, suggesting that the challenge for those who earn more is to create their own business instead of finding a new firm that pays more. Particularly in our study, a player who leaves one club will join another club (except retirement): if the new club is a former club competitor the player will take the knowledge and the skills gained at the former club to the new club, knowledge of former co-players and coaches.

One key reason for employee mobility is the difference in compensation dispersion found in organizations. Higher performer employees are associated to move to firms with higher wage dispersions and lower performer employees are associated to move to firms with compressed wage distributions (Carnahan *et al.*, 2012). Nickerson and Zenger (2008) argue that envy among employees that feel that similar employees have higher salaries also can lead to more turnovers and consequently to wither mobility. In addition, non-monetary incentives are also important to motivate and appeal skillful employees (Gambardella *et al.*, 2013). Firms can motivate employees through autonomy in the decision-making process. In other words, making employees feel that they are really part of the solution.

Terviö (2009) shows that there is significant uncertainty about the capabilities of new entry workers, above all those with few education and experience, which could generate excessively high wages for high hierarchy workers. This is the case of professional football players with low age and very few years at professional levels.

Therefore, first year's transfers and wages can indicate players' talent and potential level for future years. Hiring younger players with lower wages reduce firms' costs of hiring inexperienced players since that talent is mainly discovered on the daily job observation. Otherwise, high salaries can represent a huge cost to clubs beside the fixed-term contracts that football players have.

The literature on inter-firm mobility is still growing. Mobility in external markets is necessarily associated with promotions and career progression. Employers tend to develop skills and accumulate experience in order to achieve promotions by changing firms several times (O'Mahony and Bechky 2006). Therefore, companies that have workers with short career length and with fast-changing environments and opportunities should be prepared to lose employees and to structure human resources in a way that allows retaining the best performers.

The human resources management in professional football teams represent the largest share of money spend by the organization. Moreover the team results, financial and sportive, depend on a large extent on players' performance in the pitch game after game. Consequently we test several hypotheses that allow us to understand better the moves between clubs and across professional leagues and inform club's human resources management.

4.3 HYPOTHESES AND EMPIRICAL STRATEGY

We study players' careers and wage ranking changes by testing several hypotheses through players' movements between clubs and leagues. We want to discover which players are more likely to change club and league and how the relative players' wage within the team influence the type of move. Given the small size of the organizations

under analysis and the absence of job levels, we consider wage quartiles as pay ranks to measure players' relative position within teams. We start by formulating two hypotheses addressing the probability of changing club and league.

We model an approximation to the hazard using a discrete model, following the idea of Jenkins (1995). As we have multiple destinations upon exit, we apply a multinomial logit model (as in a competing risk model). We start by defining three possible events in each period (football season): the player can stay in the same club (the comparison outcome); the player can leave the club and the football market (leaves our observational sample); or the player can move to another club. Define the probability of each of these outcomes as

$$p_{ij} = \Pr(y_j = i) = \begin{cases} \dfrac{1}{1 + \sum_{m=2}^{k} \exp(\mathrm{x}_j \beta_m)}, if\ i = 1 \\ \dfrac{\exp(\mathrm{x}_j \beta_i)}{1 + \sum_{m=2}^{k} \exp(\mathrm{x}_j \beta_m)}, if\ i > 1 \end{cases}$$

where k is the number of outcomes; $\mathrm{x_j}$ is the row vector of observed values of the independent variables for the j_{th} observation; β_m is the coefficient vector for outcome m. The vector of observed variables $\mathrm{x_j}$ includes a vector of dummies for tenure, age at the start of the contract, a vector of dummy variables identifying player's wage quartile within the current team, and a set of dummies identifying the club's league.

We opt to define the relationship between the probability of leaving and time (tenure) as flexible as possible, not imposing any particular form, by defining a set of the dummies for tenure. The age at the start of the employment relationship capture the human capital accumulated until the start of the contract. In the football labor market, most players enter the profession at the age of 16 to 18 years old, meaning that age can

be considered as a proxy for the accumulation of skills. We do not include schooling as most players only complete the statutory level of schooling years and, in addition, it does not seem that schooling can be considered a form of accumulation of human capital useful for playing football (apart from the base level). The wage quartile within the team aims to capture the player performance progression relative to the remaining players of the team.

The log pseudolikelihood of the multinomial logit model is given by:

$$\ln L = \sum_{j} w_j \sum_{i=1}^{k} Ii(y_i) \ln p_{ik}$$

were w_j is an optional weight and

$$I_i(y_j) = \begin{cases} 1, \text{if } y_j = i \\ 0, \text{otherwise} \end{cases}$$

The change variable is equal to one when the player moves to another club and zero otherwise.

We state a set of hypotheses based on the reviewed literature taking into consideration the particularities of the football market. We start with three hypotheses concerning the hazard of exiting the current club to different destinations.

Hypothesis 1. The player's hazard of leaving the club decreases with tenure.

The first hypothesis states the expected relationship between tenure and the hazard of exit is negative – a negative time-dependence – due to the learning process about the players performance. The good club-matches will survive and the bad matches will end.

Hypothesis 2. The higher the player's wage quartile within the team, the lower the hazard of leaving the club and exiting the football market.

The second hypothesis follows from the first. It players' are in a good club-player match, they remain with the current employer and will progress in the pay rank.

Hypothesis 3. The higher the player's wage quartile, the higher the hazard of moving to a new club.

The third hypotheses aim to test the relationship between the players' pay rank within the team and the probability of moving to another club. As discussed above, in some industries employees with higher salaries are less likely to leave, however in sports industry professional football players have shorter careers and different type of contracts which can influence the decision to stay or leave. These facts presents different challenges to players since the hypotheses of emigrate, accumulate earnings and play in a specific country/club are smaller comparing with employees with a 40-year career. We assume that learning is public knowledge to all clubs. Thus, higher relative wages should increase the player's probability of finding a better match.

Hypothesis 4. The higher the player's wage quartile, the higher the probability to move to a club in a higher league.

Hypothesis 4 gives us the probability of moving up in the league ladder taking into account the player wage quartile ranking. We want to know the impact that a wage

quartile has on the decision and probability of a player to be transferred to a club in a higher league.

The last three hypotheses allow us to ascertain the influence that wage quartile has on the different players' career events. Can organizations predict or anticipate the movement or intentions of human resources based on their ranking salary? If they can, organizations can improve the efficiency of their human resource management.

The next three hypotheses deal with the player's current pay rank assignment and its relationship with the previous assignment. We apply an ordered discrete model to estimate the probability of occupying a certain wage quartile . The ordered logit function gives the probability of observing a certain outcome *i*. The probability is given by:

$$\Pr(\text{outcome}_j = i) = \Pr(k_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \beta_k x_{kj} + u_j \leq k_i)$$

We estimate the coefficients β_1, β_2, ..., β_k together with the cutpoints k_1, k_2, ...,k_{k-1}, where k is the number of possible outcomes. In our case there are four possible outcomes: the number of wage quartiles. K_0 is defined as $-\infty$ and k_k as $+\infty$.

Hypothesis 5. When the player change to new clubs they have a higher probability to be assigned to top wage quartiles within the team if they came from higher wage quartiles in previous team, independently of the type of move considered.

We want to know if the past wage quartile of a player is important to define the new wage quartile with Hypothesis 5. We also test if the type of move influences the

new wage quartile. Players who are transferred to new clubs expect something new in their career. They can expect salary pay rise or just enhance the opportunity to play more minutes in order to increase the prospect of better contracts in the future. Hypothesis 5 should provide an image of what players can expect after a transfer.

Hypothesis 6. Player's former club rank within the league has a positive relationship with his entry wage quartile in the new club.

The past history of a player – his performance – is important to define the wage that a player will be offered in a new contract. With Hypothesis 6 we want to test the possible impact that the former team performance has on wage setting. Can a player be in the shadow of a good team and expect that the team's performance is sufficient to achieve an improvement in his career? This result should serve as an advice to players, since that they can see if teams' performance is what matters in new contracts salaries.

Hypothesis 7. Player's new club rank within the league in last season has a positive relationship with his entry wage quartile.

Similar to Hypothesis 6, the impact of teams is tested in this last hypothesis. We now test the influence of the new team performance in the previous season has on the wage of the new player hired. Are teams that perform better hire more players to higher pay ranks? Or should we expect that clubs that perform better have already good players and so they do not need players in the top of the wage rank.

4.4 PORTUGUESE FOOTBALL LEAGUES

The Portuguese football league system has a hierarchical format with national and regional leagues. All leagues are open and clubs compete for the best possible rank in order to get promotion to a higher league and avoid relegation to the league below. The number of promotion and relegation clubs can vary from league to league. This system allows that in theory every club can climb from local leagues to the Portuguese First League.

National leagues are divided in four tiers and the regional leagues have typically three tiers (may vary depending on the number of teams in each region). We focus on the first four levels – the national leagues. The first two are professional leagues and the remaining two are semi-professional. In the years considered in this research the Portuguese First and Second leagues had 18 teams. The last three were relegated, until 2005-2006 season. Since 2006-2007, the two top leagues have 16 teams and the last two are relegated to the lower league. In order to reduce the number of teams in the first and second leagues in 2006, four were relegated clubs in the end of 2005-2006 First League season and only two were promoted from the Second League. In the Second League there were five relegations and only one promotion from the Third League. The two semi-professional leagues are divided in several divisions, some of them regarding clubs regional location. At the end of the season it is necessary to perform some promotion/relegation playoffs in order to know which clubs are promoted and relegated. During this period, several events disrupted the normal functioning of the promoted relegated scheme. Some clubs were relegated for financial reasons (Farense, Salgueiros, Felgueiras, Estrela da Amadora), other gave up professional football (Alverca), administrative irregularities (Gil Vicente) and there were clubs that were relegated due to

bribery of referees (Boavista) and for corruption convictions (Vizela). Table 4.1 summarizes the number of clubs, divisions, promoted and relegated clubs during the seasons covered by our study.

Table 4.1 – Professional and Semi-Professional leagues summary: number of clubs, relegations promotions, and divisions.

	First League		Second League			Third League				Fourth League		
Season	Clubs	Rel.	Clubs	Prom.	Rel.	Divisions	Clubs	Prom.	Rel.	Divisions	Clubs	Prom.	Rel.
2002-03	18	3	18	3	3	3	59	3	12	7	117	13	22
2003-04	18	3	18	3	3	3	59	3	11	7	118	13	27
2004-05	18	3	18	3	3	3	59	3	11	7	118	13	27
2005-06	18	4	18	2	5	4	58	1	13	7	115	13	23
2006-07	16	2	16	2	2	4	56	2	12	7	104	13	30
2007-08	16	2	16	2	2	4	55	2	15	7	94	13	28
2008-09	16	2	16	2	2	4	47	2	15	7	92	13	28
2009-10	16	2	16	2	2	3	47	2	13	8	94	13	25

Over the last 20 years, Portuguese clubs have been a source of high quality players to most important European leagues.[21] In the last years there were also a new trend, international players, mostly South Americans, who came to Portugal play two or three years and get transfer for European countries.[22]

Portuguese clubs play an important role in players and coaches transfer market. Portugal is nowadays an important source of players and coaches not just to the most important leagues in Europe, but also to the Middle East, South Asia and Western European countries. Among the ten best placed countries in the UEFA Country ranking over the years covered by the research only Portugal, France and The Netherlands have

[21] In the 1990s, for example, players like Fernando Couto, Luís Figo, Paulo Sousa, Abel Xavier, Rui Barros, Vítor Baía, Sérgio Conceição and Carlos Secretário were transferred from Portuguese teams, which have won domestic and international titles with European clubs. In the new millennium there are more examples of Portuguese players who won domestic and international titles with foreign clubs (Cristiano Ronaldo, Nani, Rui Costa, Paulo Ferreira, Ricardo Carvalho, Quaresma, Deco, Tiago, Simão Sabrosa and Raul Meireles).

[22] Once again there are several examples of international players that transfer from Portuguese clubs that won domestic and international titles with clubs all over the Europe, as: David Luíz, Anderson, Radamel Falcão, James Rodrigues, Hulk and Ramires.

a positive trade balance with regard to player transfers in the overwhelming majority of the years covered. Czech Republic and Belgium first leagues also have a positive trade balance, but unlike Portugal they do not appear consistently in the top 10 of UEFA country ranking. First leagues from countries like Spain, England, Germany, Italy, Ukraine, Russia and Turkey have almost yearly negative balances[23]. These facts show that Portuguese players and Portuguese clubs play a relevant role in the formation and sale of high-quality young players for the major European leagues and clubs.

4.5 DATA

Data on players and clubs came from *Quadros de Pessoal*, a longitudinal matched employer-employee micro-data, an annual mandatory survey collected by the Portuguese Ministry of Labor and Social Solidarity in the last quarter of each year. The survey covers all private firms with at least one worker. We are able to identify football players among an average of more than 3 million workers each year and the league in which players started the season (before the winter transfer market). Covering the seasons from 2002-2003 to 2009-2010, we identify 6450 players, an average of almost 850 professional and semi-professional players each year.

Clubs from semi-professional leagues have fewer players and not all have contracts with the club. We have almost 3000 players from First League and just over 300 from tier 4.

[23] The transfers balance can be seen at: http://www.transfermarkt.co.uk/statistik/transfersalden

Players' demographics

Table 4.2 shows players' statistics. Players are on average 25 years old. There are players who become professionals at the age of 16, and some only retire when they have more than 40 years old. The majority of players (75%) do not stay more than two years in each club. As expected the majority of players are from professional leagues. Clubs that compete in these leagues have more players and all players are professional.

Mobility

More than 50% of players were new hires and less than 5% of players stayed more than three years in the same club. Considering these specific characteristics of the market, low tenure and age, we could follow 1345 moves from nearly 900 players in the years covered. We considered six types of changes: player get transfer to a new club in a higher league; player get transfer to a new club in a lower league; player get transfer to a new club in the same league; player stay in the same club in a higher league (club promoted to a higher league); player stay in the same club in a lower league (club relegated to a lower league); and player that stays in the same club in the same league. Table 4.3 summarizes the number of changes that were identified in our sample.

Table 4.2 - Descriptive statistics.

	All		First League		Second League		Third League		Fourth League	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	25.089	4.615	24.675	4.544	25.564	4.567	25.128	4.541	26.289	5.600
Tenure (years)	1.228	4.394	1.502	3.215	0.750	1.443	1.276	7.309	1.150	6.347
Age < 21	0.189	0.392	0.225	0.418	0.158	0.365	0.171	0.376	0.107	0.309
21<= age <=22	0.140	0.347	0.133	0.340	0.133	0.339	0.167	0.373	0.119	0.324
23<= age <=24	0.151	0.358	0.145	0.352	0.145	0.352	0.165	0.372	0.170	0.376
25<= age <=26	0.153	0.360	0.150	0.357	0.164	0.370	0.148	0.355	0.150	0.358
27<= age <=28	0.128	0.334	0.135	0.342	0.129	0.336	0.110	0.313	0.138	0.346
29<= age <=30	0.105	0.306	0.099	0.299	0.115	0.319	0.100	0.300	0.130	0.337
31<= age <=32	0.069	0.253	0.062	0.240	0.082	0.274	0.070	0.254	0.059	0.237
age >=33	0.065	0.247	0.052	0.221	0.075	0.264	0.070	0.256	0.126	0.333
Tenure = 0	0.545	0.498	0.419	0.493	0.648	0.478	0.652	0.476	0.640	0.481
Tenure = 1	0.202	0.402	0.241	0.428	0.171	0.377	0.166	0.372	0.186	0.390
Tenure = 2	0.108	0.310	0.140	0.347	0.082	0.275	0.080	0.272	0.071	0.258
Tenure > 2	0.145	0.352	0.199	0.400	0.099	0.299	0.102	0.302	0.103	0.304
Number of players	6450		2923		1779		1495		253	

Table 4.3 – Players changes between 2002-03 and 2009-10

Type of change	Observations	Description of change
New club in a higher league	143	player get transfer to a new club of a higher league
New club in a lower league	192	player get transfer to a new club of a lower league
New club in the same league	327	player get transfer to a new club of the same league
Same club in a higher league (club promoted to a higher league)	212	player stays in a club that was just promoted
Same club in a lower league (club relegated to a lower league)	167	player stays in a club that was just relegated
Same club in the same league	1771	player stays in a club that stays in the same league
Total	2812	

Wages

We started to consider all players for each club and year and then identified in which wage quartile they are. Wages are defined by the sum of base wage and regular bonuses. Clubs with less than 11 players were excluded. Table 4.4 and Figure 4.1 show the distribution of wage by league for players who earn less than 50.000€. It is patent that the majority of players earn less than 5 000€. However the wage coefficient of variation is 2.46 for all sample, if we inspect club by club we found that the maximum wage coefficient of variation is 1.41, the minimum is 0.05 and the average is 0.54. There are nine clubs with coefficient of variation higher than 1, typically clubs from first league, and 35 with coefficient of variation less than 0.5, in general clubs from the lower leagues.

Figure 4.1 shows that there not players in the fourth tier earning more than 10 000€ and there are a few in tier three. Although, these players in the third tier are players related to first league clubs, in other words they compete in the third league but

have contracts with first league clubs. These can be the case of loan players or players that play in reserve teams.

Table 4.4 – Players' wages

	All	League 1	League 2	League 3	League 4
Mean (€)	6088	11766	1975	1293	614
Standard deviation					
Coefficient of variation (sd/mean)	2.46	1.79	1.05	1.17	0.86
percentile 10 (€)	386	828	386	403	0.00
percentile 25 (€)	900	1608	790	821	183
percentile 50 (€)	1584	4000	1450	1047	426
percentile 75 (€)	4157	10576	2499	1500	1024
percentile 90 (€)	12500	32232	4147	2069	1324

Notes: Real wages, deflated using the 2002 Consumer Price Index.

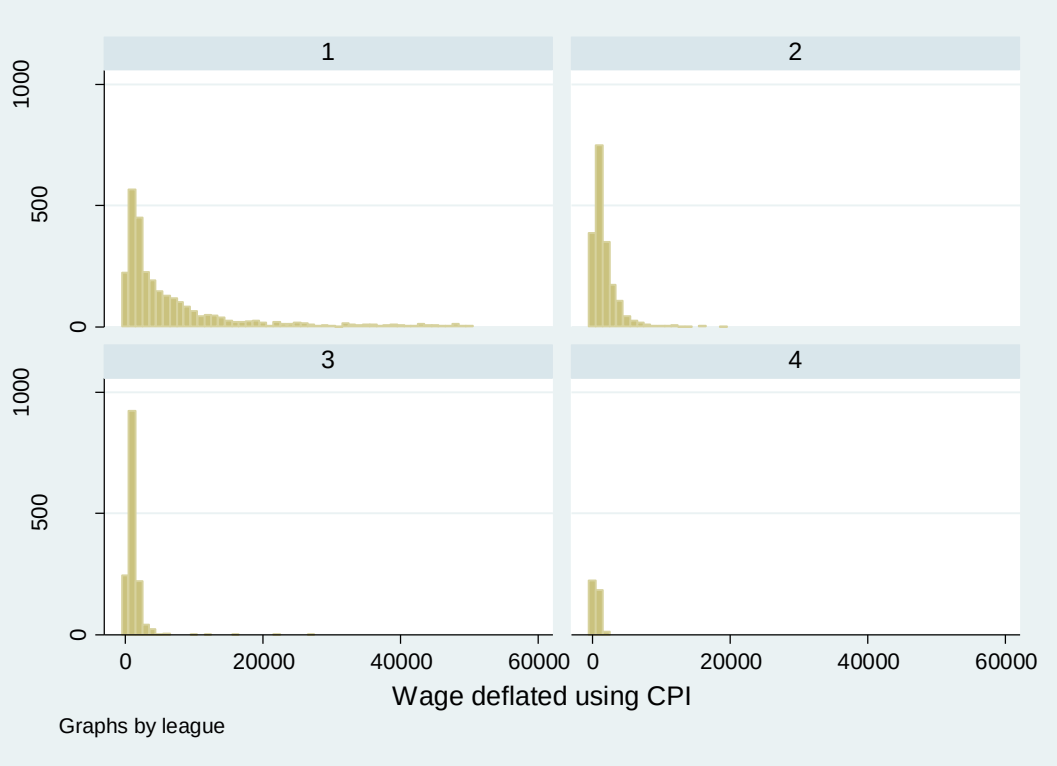


Figure 4.1 – Distribution of wages between 0 and 50.000€ by league.

4.6 MOBILITY AND PAY RANK

Unconditional changes

We identify players who repeatedly appeared in the database so that we could follow their path along the seasons covered. All clubs were identified and the professional category of each player was verified in order to reduce errors. Nevertheless, we prevent that in exceptional cases it is possible that players belong to a certain club with whom they have contract, in some cases pays them a monthly wage, but they are loaned to other clubs, in the same or different leagues. We ordered players by wage within each club and year and set wherein quartile they are. In first quartile are those who have lowest wages and in the fourth quartile are those players who earn more among their peers. Next, we analyze the career path throughout the seasons. Different types of moves are defined and the quartile variation is calculated for each year.

There are 143 players that move from a lower league to a higher league, considering that the player changed club. Almost 60% of players who leave a club in a lower league to a higher league were, before transfer, in the top quartiles of the club. After transfer the majority of players are in the bottom half of clubs pay list, more than 60%. The major difference is the number of players who were in fourth quartile, before and after transfer. Typically, we can observe a shift from the fourth quartile to the second quartile.

Concerning wage changes with respect to quartiles variation it is evident that, on average, players who accept to be transferred to a higher league club may well have different expectations of salary change. A player who rises in club order pay rank can

expect a doubling and in some cases the triple of salary. A player who moves to an immediately lower quartile can also expect a wage increase

The change to a new club in a lower league is observed 192 times. Almost 55% of players came from lower quartiles and after transfer almost 65% of them take up the two top quartiles. Less than 14% of those players go to first quartile, when before move they were almost 30%. This is an evident corroboration that in this kind of change there is a transfer of players from lower wage quartiles to higher quartiles.

There are 327 players that change club in the same league. As regards to wage quartile changes, we do not observe major variations but the tendency is to rise in the pay rank. Players who stay in the same quartile or increase internal rank are expected to earn a wage increase. This suggests that players who perform better are willing to play in the same league for better salaries. Though there are players who accept to earn less and lost importance within the club so they can remain playing in the same league.

The next changes are those where players stay in the same club but the club gets promoted or relegated. In these two cases players stay from one season to another with a promoted or relegated club. There are 212 players who followed the promoted club and 167 the relegated club. Regarding the wage quartile changes, there are not significant changes on those who followed the promoted club. For those who stay in the relegated club it is different. Players can expect an increase in wage quartile since that players had contracts for more than one season and the club comply with the obligations set in the past. An additional cause to this wage quartile increase is that relegated clubs can count with less revenue and so they must consider this breaking in new hires, as we should expect less costly than in late season.

On the subject of wage variation related to wage quartile change we saw that if a player stays in the same club after promotion and do not lose wage quartile positions it is expected on average a wage increase.

After the five possible changes, we studied players who stay in the same club and in the same league from one year to another. Among 1771 observations there are no significant variations in salary quartile rankings for players who remain in the same club. There is just a small difference in the number of players who stay in the first quartile, dispersed in the other three quartiles.

Figure 4.2 shows the cumulative quartile percentages of players before and after their change. For players who transfer to a new club in a higher league there are more players in the lowest quartiles after the transfer relating with those before the transfer. There is a significant different between the percentage of those who occupy the higher quartiles before and after the transfer to a new club in a higher league. It seems that players progress in the pay rank before being able to sign a contract in club belonging to a higher league. When they arrive to the new club, they are assigned to relatively lower wage quartiles. In this respect, it seems to replicate workers' promotion up in the job level ladder, as in Baker, Gibbs and Holmstrom (1994a).

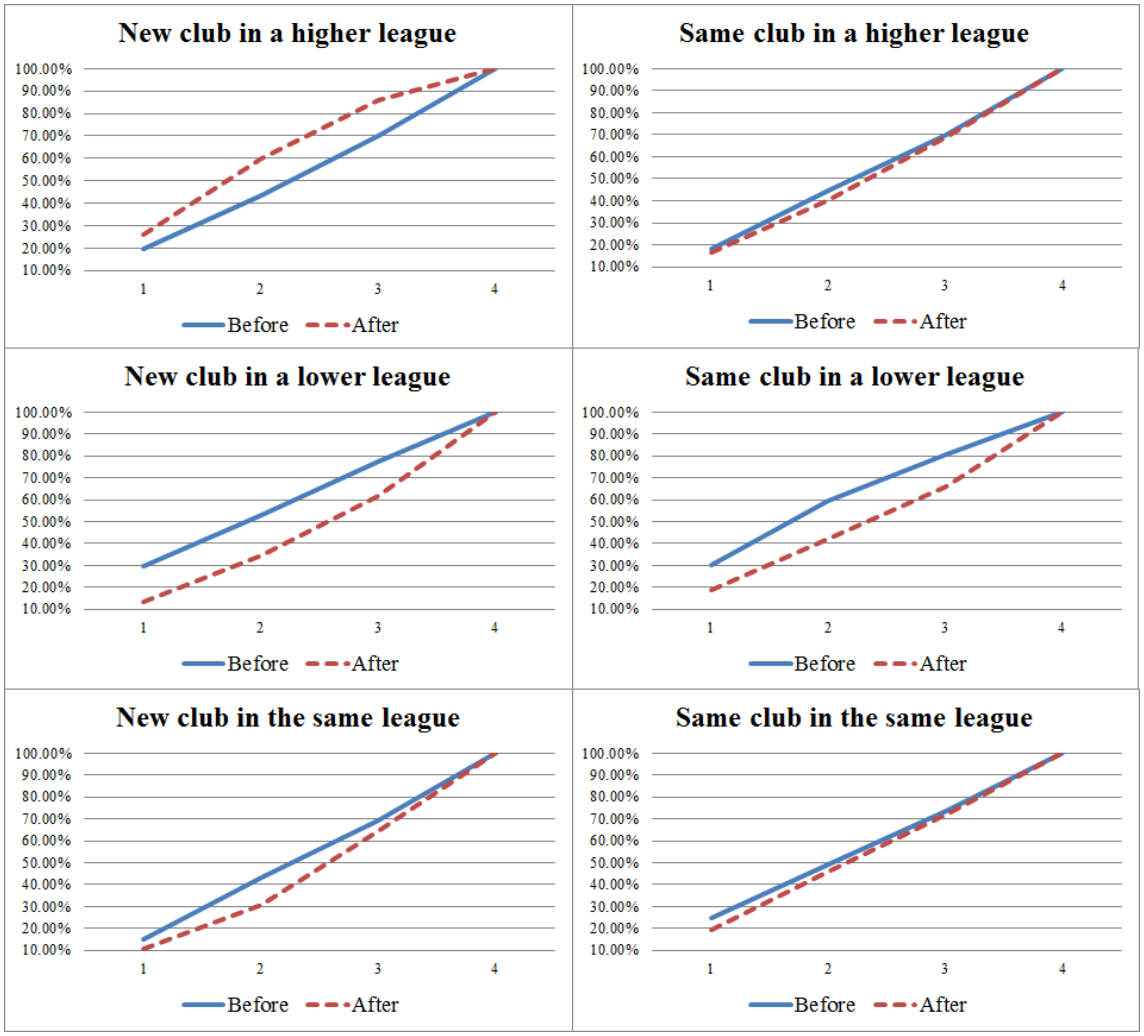


Figure 4.2 – Cumulative wage quartile before and after movement.

Regarding the remaining moves players tend to occupy higher quartiles after the move. The most significant cases are for players who move to lower leagues, with a new club or with the previous club. When players move to lower leagues there is a significant change to higher wage quartiles. When players stay in the same club (in the same league), the cumulative distribution before and after this career event is almost the same.

Concerning players' mobility we follow players for two and three years and show in Table 4.6 the evolution on wage quartiles for those who appear more than one

year in our sample. As showed before tenure is around 1.2 years old and not all players appear more than one year. There are a considerable number of players wo appears just one time in our sample.

We gathered two groups of players: players who are present at least two years in sample and players who are present at least three years. Then, we sum up who many where in each of the four wage quartiles. Consequently, we observe which quartiles they occupy in the following year and in the second year after. The first result is that a high proportion of players maintain their relative position from one year to the following – the figure in the main diagonal range from 38.45% in the second quartile to 55.90% in the fourth. The second is that the cells above the main diagonal have always a higher percentage of players when compared with the cells below the diagonal, showing that players generally progress up within the pay rank. Third, the movement up continues as the comparison between the two bottom panel show.

Table 4.5 – Players' wage quartile after one and two years.

Year N		Year N+1				Year N+2			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Quartile 1	793	41.11%	34.80%	13.24%	10.84%				
Quartile 2	879	15.93%	38.45%	27.08%	18.54%				
Quartile 3	852	9.74%	19.84%	40.38%	30.05%				
Quartile 4	882	7.03%	11.34%	25.74%	55.90%				
Quartile 1	416	42.31%	33.89%	14.90%	8.89%	24.04%	39.18%	23.32%	13.46%
Quartile 2	478	14.02%	40.17%	29.08%	16.74%	14.44%	30.75%	28.45%	26.36%
Quartile 3	464	10.13%	19.18%	39.87%	30.82%	11.85%	18.53%	36.42%	33.19%
Quartile 4	463	6.91%	12.53%	24.41%	56.16%	7.13%	16.63%	26.35%	49.89%

Notes: Players that appears at least two years in database and players that appears at least three years.

4.7 RESULTS AND DISCUSSION

We test the first three hypotheses by estimating a multinomial logit with two possible destinations if the employment relationship between the player and the club ends: moving to another club or exiting the football market (exit our sample of workers). Table 4.6 presents the estimated results on the form of odds ratio, by comparing each coefficient (the ratio) with its counterpart in the base category – to remain in the club.

Tenure decreases the hazard of leaving the club, but only for the exit the market destination. For players who move to another club, the (negative) time dependence only shows up after two years of employment in the same club. These results only confirm partially Hypothesis 1. Concerning the wage quartiles, they do not seem to influence the decision to leave the market (against Hypothesis 2), contrary to what happens for those who move to a new club: the wage quartile increasingly leads to a higher hazard of moving, confirming Hypothesis 3. Players in higher wage quartiles are those who on average perform better and so they aspire transfers to better clubs and higher leagues in search of better club-matches. As we showed previously this does not mean that they will occupy higher wages quartiles. Entry age is a control variable that is only significant and positive (odd ration higher than one) for those who leave the market.

Table 4.6. Hazard of changing club or leaving the football market – multinomial logit (odd ratios)

	Move to a new club	Leave market
2nd wage quartile before change	1.284*	1.088
	(1.89)	(1.00)
3rd wage quartile before change	1.337**	1.083
	(2.17)	(0.92)
4th wage quartile before change	1.393**	1.122
	(2.50)	(1.34)
Entry age in the club	1.003	1.015***
	(0.43)	(3.04)
Tenure = 1	0.917	0.839**
	(0.73)	(2.29)
Tenure = 2	1.173	0.696***
	(1.16)	(3.63)
Tenure > 2	0.785*	0.648***
	(1.76)	(4.85)
Number of observations	5,595	
Chi^2	299.84	

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ Note: Stay in the same club is the base group to compute the odds ratio. The 1st wage quartile (the lowest) is the comparison category for wage quartiles. Leagues' dummy omitted.

We now test Hypothesis 4 by inspecting the possible changes that players can make in Table 4.7. In order to perform this analysis we do a multinomial logit regression with five possible destinations. Again, the comparison is made with those players who stayed in the same club and in the same league. The first result is for those players who get transfer to higher leagues. Considering all players we can see that as long as players occupy higher wage quartiles the most probable is to get transfer for higher leagues. Only the third and fourth quartiles are significant and the hazard of moving increases with the quartile. Players in higher wage quartiles are those who on average perform better, progressing up within the pay rank. The player who performs better earns more compared with other players in the same team and increases the

probability to play in higher leagues. This does not mean that players will again occupy higher wage quartiles. If they look just for the value of the wage the statistics, players who change to higher leagues will earn, on average, more 45% of salary. Therefore these players will have the opportunity to play in higher leagues and earn more money which leads us to say that this is a promotion. The results are similar if we consider only players from league two and league three and four. Logically, this estimation does not make sense in the case of players from first league.

Table 4.7. Hazard of moving to another club across leagues or leaving – multinomial logit (odd ratios)

	New club in a higher league	New club in a lower league	New club in the same league	Same club in a higher league	Same club in a lower league	Leave and return to database	Leave
2nd wage quartile before change	1.389	0.700*	1.979***	1.403	1.021	1.450**	1.041
	(1.23)	(1.66)	(3.54)	(1.51)	(0.10)	(2.52)	(0.42)
3rd wage quartile before change	1.556*	0.662*	1.771***	1.293	0.743	1.315*	0.919
	(1.68)	(1.89)	(2.89)	(1.12)	(1.28)	(1.82)	(0.87)
4th wage quartile before change	1.655**	0.535***	1.943***	1.395	0.619**	1.106	0.951
	(1.96)	(2.75)	(3.41)	(1.46)	(1.99)	(0.66)	(0.52)
Entry age in the club	0.981***	1.061***	1.010	1.029*	0.994	0.994	1.038***
	(2.59)	(3.46)	(0.88)	(1.76)	(0.56)	(1.04)	(5.30)
Tenure = 1	0.489***	1.115	0.771	0.832	0.535***	0.837	0.662***
	(2.85)	(0.54)	(1.64)	(0.99)	(2.68)	(1.35)	(4.93)
Tenure = 2	0.648	1.659**	0.980	0.821	0.869	0.693**	0.572***
	(1.52)	(2.26)	(0.11)	(0.83)	(0.56)	(2.09)	(5.07)
Tenure > 2	0.368***	1.269	0.542***	0.578**	0.605**	0.678***	0.479***
	(3.41)	(1.09)	(3.20)	(2.36)	(2.05)	(2.60)	(7.47)
Number of observations	5,487						
Chi^2	236.72						

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ Stay in the same club is the base group to compute the odds ratio. The 1st wage quartile (the lowest) is the comparison category for wage quartiles. When the player stays in the same club and the league changes means that the club was promoted (move to a higher league) or demoted (move to a lower league).

For those players who get transferred to lower leagues the results are the opposite of the previous ones. Players with higher probability to be transferred are those who occupy lower wage quartiles. Players in higher wage quartiles are less likely to move down. The new club in a lower league movement is possible to be seen as a demotion. Players who move to lower leagues can expect on average a wage reduction of 45%. Contrary to the move new club and higher league, when players move to lower leagues they can expect an increase in wage quartile, therefore they are willing to play in lower leagues earning less money but occupying higher wage quartiles. These results are similar if we consider all players or just the players of first league. When we isolate players of lower leagues the results are not significant because the number of observations is limited.

In the same club and same league movement players get transfer to a new club of the same league. When we look for all players the results are not conclusive because the coefficients are not growing in one way. Players have a higher probability of transfer to clubs of the same league in the second wage quartile players. We can think of them as players who are seeking a new career opportunity in the same league. The coefficient reduces when we go to the third wage quartile and then goes up again in the top wage quartile. However if we look just for players that get transfer in first league, the coefficients decrease as we advance in the wage quartiles. Players in the first wage quartile are less likely to get transfer for clubs of the same league and players in the second wage quartile are those who have the higher probability of succeed with this transfer. Usually players who move for a new club in the same league can expect an average increase in salary of just about 7% and a slightly increase in wage quartile. The main motivation is not to earn more money but to have the chance to play in the same league in a different club that offers a more advantageous wage position.

The next two moves imply a league change in the same club. Players stay with the same club after clubs' promotion or relegation. The results for players who stay in the same club after promotion are not significant if we consider the set of all players. Nevertheless, we can see that players in higher wage quartile have a higher probability of staying in the promoted club. Important players in the successful season are kept in the team in the new season. This does not mean that players will earn more money; they just have the opportunity to play in a higher league. Additionally, players can expect a wage decrease since the team have less success in the league and consequently players receive less performance bonus.

Regarding players who stay in the same club after the club gets relegated the results are not conclusive. The coefficients are not statistically significant. The outcome leave and return the database in Table 4.7 shows players who leave the data for at least one year and then return. The reasons for being absent in the data are inconclusive and impossible to determine. Players could have been playing abroad or there is missing data. Nevertheless, as long as players reach higher wage quartiles, before leave the data and return, they have less probability to return. Players who leave the data in higher wage quartiles to play in international leagues are those who on average play better and have higher chances to succeed and stay longer playing abroad. The other players could have a lack of experience and talent that lowers the probability of success in other leagues.

Overall, the above results confirm Hypothesis 4, where the higher the wage quartile in the current club, the better the prospects of progressing up in the league ladder. Concerning tenure and the time dependence, apart from the decision to leave the market (or leave and return), where more tenured players hold lower hazards, the remaining results are not conclusive. The exception is for those players who stay in the

club for more than two years: the hazard of terminating the employment relationship decreases across all destinations, apart for those who move to a new club in a lower league (most likely for few matches that still remain for these players).

As to Hypothesis 5, considering all players who sign for a new club we analyze the probability of being assigned to a wage quartile giving the movement made to reach the new club. Players who stayed in the same club are the comparison group. We consider the previous wage quartile the relationship with new contracts. Table 4.8 presents the results for all leagues and show that players who occupy a previous high quartile increase the probability to occupy a higher quartile in the new club. Players who get transfer for the same league and for lower leagues have a higher probability of being high paid considering the remaining players of the team.

Table 4.8. Likelihood to enter in a certain wage quartile considering the previous wage quartile and move – ordered logit (marginal effects)

	4th Quartile	3rd Quartile	2nd Quartile	1st Quartile
New club in same league	0.185***	0.049***	-0.073***	-0.128***
	(6.20)	(3.39)	(5.48)	(5.17)
New club in higher league	0.027	0.017	-0.008	-0.027
	(0.89)	(0.90)	(0.86)	(0.89)
New club in lower league	0.198***	0.049***	-0.079***	-0.134***
	(5.59)	(3.28)	(5.03)	(5.25)
Age at entry	0.017***	0.003**	-0.006***	-0.011***
	(5.31)	(2.02)	(4.37)	(5.00)
2nd wage quartile before change	0.099***	0.033**	-0.036***	-0.075***
	(3.15)	(2.52)	(3.01)	(2.98)
3rd wage quartile before change	0.103***	0.033**	-0.038***	-0.077***
	(3.09)	(2.50)	(2.89)	(2.95)
4th wage quartile before change	0.179***	0.035***	-0.069***	-0.116***
	(4.85)	(2.74)	(4.32)	(4.49)
Number of observations		798		
Chi^2		151.33		

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ Notes: players in the same club in same league are the comparison category.

An additional result is the age of entry in the new club. As players get older the higher the probability of get a better wage quartile position. Younger players are more likely to be assigned to lower wage quartiles.

Table 4.9 shows that the league position in the previous year of the exit team does not influence the wage quartile that the player gets in the new club, refuting Hypothesis 6. The coefficients on wage quartile in the year before move and age are similar to the previous hypotheses results. The reason to offer a better or worse contract and consequently a certain wage quartile position seems to have no relationship with the performance of the player's former club; it seems that what really matter is the player performance within the team and not the team performance. Becomes clear that a player should not be seated waiting for the team's results to get a good transfer and a better contract.

Table 4.9. Likelihood of enter in a certain wage quartile considering the previous wage quartile; move and former club league position in year before move – ordered logit (marginal effects)

	4th Quartile	3rd Quartile	2nd Quartile	1st Quartile
New club in same league	0.179***	0.047***	-0.071***	-0.124***
	(5.82)	(3.21)	(5.24)	(4.87)
New club in higher league	0.017	0.011	-0.005	-0.017
	(0.54)	(0.54)	(0.53)	(0.54)
New club in lower league	0.202***	0.046***	-0.081***	-0.134***
	(5.56)	(3.03)	(5.06)	(5.15)
Age entry in club	0.017***	0.004**	-0.006***	-0.011***
	(5.17)	(2.08)	(4.26)	(4.90)
1st wage quartile before change	0.000	0.000	0.000	0.000
2nd wage quartile before change	0.100***	0.034**	-0.036***	-0.077***
	(3.22)	(2.57)	(3.07)	(3.04)
3rd wage quartile before change	0.107***	0.035***	-0.039***	-0.081***
	(3.23)	(2.59)	(3.02)	(3.07)
4th wage quartile before change	0.186***	0.037***	-0.072***	-0.120***
	(5.02)	(2.78)	(4.47)	(4.63)
League position - 1st quartile	0.000	0.000	0.000	0.000
League position – 2nd quartile	0.041	0.007	-0.015	-0.027
	(1.21)	(1.15)	(1.20)	(1.21)
League position – 3rd quartile	0.053	0.009	-0.019	-0.033
	(1.61)	(1.43)	(1.61)	(1.59)
League position – 4th quartile	0.054	0.009	-0.020	-0.034
	(1.54)	(1.42)	(1.53)	(1.54)
Number of observations		798		
Chi^2		154.66		

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ Notes: Same club in same league players' are the comparison category.

Lastly, we test if the new club position in the season before the move has impact in the quartile wage position of new player – Hypothesis 7. The results show that when players move to clubs that perform better they have a lower probability of being hired to a higher quartile. When we look just for the two bellow wage quartiles there is a negative impact if the club that is hiring a player were classified in the above half of the table. Moreover, these clubs typically hire players to the top quartiles. Regarding clubs that end in the last quarter of the table the results are not statistically significant. However the trend show that clubs better classified are more willing to sign players to the top wage quartiles, or on other words when a player moves to a top team he has a higher probability to go to higher wage quartiles, confirming Hypothesis 7.

Table 4.10. Likelihood of enter in a certain wage quartile considering the previous wage quartile; move and new club league position in year before move – ordered logit (marginal effects)

	4th Quartile	3rd Quartile	2nd Quartile	1st Quartile
New club in same league	0.204***	0.053***	-0.083***	-0.135***
	(6.44)	(3.45)	(5.57)	(5.37)
New club in higher league	0.032	0.020	-0.010	-0.032
	(1.02)	(1.04)	(0.97)	(1.03)
New club in lower league	0.201***	0.054***	-0.082***	-0.133***
	(5.28)	(3.41)	(4.75)	(5.11)
Age entry in club	0.017***	0.004**	-0.006***	-0.011***
	(5.18)	(2.09)	(4.28)	(4.86)
1st wage quartile before change	0.000	0.000	0.000	0.000
2nd wage quartile before change	0.101***	0.033**	-0.038***	-0.073***
	(3.04)	(2.44)	(2.89)	(2.88)
3rd wage quartile before change	0.084**	0.030**	-0.031**	-0.063**
	(2.48)	(2.13)	(2.35)	(2.38)
4th wage quartile before change	0.187***	0.035***	-0.074***	-0.114***
	(4.75)	(2.58)	(4.24)	(4.40)
New team position – 1st quartile	0.000	0.000	0.000	0.000
New team position – 2nd quartile	0.072*	0.011*	-0.027*	-0.043*
	(1.89)	(1.73)	(1.86)	(1.93)
New team position – 3rd quartile	0.066**	0.010*	-0.024**	-0.040**
	(2.01)	(1.68)	(1.99)	(1.98)
New team position – 4th quartile	0.019	0.004	-0.007	-0.012
	(0.56)	(0.56)	(0.55)	(0.56)
Number of observations		704		
Chi^2		145.40		

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ Notes: Same club in same league players' are the comparison category.

4.8 CONCLUSIONS

We examine the changes between clubs of professional football players in Portugal for eight seasons. After defining six different possible changes concerning new club, leagues, promotions and relegations, we can conclude that professional football players are willing to lose importance within teams in exchange for a chance of playing in a higher league. Nevertheless, this relative loss does not mean lower wages. The opposite is also true, players are accepting to lose money and visibility for playing in a lower league in exchange of more importance within the new team. We also saw that typically players who move from clubs of the same league expect to earn a wage increase and

also a rise the internal pay rank. Players who stay in the same club after club promotion cannot expect to receive a wage bonus or a rise in internal ranking. In contrast, players who stay in the same club after relegation in general rise in teams' pay hierarchy. However, this rise does not mean that players receive a wage bonus. Statistically speaking we cannot compare the wages year by year of those players who leave the data and return; there is a gap between the years covered so we cannot conclude accurately the gain or loss of wage.

A common conclusion for all players is that who climbs in teams' pay hierarchy can expect a wage increase. These types of players have their effort recognized in two different ways: monthly wage increase and higher pay rank.

Concerning the hypotheses tested we conclude that players in higher wage quartiles are more likely to move and particularly to higher leagues. We state this movement as a promotion as players have the opportunity to play in a better league earning more money. Players in higher wage quartiles are more likely to move to clubs of the same league with a slightly wage increase associated to the transfer. Players who came from higher wage quartiles are also more likely to sign new contracts in higher paid positions in the new team hierarchy. Finally, players in high wage quartiles are less likely to move to lower leagues.

On the subject of the moves studied we can conclude that when a player move to a higher league on average he will lose importance within the new team compared with the previous team because he will be placed in a lower wage quartile, however the player is rewarded with a significant wage increase. The opposite is true for players who get transferred to lower leagues: players lose monthly wage but climb in the team hierarchy of salaries: players lose money in exchange of more importance within the new team. When players get transferred to new clubs in the same league they expect an

increase in the salary earned and in the internal pay rank. Considering players who stay in the same club but change leagues, by virtue of the club be promoted or relegated, in neither the cases players can expect a wage rise nor a rise in the internal pay ranking. Players who stay in the same club and in the same league can expect a wage increase and a rise in the internal pay ranking.

5 FOOTBALL PLAYERS' CAREER AND WAGE PROFILES [24]

5.1 INTRODUCTION

Football is a special case of a successful industry in Europe. According to the latest reports, the overall revenue amounts of European football market reached around €19.9 billion in 2012/13 (Deloitte 2014). Players' wages go in the same direction, with yearly wages of seven digits. Players are expensive assets, as most of football clubs' costs are players' wages, but also represent lucrative investments, given the high values involved in transfer fees.

Football clubs are business organizations where the main inputs are players' skills in the playing field. Clubs face the challenge of devising efficient incentive devices to motivate players. We can argue that top players' wages are the outcome of a tournament within teams to induce performance (Lazear and Rosen 1981) as shown in Chapter 3 of this thesis. Wages are also partially the result of a star effect, as shown by Franck and Nüesch (2012) and Lucifora and Simmons (2003).

Players' careers are not characterized by stable job relationships, as transfers among clubs are frequent. Their human capital is highly transferable, which suggest the relevance of industry-specific human capital as opposed to club-specific human capital.

[24] Results from this chapter were presented in the following conferences: Druid Academy Conference in Aalborg; North American Society for Sport Management Conference in Austin; Association for Public Economic Theory in Lisbon and European Conference in Sport Economics in Esbjerg.

This work was partially supported by the Portuguese Foundation for Science and Technology (PTDC/EGE-ECO/101493/2008, PTDC/EGE-ECO/118070/2010 and PTDC/IIM-ECO/5123/2012). We are also thankful to the Portuguese Ministry of Labor and Social Solidarity for giving us access to the data used in this research.

We may ask how wages evolve along players' careers progression within and between clubs. The objective of this chapter is to answer this question, presenting a characterization of the wage-career profile of football players.

We use data from the Portuguese matched employer-employee Quadros de Pessoal, an administrative yearly census of all private firms (profit and non-profit) and their workforce. The census includes football clubs from professional and semi-professional leagues. The objective is to look over the players' career path, from lower leagues to Portuguese first league and the associated wage profile. We define six career events: staying in the same club and the club stays in the same league, is promoted to a higher league or relegated to a lower league; and the player moves to another club in the same, higher or lower league.

As we cannot distinguish between voluntary from involuntary moves between clubs, we also use as an identifying strategy the moves induced by a club's coach change. When a new coach arrives to a club, we expect to observe players' transfers that are not induced by better or worst performance, but because he does not fit the new vision the coach brings in. Therefore, some club-player matches are destroyed for reasons orthogonal to player performance, solving part of the bias induced by the (in)voluntary players' transfers between clubs.

We present the background literature and a simple wage determination model in the next section. Section 5.3 describes the Portuguese football organization and the data used in this research. In section 5.4, we obtain and discuss the results of the wage growth estimation and in Section 5.5 we present the main conclusions.

5.2 THEORY: WAGE DETERMINATION

The high players' mobility across clubs suggests that club-specific human capital, in the distinction made by Becker (1962, 1975), plays a small role in retaining players (Wachter and Wright, 1990) and determining their wages. However, the industry-specific human capital (Kletzer 1989; Neal 1995; Parent 2000; Sullivan 2010) has presumably a strong role, as players find limited use of their professional traits outside the industry, close to the guild or craft market as defined by Kerr (1954). Sullivan (2010) shows that firm-specific has little relevance for the wage determination as opposed to occupation- and industry-specific human capital, and find that some occupations are mainly industry-specific (managers). Early papers Abraham and Farber (1987) and Altonji and Shakotko (1987), or more recently Dustmann and Pereira (2007), also point to the small relevance of worker's tenure for wage growth.

Topel and Ward (1992) show the importance of job mobility for young workers' careers, characterized by high turnover and wage growth – over the first ten year of labor market experience, roughly one third is accountable by job mobility. McCue (1996) estimated a smaller contribution, but still of sizeable magnitude (24%).

Matching models, following Jovanovic (1979), argue that there is imperfect information about workers' productivity. As tenure increases, information about the match between the worker and the firm is revealed: good matches are revealed and maintained while bad matches are destroyed. Thus, information about the match determines the optimal assignment of workers to firms. The learning process is also present in the learning models of Farber and Gibbons (1996) and Altonji and Pierret (2001) in a context where learning produces information that is publicly available to

employers.[25] The football labor market as several features that fall into the public-learning model of Farber and Gibbons (1996): players' performance is publicly available to all clubs; and the market resembles a spot market, as players' transfers between clubs are frequent, even though (fixed)-term contracts regulate the employment relationship. We propose a model along these lines, allowing for a club-player match value component, as proposed by Jovanovic (1979).

A Simple Model of Wage Determination

Consider the public-learning model proposed by Farber and Gibbons (1996) with human capital accumulation. Assume that players receive a wage equal to the expected value of the contribution to the team in each period given club's information about the player's performance (there are no long-term contracts). The wage determination equation for player *i* employed in club *j* in period *t* is

$$w_{ijt} = E\left(y_{ijt} \mid I_{ijt}\right) \qquad (1)$$

Information I_{ijt} is public knowledge – observable by all agents in the marker. Information at moment *t* includes the observable player characteristics as labor market experience, imperfectly observable variable as the player value to the club, and past realization of performance until moment *t* – 1. Assume that output grows with acquired skills due to on-the-job training and learning by doing, captured by a vector of variables

[25] See the discussion on the issue of symmetric versus asymmetric learning in Schönberg (2007) and Pinkston (2009). Several models integrate learning about worker's ability, human capital accumulation and job assignment, as in Gibbons and Waldman (1999, 2006) and the extension to worker turnover by Gosh (2007). We argue that information about players' performance is publicly available to all club and job assignment within clubs is not an issue.

measuring labor market experience x_{it}. Imperfectly observable variables, include the value of the club-player match μ_{ijt}, club specific affects v_j and player's innate ability θ_i.

We can write the wage equation determination in each moment *t* as

$$w_{ijt} = \alpha_0 + x_{it}\alpha_1 + \mu_{ijt} + \theta_i + v_j + \varepsilon_{ijt} \qquad (2)$$

where ε_{ijt} is an i.i.d disturbance. We assume that experience and innate ability have the same value in all clubs. The value of the match μ_{ijt} is an "experience good" as in Jovanovic (1979). Given the public information setting, we assume that a competing club that wants to bid away the player from his current employer also draws a value for the prospective match. The value of the match is specific to the club, thus the same player will generate different match values for different clubs. The match value depends on the composition of the club's team and how it is managed by the coach. The club idiosyncratic effect v_j represents the common characteristics specific that identify the club and that are constant across time. For example, the club permanently achieves the top three positions within the first league, or the club belongs to the fourth league. We do not consider schooling in our model, as it is a form of human capital accumulation that does not seem to play a role in the wage process (see Chapter 3). Players' tenure appears in the model through the accumulation of labor market experience as we assume that any club-specific valuation of players' human capital appears in μ_{ijt}.

Consider that club *s* employs player *i* with a wage w_{ist}. If another club *k* offers the wage w_{ikt} to bid away the player and if $w_{ikt} < w_{ist}$, then the player stays in the same club and the wage growth between period *t* and *t* – 1 is (dropping subscript *i*)

$$w_{st} - w_{st-1} = (\mathrm{x}_t - \mathrm{x}_{t-1})\alpha_1 + (\mu_{st} - \mu_{st-1}) + (\varepsilon_{st} - \varepsilon_{st-1}) \tag{3}$$

If $w_{ikt} > w_{ist}$, the player moves to club *k* and the corresponding wage growth is

$$w_{kt} - w_{st-1} = (\mathrm{x}_t - \mathrm{x}_{t-1})\alpha_1 + (\mu_{kt} - \mu_{st-1}) + (v_k - v_s) + (\varepsilon_{kt} - \varepsilon_{st-1}) \tag{4}$$

The difference in wage growth between the mover and the stayer, D_t, by equations (3) and (4) is given by (ignoring the disturbances)

$$\begin{aligned} D_t &= (\mu_{kt} - \mu_{st-1}) + (v_k - v_s) - (\mu_{kt} - \mu_{st-1}) \\ &= (\mu_{kt} - \mu_{st}) + (v_k - v_s) \end{aligned} \tag{5}$$

Defining the wage growth equation for all players, stayers and movers, we have (using $\Delta z_t = z_t - z_{t-1}$)

$$\Delta w_t = \gamma_0 + \Delta \mathrm{x}_t \alpha_1 + \gamma_1 d_t + \Delta \varepsilon_t \tag{6}$$

where the $\gamma_1 = (\mu_{kt} - \mu_{st}) + (v_k - v_s)$ and $d_t = 1$ if the player moves to another club and $d_t = 0$ if he stays in the same club. The coefficient γ_0 is the average wage growth for

players who stay in the same club from one season to the next, $(\mu_{st} - \mu_{st-1})$, controlling for the remaining variable included in the model. The coefficient γ_1 can be positive or negative, delivering a wage premium or penalty to the player's movement from one club to another.

Until now, we only defined two career events – to stay or to move to another club. In our empirical framework, we are able to define a vector of career events, distinguishing among football leagues and accounting for club's promotion and relegation. Thus, we will define a vector of binary (0,1) variables identifying each career event d_t, and will estimate the following wage growth equation

$$\Delta w_t = \gamma_0 + \Delta x_t \alpha_1 + \mathrm{d}_t \gamma_1 + \Delta \varepsilon_t \qquad (7)$$

where γ_1 is now a vector of coefficients capturing each kind of players transfer between club *s* and *k*. The vector also includes the case where players remain in the same club, but the club moves up in the league ladder (promotion) or moves down (relegation).

Our paper follows close to other papers on the wage process: Baker, Gibbs and Holmstrom (1994a,b), Lazear (1999) and Lima and Pereira (2003) for wage growth within firms, and Topel and Ward (1992), McCue (1996) and Pergamit and Veum (1999) with additional results for wage growth and mobility between firms. We abstract from incentive wage policies within teams, as for example designing a rank-order tournament (Lazear and Rosen 1981; Rosen 1986) among players of the same team to induce effort (as studied in Chapters 2 and 3).

The estimated coefficients of the wage growth equation (7) suffer several potential sources of bias. The individual specific effects θ_i in equation (2) cancel out in

the first-difference equation (7). However, we will probably face a problem of non-randomness of the stayers and movers samples. Even if we assume that the spot market in a public-information framework induces a constant flow of players between clubs, the sample of stayers and movers will only be close to random within clubs that are close to each other (similar v_j). Within leagues, at the aggregate, it is possible that the resulting set of observations defined by each career events do not reveal a problem endogeneity. However, most likely the movements between clubs far apart in the league's rank or movements between leagues will generate non-random observations.

We try to reduce the selection bias induced by the player's decision to move or not, by restricting the sample to those players who stay or move from clubs that hired a new coach. This identification strategy reduces the bias assuming that part of the moves are not caused by better or worst player performance, but because a new club-player match is formed when a new coach is hired. The new coach will bring new tactics to face adversaries in the playing field and will build a new team of players, probably keeping some, dismiss others and hire new ones. Considering the importance of coaches and coach staff has on sports teams (Hadley *et al.* 2000; Frick and Simmons 2008; Inoue *et al.* 2013), restricting the sample of players to those who experience a career event due to a coach change seems a viable identification strategy to reduce the bias of the estimation coefficient.[26] In the results section, we will discuss additional ways to increase the robustness of our empirical framework.

[26] It does not guarantee that we will reduce all the bias to make an argument of causality. A new coach can be due to several reasons. Possibly the two most important reasons for a coach leave the club is good or bad performance of the team and the recognition that part of this result is the coach's merit or responsibility. If club's performance is higher than expected, coaches can expect new invitations to manage new teams with more resources and economic capabilities. If the results are lower than the expected, coaches can be seen as responsible for those results and are dismissed or do not see their contract renewed.

5.3 DATA ON PORTUGUESE FOOTBALL LEAGUES

Portuguese national football league system is divided in four open levels, two semi-professionals and two professionals. There are two leagues in the top two levels and between 10 and 11 leagues in the two semi-professional leagues. Multiple clubs can be promoted and relegated each season. From season 2005-2006 to 2006-2007 season the number of teams playing in First League and Second League decreased. Therefore there were more clubs relegated and fewer clubs promoted. Nevertheless, in the beginning of the season all clubs had the same chance of being promoted or relegated.

Portuguese players and coaches are present in most European championships. There are numerous examples of successful players and coaches. Some of them were European Champions with foreign clubs, for example, the most notable, Luís Figo (Real Madrid), Paulo Sousa (Juventus and Borussia Dortmund), Rui Costa (Milan), Nani (Manchester United), Cristiano Ronaldo (Manchester United and Real Madrid) and Paulo Ferreira (Chelsea). Some Portuguese coaches also achieved sizeable results in international leagues, such a José Mourinho who won the English, Italian and Spanish leagues. Portuguese clubs also reached important classifications in UEFA competitions and since the new century Portuguese teams played seven European finals and won three.

The Data Set

We use data from Quadros de Pessoal (QP), a longitudinal matched employer-employee data set collected every year by the Portuguese government with information on all workers and firms in Portuguese private sector. The firms covered include football clubs

in the professional and semi-professional leagues. We selected players from 2002-2003 to 2009-2010 seasons, corresponding to almost 7000 players-years (as in Chapter 4).

Table 5.1 presents descriptive statistics for players present in the sample for at least two consecutive years, breakdown by league. We lumped together the Third and Fourth Leagues given the small number of observation associated with some of the career events defined below. Average tenure is very low compared with other industries. For the full sample (Table 4.1, Chapter 4) which does not restrict observations to two consecutive years of employment in football clubs, average tenure is two years. Considering the whole economy covered by the matched employer-employee data set, the average tenure is seven years. In the football industry, only 25% of players stay for more than two year in the same club. The tenure statistics show that player turnover is relatively high. Results from wage regression in Chapter 3 and exit hazards estimated in Chapter 4 point to the irrelevance of tenure as a measure of (specific) human capital accumulation.

The average age is also low, around 25 years (26 years for the restricted sample in Table 5.1), which compares with 38 years for the whole economy. The typical career length for football players is less than 20 years. Most players enter into the profession when they are 16 to 18 years old and exit short after the 30s (less than 10% have more than 32 years). Given the characteristics of entry and exit from the football labor market, we consider that player's age measures his labor market experience. It is not a perfect measure due to different entry dates into the profession, but it varies within a narrow interval. Moreover, schooling is not an issue in the case of football players, when compared with workers in other industries.

We calculated wages in QP by adding base payment with regular bonuses, both measured monthly and corresponding to October of each year. Wages show a high

variation between leagues, from 1,354 euros in the Third and Fourth League to 12,874 euros in the First League. The average for the football market, 7,653 euros, compares with less than 900 euros for the whole economy (at 2002 prices).

TABLE 5.1
Players' descriptive statistics, 2002-2003 to 2009-2010 seasons

	All		1st League		2nd League		3rd and 4th Leagues	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Monthly wage (€)	7,653		12,874		1,830		1,354	
Age (years)	25.816	4.489	25.685	4.437	26.366	4.573	25.401	4.447
Tenure (years)	1.673	1.922	2.087	2.088	1.059	1.523	1.389	1.642
Age < 21	0.133	0.340	0.145	0.353	0.117	0.321	0.123	0.329
21<= age <=22	0.147	0.354	0.132	0.339	0.132	0.338	0.209	0.407
23<= age <=24	0.139	0.346	0.135	0.342	0.128	0.334	0.164	0.371
25<= age <=26	0.155	0.362	0.166	0.372	0.147	0.354	0.139	0.346
27<= age <=28	0.139	0.346	0.148	0.355	0.145	0.353	0.104	0.305
29<= age <=30	0.120	0.325	0.122	0.328	0.130	0.337	0.100	0.300
31<= age <=32	0.086	0.281	0.082	0.274	0.102	0.302	0.076	0.266
age >=33	0.081	0.273	0.070	0.255	0.100	0.300	0.084	0.278
Tenure = 0	0.297	0.457	0.173	0.379	0.481	0.500	0.380	0.486
Tenure = 1	0.303	0.460	0.332	0.471	0.263	0.441	0.278	0.448
Tenure = 2	0.169	0.375	0.209	0.407	0.112	0.316	0.139	0.346
Tenure > 2	0.231	0.421	0.285	0.452	0.143	0.350	0.204	0.403
Number of players	2,670		1,430		729		511	

Notes: Real wages, deflated using the 2002 Consumer Price Index. Statistics for players with at least two consecutive years of employment.

Career Events

Players can stay in the same club from one season to the other, or can leave the club and be transferred to a new one. We defined six types of career events according to players' movements from one year to the other. When players move to a new club, they can move to a club in a higher league, in the same league, or in a lower league. When the player stays in the same club, the club can be promoted to a higher league, stay in the same league, or be relegated to a lower league.

Table 5.2 summarizes the number of observations in each of the six career events. The most frequent career event is to stay in the same club in the same league (63.78%). The second most frequent is the move to a new club also in the same league (11.16%). The less frequent event is the move to a new club in a higher league (4.98%). The frequencies for the other three movements vary from 6% to 8%.

TABLE 5.2
Career events: players' moves between 2002-2003 and 2009-2010 seasons

	All players		Restricted sample	
Career event	Observations	%	Observations	%
New club in a higher league	133	4.98	73	3.85
New club in a lower league	175	6.55	108	5.7
New club in the same league	298	11.16	186	9.81
Same club in a higher league (club promoted to a higher league)	200	7.49	122	6.43
Same club in the same league	1,703	63.78	1,273	67.14
Same club in a lower league (club relegated to a lower league)	161	6.03	134	7.07
Total	2,670	100.0	1,896	100.0

Notes: Restricted sample: players employed in t-1 by clubs where former coach left. Same club in a different league means that the player's club was promoted (higher league) or relegated (lower league).

The six career events can also be observed across leagues. For instance, a player can move to a new club of a higher league from the Second League to the First League or even from the Third or Fourth Leagues to the Second of First Leagues. Table 5.3

presents the number of players in each of the career events detailing the league of origin and destination. The most frequent career event is to stay in the same club in the First League from one season to the next, 39.36%, corresponding to 1,051 players. The smaller number of observation in the Third and Fourth Leagues leads to career events that are less frequent across these two leagues (from 2.1% to less than 3.5%). The same happens when the player stays in the same club and the club is promoted or relegated.

The less frequent event is the case where the player stays in the same club and the club is promoted to the Second League (1.95%). Though we expect to find such low frequencies in clubs' promotions and relegations, given the definition of the event, the significance of our results will be mitigated.

Overall, the frequencies of the career events indicate that players' careers include moving up or down the league ladder. Such progression up or down can be consider as players' promotion or demotions.

TABLE 5.3
Career events across leagues: players' moves between 2002-2003 and 2009-2010 seasons

Career event	Observations	%
New club in a higher league		
From 2nd to 1st League	56	2.10
From 3rd and 4th to 1st and 2nd Leagues	77	2.88
New club in the same league		
1st League	148	5.54
2nd League	94	3.52
3rd and 4th League	56	2.10
New club in a lower league		
From 1st to 2nd League	84	3.15
From 1st and 2nd to 3rd and 4th Leagues	91	3.41
Same club in a higher league (club promoted)		
1st League	160	5.99
2nd League	52	1.95
Same club in the same league		
1st League	1,051	39.36
2nd League	347	13.00
3rd and 4th League	305	11.42
Same club in a lower league (club relegated)		
2nd League	103	3.86
3rd and 4th League	64	2.40
Total	2,670	100.00

Wage Growth

Table 5.4 shows the real wage variation in percentage between seasons for each of the career events considered. The move to a new club in a higher league holds the highest premium (215.83%). The move to a new club in the same club is associated with a wage increase of 87.64%, but if the player moves to a club in a lower the wage growth is only 6.75%, which is lower than staying in the same club in the same club – the stayers have

a wage growth of 29.70% – corresponding to an effective negative wage premium of 23%. When the club is promoted, players who stay in the club experience a wage growth of 70.29%, showing that clubs change their wage policy when gaining access to a higher league. The opposite club movement – the relegation – bears an average wage decrease of 19% for those players who follow the club to a lower league, when compared with the stayers (10.59%-29.70%). When we consider career events across leagues (Table 5.5), it is clear that the wage growth decreases when moving down the league for each career event, though with some exceptions that we deal with in the section results.

TABLE 5.4
Wage change (%) between seasons by career event

Career event	Mean	Std. Dev.
New club in a higher league	215.832	713.960
New club in the same league	87.642	259.920
New club in a lower league	6.757	127.238
Same club in a higher league (club promoted to a higher league)	70.295	222.994
Same club in the same league	29.704	125.399
Same club in a lower league (club relegated to a lower league)	10.588	115.350
All	47.504	230.204

The figures for wage growth are considerable higher than the ones found in other contexts. McCue (1996) present wage growth for white males at the top of the wage distribution (75 percentile) that ranges from 23% for job separation, 18% for a promotion and 7% for no job change. Dustmann and Pereira (2007) present statistics on wage growth for job separation that are always less than 0.15 log points on average across different levels of labor market experience and for both Germany and UK.

TABLE 5.5
Wage change (%) between seasons by career event and across leagues

Career event	Mean	Std. Dev.
New club in a higher league		
From 2nd to 1st League	215.496	395.843
From 3rd and 4th to 1st and 2nd Leagues	236.639	915.186
New club in the same league		
1st League	136.435	343.373
2nd League	67.635	187.892
3rd and 4th League	21.755	67.796
New club in a lower league		
From 1st to 2nd League	17.121	164.354
From 1st and 2nd to 3rd and 4th Leagues	4.239	92.489
Same club in a higher league (club promoted)		
1st League	101.688	252.100
2nd League	-26.365	58.792
Same club in the same league		
1st League	40.242	154.954
2nd League	11.082	59.477
3rd and 4th League	16.733	56.181
Same club in a lower league (club relegated)		
2nd League	17.324	138.711
3rd and 4th League	2.061	65.188

Serial Correlations between Wage Increases

The learning model with the human accumulation implies that innovation should be serially correlated (Farber and Gibbons, 1996; Baker, Gibbs and Holmstrom 1994b). Table 5.6 calculates the correlation between the wage growth between two and three adjacent years. The serial correlation between wage growth is positive and significant in both cases, though decreasing as expected. It implies that players' attributes differ and are correlated with wages increases. For example, older players with more labor market

experience will presumably receive higher or lower wages increases on average or that wage growth is affected by wage levels (which might be inferred by the results in the previous chapter). We regress percentage wage increases on age and year of the transition between seasons to compute wage residuals – wage innovation not accounted for by the accumulation of human capital and observational year. On average, we find positive but not significant serial correlation between residuals, a result close to Farber and Gibbons (1996) but not in line with Baker, Gibbs and Holmstrom (1994b). The possible misspecification of the regression model can drive the result. However, Baker, Gibbs and Holmstrom (1994b) deal with data from a single large hierarchical organization, where job assignment plays a strong role, contrary to the football labor market.

TABLE 5.6
Correlations of wage variation after moves.

	Correlation between real percentage wage variation in move year and:	Observations	Correlation between wage growth residuals in move year and:	Observations
One year after the move	0.564*	2745	0.039	2697
Two years after the move	0.491*	1515	0.070	1244
Three years after the move	0.415*	775	-0.045	637
Four years after the move	0.426*	380	0.030	318

Notes: Correlations significant at the 1% level after Bonferroni adjustment. Residuals from a regression of percentage wage growth on dummies for age and years.

5.4 RESULTS AND DISCUSSION

We estimate the first-difference equation (7) by least squares. As explained, we aim to identify the relationship between players' career events and wage growth. The career

events are defined for moves between clubs and leagues. In the set of control variables, we include age dummies (for every two-year interval) and year of observation to account for the positive or negative conjuncture of the industry in a particular year. The age dummies capture the change in the player labor market experience, being flexible enough to capture non-linearities of the relationship with wage growth.

The first-differences reduce part of the bias originated by the players' ability not observable in the data, by canceling out the individual specific effects, assuming their constancy within the time range covered by the data set. To the extent that the unobserved individual effect is correlated with the observable variables, that will induce in bias in the estimated coefficients in the first-differences. The bias is a potential serious issue in labor markets where long-term contracts prevail. However, in the case of football players, the labor market resembles a spot market, given the prevalence of fixed-term contract and high players' turnover. In this case, we observe players movements induced by bad matches between the club and the player, but also because the perceived match with a new club can be better than the present club.

We further restricted the sample to those players employed by clubs in $t - 1$ that have a different coach in period t. The objective is to reduce the selection bias induced by the decision of payers to move to another club or of clubs to fire players. We expect that part of the decisions to stay or to move will be dictated by the new vision the coach implements for the new season. Thus, a proportion of the players' and clubs' decisions will not be dictated by a better or worst players' performance, inducing some randomness in the restricted sample. We do not claim that the change of the coach can results in a completely random sample of players, but presents a viable identification strategy to increase the robustness of the results.

Table 5.7 presents the results of the estimation when career events do not take into account the specific league of departure or destination. We aggregate all movements in staying in the same club or moving to another, only distinguishing the relative position of the leagues – moving up or down, or staying in the same league. The highest wage premium comes from being transferred to a new club in a higher league (0.467 long points in the restricted sample). Moving to a new club in a lower league has an associated wage penalty of 0.4 log points. If the player stays in a relegated club (moves to a lower league), there is also a wage penalty of 0.184 log points.

The other two career events – new club in the same league and same club in a higher league (club promotion) – do not produce statistical significant results. Compared with the base career event – stay in the same club in the same league – the no significance implies that, on average, there is no superiority in terms of wage growth by moving or staying in the same club, provided that the league is the same, or to stay in the next season in a promoted club over a no promoted club. The combination of a spot market with the public information setting produces a result where the club-player match does not evolve as in a standard matching model. Note that the value of the match does not increase in a club due to the accumulation of club-specific capital. Any productivity growth not captured by labor market experience can be perceived by any club. The difference between clubs, according to our model is due to different realizations of the match value. These differences arise from different use of the player in different teams, where co-players and the coach are not the same.

TABLE 5.7
Wage growth and career events

Career event	I. All players	II. Restricted sample
New club in a higher league	0.366***	0.467***
	(3.95)	(3.48)
New club in the same league	-0.039	0.069
	(0.60)	(0.81)
New club in a lower league	-0.461***	-0.400***
	(6.21)	(4.22)
Same club in a higher league	0.011	0.051
	(0.18)	(0.58)
Same club in a lower league	-0.213***	-0.184***
	(3.72)	(2.79)
Constant	0.347***	0.318***
	(7.27)	(6.10)
Observations	2,670	1,896
Adjusted R-squared	0.08	0.08
F-statistic	10.47	8.08

* p<0.10, ** p<0.05, *** p<0.01. Standard errors between brackets. Estimated by least squares. Dependent variable: first-difference of player's log wage. Players who stay in the same clubs in the same league are the comparison group. Restricted sample: players employed in t-1 by clubs where former coach left. Same club in a different league means that the player's club was promoted (higher league) or relegated (lower league). Regressions include dummies for age (two-year interval) and season's year.

The next step is to consider the career events across leagues. Table 5.8 presents the results. Overall, the estimated coefficients convey the same information as in the previous table. Namely, the no superiority of moving to a new club over staying provided that the league remains the same. The highest wage premium comes from being transferred to a new club in a higher league, when moving from the 2nd to the 1st League (0.58 log points). The same career event, but when moving from the 3rd and 4th to 1st and 2nd Leagues – from semi-professional to professional leagues – is associated with a smaller wage premium (0.38 log points). The high wage premium associated with the move within the professional leagues is probably the outcome of a large difference in the club specific effect when moving from club *s* in the 2nd League to club *k* in the 1st League, $(v_k - v_s)$ in equation (5). That would also explain the lower wage premium when changing from the semi-professional to the professional. Judging from

the average wage in each league (12,874€ for the 1st, 1,830€ for the 2nd, 1,354€ for the 3rd and 4th, Table 5.1), the highest increase comes from moving to the 1st League.

Contrary to the results of previous table, when the club is promoted to the 1st League and the player remains in that club, there is a positive wage premium (0.496 log points). However, the promotion to the 2nd League holds a large wage penalty (-0.703 log points). Given the small number of observations in both cases, we need to go deeper into the cases behind these promotions, which is not within the scope of the present chapter. For example, it can be the case where in $t - 1$, when the club wins the promotion, players receive a relative high wage premium, which would render a negative wage variation computed at season *t* (when the club starts to play in the upper league).

A large wage penalty arises from being transferred from a club in the 1st League to a club in the 2nd League (0.515 log points), which is even larger than the same movement but from the 1st and 2nd Leagues to 3rd and 4th Leagues (0.294 log points). The same reasoning applied before to the opposite movement – progressing up in the league ladder – can be used here. Club's relegation also carries a wage penalty for players who remain: 0.148 log points if relegated to the 2nd League and 0.271 log points if relegated to the 3rd or 4th Leagues.

TABLE 5.8
Wage growth and career events across leagues

Career event	I. All players	II. Restricted sample
New club in a higher league		
From 2nd to 1st League	0.460***	0.580***
	(3.18)	(2.74)
From 3rd and 4th to 1st and 2nd Leagues	0.337***	0.356**
	(2.76)	(2.05)
New club in the same league		
1st League	0.028	0.060
	(0.26)	(0.49)
2nd League	-0.098	0.091
	(0.86)	(0.58)
3rd and 4th League	0.022	-0.040
	(0.28)	(0.40)
New club in a lower league		
From 1st to 2nd League	-0.496***	-0.515***
	(4.24)	(3.78)
From 1st and 2nd to 3rd and 4th Leagues	-0.379***	-0.294**
	(3.93)	(2.20)
Same club in a higher league		
1st League	0.258***	0.496***
	(3.97)	(5.26)
2nd League	-0.701***	-0.703***
	(5.60)	(5.72)
Same club in the same league		
1st League	0.058**	0.000
	(2.16)	(0.01)
2nd League	-0.052	-0.044
	(1.58)	(1.22)
Same club in a lower league		
2nd League	-0.134**	-0.148*
	(2.06)	(1.83)
3rd and 4th League	-0.299***	-0.271**
	(2.75)	(2.37)
Constant	-0.045	-0.004
	(0.82)	(0.06)
Observations	2,670	1,896
Adjusted R-squared	0.10	0.12
F-statistic	9.67	7.67

* p<0.10, ** p<0.05, *** p<0.01. Standard errors between brackets. Estimated by least squares. Dependent variable: first-difference of player's log wage. Players who stay in the same clubs in the same league (3rd and 4th League) are the comparison group. Restricted sample: players employed in t-1 by clubs where former coach left. Same club in a different league means that the player's club was promoted (higher league) or relegated (lower league). Regressions include dummies for age (two-year interval) and season's year.

We can trace a wage-career profile with the estimation of the wage growth equation. It is clear that some career events, as progressing up or down in the league ladder by being transferred to another club, can bring large wage premiums or penalties for football players. As we discussed before, the current version of the model does not provide an identification of the wage growth due to different values of the club-player match or due to the different clubs' fixed effects. The results concerning the similarity of wage premiums between stayers and movers within the same league imply that the two career events are not distinguishable on average.

The spot market allocates players to the club where the match value combined with the club specific effect is higher. One possible extension of the current study is to consider the relative position of the club within the league ranking in each season. We need, however, to gather information on additional seasons to obtain sufficient variation in the data. With this information, we could analyze players' progression within each league in more detail, and device a way to identify the variation in the players' match value.

Additional information will also provide a setting where we can infer how much each career event contributes to the total wage growth (not just season-to-season wage growth) as studied by McCue (1996), and to examine the relationship between the incidence of mobility and players' age, following Topel and Ward (1992). Another line of research can also be pursued if we have enough observations to follow players when they leave the football market. For example, that would provide a setting to estimate the value of the football industry-specific human capital (Neal 1995).

The correlation between unobservable and observable players' characteristics is always a concern when estimating wage level or wage growth equations. We use

players' and clubs' fixed effects and an identification strategy that, as we argue, reduces the bias. The choice of players who stay in or move from clubs that dismissed their former coach reduces the non-randomness accruing from players' career decisions. At the current stage and in our particular setting, it is not possible to apply an instrumental variable strategy as in Altonji and Shakotko (1987). We aim in future research to account for those players who leave the club and do not have a contract in the following year, providing a correction of a selection bias coming from these additional career events and using the setting developed in Chapter 4.

5.5 CONCLUSIONS

We have proposed to study football players' wage-career profile in the context of a public learning model with human capital accumulation. We define a set of career events that characterize players' progression in his profession and infer the resulting wage process. We rely on information about players' movements between clubs and leagues along seven seasons captured by a longitudinal matched employer-employee data set. We try to reduce the typical non-randomness of the sample under study by considering players who were in a club that changed the coach. Given the joint production involved in a football team and its strong dependence on how the coach exercises his leadership, we argue that part of players' career events are exogenous to player's quality.

Results indicate that players can expect a wage premium when they get transferred to new clubs in higher leagues or a wage penalty when moving to lower leagues. Players who stay in the same club after the club gets relegated can also expect a

wage penalty. In our setting, players moving between clubs within the same league are not distinguishable from players staying in the same club from one season to the other. We plan in future development of this line of research to incorporate the club's position within the league championship rank to capture different career paths within leagues.

6 MAIN CONCLUSIONS AND IMPLICATIONS

This dissertation analyzed careers and wages of football players in Portugal. Football players are among the best paid workers in Portugal and face a very short working life span comparing with workers from other industries. The effect that performance and moves has on wage ranking and wage were also studied.

It was necessary to perform an intensive, and sometimes invisible, work with the data from QP and with the data collected from official statistics to realize this thesis. This exhaustive work allowed the identification of thousands of individuals with a high accuracy because it was crossed several facts in order to reduce errors to the minimum possible.

Chapter 2 allows concluding that several clubs in Portugal spend more than they should with players' salaries. Signing players with high salaries can seriously damage clubs' accounts and efficiency. This is all the more remarkable as the competitive level is increasing and UEFA is issuing more stringent financial stability conditions. We demonstrate that a higher wage spread tends to be associated with an increase in efficiency. The implication is that clubs should structure wages so as to have the optimal pay ranking for inducing players' effort.

Chapter 3 emphasis the relationship between players' performance and wages. Results show that general and club-specific human capital do not seem to play any role on wage formation. Industry-specific human capital has a positive relationship with wages. Using minutes played during the season as a proxy for performance, we show that players who play more minutes earn a wage prize, and those at the top face a convex relationship, suggesting the setup of a tournament within football teams.

Furthermore, and joining the results of the first two chapters we can conclude that clubs should set internal tournaments to reward better performers and increase efficiency. However, we should never forget that a tournament does not mean uncontrolled expenditure with wages.

In the last two Chapters we use data from several seasons to follow players' career path and the influence that some decisions, move or not, can have in salary and in internal salary ranking. The results suggest that players who move from a lower to a higher league are willing to lose pay rank positions (internal reputation) in order to have the opportunity to play in a more visible league and win more money. Players who move from a higher league to a lower league accept to earn less, but move up in the pay ranking within the new team. Players who stay in the same club can rise in the pay rank. Former team league position does not seem to have impact in wage quartile when players moves to new teams, subsequently individual performance is the most important to define wage quartiles.

Finally, results also show that players who move to higher leagues can expect a substantial wage increase comparing with those who stay in the same club and in the same league. Players moving to lower leagues, either by changing club, either by continuing in the relegated club, can expect a significant wage decrease. Regarding players who move to new clubs in the same league the results were not statistical significant.

REFERENCES

Abraham, K.G. and Farber, H.S. (1987) Job duration, seniority, and earnings. *American Economic Review,* **77**, 278–297.

Adler, M. (1985) Stardom and Talent, *American Economic Review*, **75**(1), 208–212.

Afonso, A., Schuknecht L. and Tanzi, V. (2010) Public sector efficiency: evidence for new EU member states and emerging markets, *Applied Economics,* **42**, 2147-2164.

Akerlof, G. A. and Yellen, J. L. (1988) Fairness and unemployment, *American Economic Review*, **78**, 44-49.

Alchian, A. A. and Demsetz, H. (1972) Production, Information Costs, and Economic Organization, *American Economic Review*, **62**(5), 777-795.

Altonji, J. G., and Pierret, C. R. (2001) Employer Learning and Statistical Discrimination, *Quarterly Journal of Economics*, **116**(1), 313–350.

Altonji, J. and Shakotko, R. (1987) Do wages rise with seniority?, *Review of Economic Studies,* **54**, 278-297.

Audas, R., Barmby, T. and Treble, J. (2004) Luck, Effort, and Reward in an Organizational Hierarchy, *Journal of Labor Economics,* **22**(2), 379-396.

Baker, G. P., Jensen, M. C., and Murphy, K. J. (1988) Compensation and Incentives: Practice vs. Theory, *Journal of Finance*, **43**(3), 593.

Baker, G., Gibbs, M., and Holmstrom, B. (1994a). The Internal Economics of the Firm: Evidence from Personnel Data, *Quarterly Journal of Economics*, **109**(4), 881-919.

Baker, G., Gibbs, M., and Holmstrom, B. (1994b) The Wage Policy of a Firm, *Quarterly Journal of Economics,* **109**(4), 921–954.

Banker, R.D., Charnes, A. A. and Cooper, A. (1984) Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis, *Management Science*, **30**(9), 1078-1092.

Barros, C.P. and Leach, S. (2006) Performance evaluation of the English Premier Football League with data envelopment analysis, *Applied Economics*, **38**, 1449-1458.

Baptista, R., Lima, F. and Torres Preto, M. (2012) How former business owners fare in the labor market? Job assignment and earnings, *European Economic Review* **56**(2), 263–276.

Becker, G. S. (1962) Investment in human capital: A theoretical analysis, *Journal of Political Economy*, **70**, 9–49.

Becker, G. S. (1975) Human capital (2nd ed.). New York: National Bureau of Economic Research (first edition 1964).

Becker, B. E. and Huselid, M. (1992) The Incentive Effects of Tournament Compensation Systems, *Administrative Science Quarterly*, **37**(6), 336-350. doi:10.2307/2393228

Benito, B., Bastida, F. and García, J. A. (2010) Explaining differences in efficiency: an application to Spanish municipalities, *Applied Economics*, **42**, 515-528.

Bognanno, M. L. (2001) Corporate Tournaments, *Journal of Labor Economics*, **19**(2), 290-315

Branstetter, L., Lima, F., Taylor, L. J. and Venâncio, A. (2014) Do Entry Regulations Deter Entrepreneurship and Job Creation? Evidence from Recent Reforms in Portugal, *The Economic Journal*, **124**(577), 805-832.

Brown, J. (2011) Quitters Never Win: The (Adverse) Incentive Effects of Competing with Superstars, *Journal of Political Economy*, **119**(5), 982–1013.

Buhai, S., Portela, M. A., Teulings, C. N. and van Vuuren, A. (2014) Returns to Tenure or Seniority?, *Econometrica*, **82**(2), 705-730.

Campbell, B.A., Ganco, M., Franco, A.M. and Agarwal, R. (2012) Who leaves, where to, and why worry? Employee mobility, entrepreneurship and effects on source firm performance, *Strategic Management Journal*, **33**(1), 65–87.

Carmichael, H.L. (1983) The agent–agents problem: payment by relative output, *Journal of Labor Economics*, **1,** 50–65.

Carnahan, S., Agarwal, R. and Campbell, B.A. (2012) Heterogeneity in turnover: The effect of relative compensation dispersion of firms on the mobility and entrepreneurship of extreme performers, *Strategic Management Journal*, **33**(12), 1411–1430.

Carneiro, A., Fortuna, N. and Verejão, J. (2012) Immigrants at New Destinations: How They Fare and Why, *Journal of Population Economics*, **25**, 1165-1185.

Chan, W. (1996) External Recruitment versus Internal Promotion, *Journal of Labor Economics*, **14**(4), 555-570.

Charnes, A., Cooper, W. W. and Rhodes, E. (1978) Measuring the efficiency of decision-making units, *European Journal of Operational Research*, **2**(6), 429–444.

Chiu, Y.-H., Ma, C.-M. and Sun, M.-Y. (2010) Efficiency and credit rating in Taiwan banking: data envelopment analysis estimation, *Applied Economic*, **42**, 2587-2600.

Cooper, W.W., Ruiz, J. L. and Sirvent, I. (2009) Selecting non-zero weights to evaluate effectiveness of basketball players with DEA, *European Journal of Operational Research,* **195**(2), 563-574.

Deloitte (2014). A Premium blend. Annual Review of Football Finance. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/uk/Documents/sports-business-group/deloitte-uk-annual-review-football-finance.pdf (accessed 9 March 2015).

Deloitte & Touche (2010) Deloitte Football Money League 2010. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/uk/Documents/sports-business-group/deloitte-uk-deloitte-football-money-league-2010.pdf (accessed 9 March 2015).

Deloitte & Touche (2014). All to play for Football Money League. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/uk/Documents/sports-business-group/deloitte-uk-deloitte-football-money-league-2014.pdf (accessed 9 March 2015).

DeVaro, J. (2006a) Strategic Promotion Tournaments and Worker Performance, *Strategic Management Journal,* **27(8)**, 721-740.

DeVaro, J. (2006b) Internal Promotion Competition in Firms, *Rand Journal of Economics,* **37(3),** 521-542.

Dixit, A. (1987) Strategic Behavior in Contests, *American Economic Review*, **77**, 891–898.

Doeringer, P. B. (1967) Determinants of the Structure of Industrial Type Internal Labor Markets, *Industrial and Labor Relations Review,* **20**(2), 206-220.

Doeringer, P.B. and M.J. Piore (1971) Internal Labor Markets and Manpower Analysis. 2nd ed, Lexington, MA: Heath

Duch J, Waitzman J.S. and Amaral, L.A.N. (2010) Quantifying the Performance of Individual Players in a Team Activity, *PLoS ONE,* **5**(6): e10937.

Dustmann, C., and Pereira, S. C. (2007) Wage growth and job mobility in the United Kingdom and Germany, *Industrial and Labor Relations Review*, **61**(3), 374–393.

Ehrenberg, R. G. and Bognanno, M. L. (1990a) The Incentive Effects of Tournaments Revisited: Evidence from the European PGA Tour, *Industrial and Labor Relations Review*, **43**(3), 74-88.

Ehrenberg, R. G. and Bognanno, M. L. (1990b) Do Tournaments Have Incentive Effects?, *Journal of Political Economy*, **98**(6), 1307-1324.

Einolf, K.W. (2004) Is winning everything? A data envelopment analysis of Major League Baseball and the National Football League, *Journal of Sports Economics* **5**(2) 127-151.

Eriksson, T. (1999) Executive Compensation and Tournament Theory: Empirical Test on Danish Data, *Journal of Labor Economics*, **17,** 262-280.

Eriksson, T., Teyssierb S. and Villeval, MC. (2009) Does Self-Selection Improve the Efficiency of Tournaments?, *Economic Inquiry,* **47,** 530-548.

Farber, H. S., and Gibbons, R. (1996) Learning and Wage Dynamics. *Quarterly Journal of Economics,* **111**(4), 1007–1047.

Farrell, M. J. (1957) The Measurement of Productive Efficiency, *Journal of the Royal Statistical Society, Series A*, **120**, 253-290.

Franck, E. and Nüesch, S. (2012) Talent and/or popularity: What does it take to be a superstar?, *Economic Inquiry*, **50**(1), 202-216

Frick, B. (2007) The Football Players' Labor Market: Empirical Evidence from the Major European Leagues, *Scottish Journal of Political Economy*, **54**(3), 422-446.

Frick, B. and Simmons, R. (2008) The impact of managerial quality on organizational performance: evidence from German soccer, *Managerial and decision economics*, **29**(7), 593-600.

Gabaix, X. and Landier, A. (2008) Why has CEO pay increased so much?, *Quarterly Journal of Economics*, **123**, 49-100.

Gambardella, A., Panico, C. and Valentini, G. (2015) Strategic incentives to human capital, *Strategic Management Journal*, **36**(1), 37–52.

Gerosky, P.A., Mata, J. and Portugal, P. (2010) Founding conditions and the survival of new firms, *Strategic Management Journal*, **31**, 510-529.

Gibbons, R. (2005). Incentives Between Firms (and Within). Management Science, **51**(1), 2–17.

Gibbons, R., and Waldman, M. (1999) A Theory of Wage and Promotion Dynamics Inside Firms, *Quarterly Journal of Economics*, **114**(4), 1321–1358.

Gibbons, R., and Waldman, M. (2006) Enriching a Theory of Wage and Promotion Dynamics inside Firms, *Journal of Labor Economics*, **24**(1), 59–107.

Ghosh, S. (2007) Job mobility and careers in firms, *Labour Economics*, **14**(3), 603–621.

Green, J. R. and Stokey, N. L. (1983) A Comparison of Tournaments and Contracts, *Journal of Political Economy*, **91**(3), 349.

Hadley, L., Poitras, M., Ruggiero, J. and Knowles, S. (2000) Performance evaluation of National Football League teams, *Managerial and Decision Economics*, **21**(2), 63–70.

Haugen, K.K. and Hervik. A. (2002) Estimating the value of the Premier League or the world's most profitable investment project, *Applied Economics Letters*, **9,** 117-120.

Holmstrom B. (1982) Moral hazard in teams, *Bell Journal of Economics*, **13**, 324–340.

Idson, T. and Kahane, L. (2000) Team effects on compensation: an application to salary determination in the National Hockey League, *Economic Inquiry*, **38**(2), 345–357.

Inoue, Y., Plehn-Dujowich, J. M., Kent, A., and Swanson, S. (2013) Roles of Performance and Human Capital in College Football Coaches' Compensation, *Journal of Sport Management*, ***27***(1), 73-83.

Jenkins, S. (1995) Easy estimation methods for discrete-time duration models, *Oxford Bulletin of Economics and Statistics*, **57**(1), 129–136.

Jovanovic, B. (1979) Job Matching and the Theory of Turnover, *Journal of Political Economy*, **87**(5), 972–990.

Kahn, L. M. (2000) The Sports Business as a Labor Market Laboratory, *Journal of Economic Perspectives*, **14**(3), 75-94.

Kahn, L. M. and Shah, M. (2005) Race, Compensation and Contract Length in the NBA: 2001–2002, *Industrial Relations*, **44**(3), 444–462.

Kempkes, G. and Pohl, C. (2010) The efficiency of German universities-some evidence from nonparametric and parametric methods, *Applied Economics*, **42**, 2063-2079.

Kerr, C. (1954) The Balkanization of labor markets, in E.W. Bakke (ed), Labor Mobility and Economic Opportunity, MIT Press Cambridge, 92-110.

Kletzer, Lori G. (1989) Returns to Seniority after Permanent Job Loss, *American Economic Review*, **79**, 5326-5343

Kesenne, S. (2007) The peculiar international economics of professional football in Europe, *Scottish journal of political economy*, **54**(3), 388-400.

Knoeber, C. and Thurman, W. (1994) Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production, *Journal of Labor Economics* **12**(2), 155-179.

Koenker, R. and G. Bassett. (1978) Quantile Regression, *Econometrica,* **46**(1), 33–50.

Krautmann, A. C. (1999) What's wrong right With Scully Estimates of a Player's Marginal Revenue Product, *Economic Inquiry*, **37**(2), 369–381.

Kritikos, M., Markellos, R. N. and Prastacos, G. (2010) Corporate real estate analysis: evaluating telecom branch efficiency in Greece, *Applied Economics*, **42**, 1133-1143.

Kuethe, T. H. and Motamed, M. (2010). Returns to Stardom: Evidence From U.S. Major League Soccer, *Journal of Sports Economics*, **11**(5), 567-579.

Lambert, R. A., Larcker, D.F. and Weigelt, K. (1993) The Structure of Organizational Incentives, *Administrative Science Quarterly*, **38**, 438-461.

Lazear, E. (1999) Personnel economics: past lessons and future directions, *Journal of Labor Economics*, **17**, 199–236.

Lazear, E. and Rosen, S. (1981) Rank Order Tournaments as Optimal Labor Contracts, *Journal of Political Economy*, **89**(5), 841-64.

Lazear, E. and K. Shaw, (2007) Personnel Economics: The Economists' View of Human Resources, *Journal of Economic Perspectives*, **21**, 91-114.

Liga Portuguesa de Futebol Profissional. (2009) Game reports. Retrieved from http://www.ligaportugal.pt/oou/jornada/20082009/primeiraliga (accessed 9 March 2015)

Lima, F., and Pereira, P. T. (2003) Careers and wages within large firms: evidence from a matched employer-employee data set, *International Journal of Manpower*, **24**(7), 812–835.

Lucifora, C. and Simmons, R. (2003) Superstar Effects in Sport: Evidence from Italian Soccer, *Journal of Sports Economics*, **4**(1), 35-55.

Main, B. G. M., O'Reilly III C.A. and Wade, J. (1993) Top Executive Pay: Tournament or Teamwork?, *Journal of Labor Economics*, **1**, 606-628.

Malcomson, J. M. (1984) Work Incentives, Hierarchy, and Internal Labor Markets, *Journal of Political Economy*, **92**(3), 486-507.

Martins, P. S. (2009) Dismissals for Cause: The Difference That Just Eight Paragraphs Can Make, *Journal of Labor Economics*, **27**(2), 257-279.

McCue, K. (1996) Promotions and wage growth, *Journal of Labor Economics*, **14**(2), 175–209.

McLaughlin K. (1988). Aspects of tournament models: a survey. In Research in Labor Economics, Vol. 9, Ehrenberg R (ed.). JAI Press: Greenwich, CT; 225–256.

Mincer, J. (1974) Schooling, experience, and earnings. New York: Columbia University Press.

Mohr, M., Krustrup, P. and Bangsbo, J. (2003) Match performance of high-standard soccer players with special reference to development of fatigue, *Journal of Sports Sciences*, **21**, 519–528.

Moldovanu, B. and Sela, A. (2001) The Optimal Allocation of Prizes in Contests, *American Economic Review*, **91**, 542–558.

Moldovanu, B., Sela, A. and Shi, X. (2012) Carrots and sticks: prizes and punishments in contests, *Economic Inquiry*, **50**(2), 453-462

Mourao, P. (2012) The indebtedness of Portuguese soccer teams – looking for determinants, *Journal of Sports Sciences*, **30**(10), 1025-1035.

Nalebuff, B. and Stiglitz, J. (1983) Prizes and incentives: towards a general theory of compensation and competition, *The Bell Journal of Economics*, **14**(1), 21–43.

Neal, D. (1995) Industry-Specific Human Capital: Evidence from Displaced Workers, *Journal of Labor Economics*, **13**(4), 653- 677.

Neale, W. (1964) The Peculiar Economics of Professional Sports, *Quarterly Journal of Economics*, **78**(**1**), 1-14.

Nickerson, J.A. and Zenger, T.R. (2008) Envy, comparison costs, and the economic theory of the firm. *Strategic Management Journal,* **29**(13)**,** 1429–1449.

Noll, R. G. (2002) The Economics of Promotion and Relegation in Sports Leagues: The Case of English Football, *Journal of Sports Economics*, **3**(2), 169-203.

O'Keeffe, M., Viscusi, W.K. and Zeckhauser, R.J. (1984) Economic contests: comparative reward schemes, *Journal of Labor Economics***, 2**, 27–56

O'Mahony, S. and Bechky, B.A. (2006) Stretchwork: Managing the career progression paradox in external labor markets. *Academy of Management Journal*, **49(**5**),** 918–941.

Orrison, A., Schotter, A., and Weigelt, K. (2004) Multiperson Tournaments: An Experimental Examination, *Management Science*, **50**(2), 268–279.

Osterman, P. (1982) Employment Structures within Firms, *British Journal of Industrial Relations*, **20(3)**, 349-361.

Osterman, P. (1984) Internal Labor Markets. Cambridge, MA: MIT Press.

Oyer, P. (2007) Is There an Insider Advantage in Getting Tenure?, *American Economic Review*, **97**(2): 501-505.

Parent, D. (2000) Industry specific capital and the wage profile: evidence from the national longitudinal survey of youth and the panel study of income dynamics, *Journal of Labor Economics*, **18**(2), 306-323.

Pawlowski, T., Breuer, C. and Hovemann, A. (2010) Top Clubs' Performance and the Competitive Situation in European Domestic Football Competitions, *Journal of Sports Economics*, **11**(2), 186-202.

Pergamit, M. R. and Veum, J. R. (1999) What is a promotion?, *Industrial and Labor Relations Review*, **52**(4), 581-601.

Pinkston, J. C. (2009) A Model of Asymmetric Employer Learning with Testable Implications, *Review of Economic Studies*, **76**(1), 367–394.

Reilly, T., Williams, A.M., Nevill, A. and Franks, A. (2000) A multidisciplinary approach to talent identification in soccer, *Journal of Sports Sciences*, **18**(9), 695-702

Reverte, C. and Guzman, I. (2010) The predictive ability of relative efficiency for future earnings: an application using data envelopment analysis to Spanish SMEs, *Applied Economics*, **42**, 2751-2757.

Ribeiro, A.S. and Lima, F. (2012) Portuguese Football league efficiency and players' wages, *Applied Economics Letters*, **19**(**6**), 599-602

Rosen, S. (1981). The economics of superstars, *American Economic Review*, **71**(5), 845–858.

Rosen, S. (1986) Prizes and Incentives in Elimination Tournaments, *American Economic Review*, **76**(9), 701-715.

Rosen, S. and Sanderson, A. (2001) Labour markets in professional sports, *Economic Journal*, **111**, 47–68.

Rottenberg, S. (1956) The baseball Player's Labor Market, *Journal of Political Economy*, **64**(3), 242-258.

San, G. and Jane, W.-J. (2008) Wage dispersion and team performance: evidence from the small size professional baseball league in Taiwan, *Applied Economics Letters*, **15**, 883-886.

Schönberg, U. (2007) Testing for Asymmetric Employer Learning, *Journal of Labor Economics*, **25**(4), 651–691.

Scully, G.W. (1974) Pay and Performance in Major League Baseball, *American Economic Review*, **64**(6), 915–930.

Siegfried, J. and Sanderson, A. (2006) Simon Rottenberg and baseball, then and now: a fiftieth anniversary retrospective, *Journal of Political Economy*, **114**, 594–605.

Sloane, P. (1971) The economics of professional football: the football club as a utility maximiser, *Scottish Journal of Political Economy*, **17**, 121-146.

Sloane, P. J. (2006) Rottenberg and the economics of sport after 50 years: an evaluation, *Discussion Paper* No. 2175, IZA, Bonn.

Sullivan, P. (2010) Empirical Evidence on Occupation and Industry Specific Human Capital, *Labour Economics*, **17**(3), 567–580.

Taylor, M. (2001) Beyond the Maximum Wage: The Earnings of Football Professionals in England. 1900-39. *Soccer and Society*, **2**(3), 101-118.

TerviÖ, M. (2009) Superstars and Mediocrities: Market Failure in the Discovery of Talent. *Review of Economic Studies*, **76**(2), 829-850.

Topel, R. H., and Ward, M. P. (1992) Job mobility and the careers of young men, *Quarterly Journal of Economics*, **107**, 439–479.

UEFA (2009) UEFA Executive Committee Nyon decisions. *101*. Retrieved from http://www.uefa.com/MultimediaFiles/Download/PressRelease/uefa/UEFAMedia/88/67/81/886781_DOWNLOAD.pdf (accessed 9 March 2015).

UEFA (2010) UEFA Club Licensing and Financial Fair Play Regulations, 2010 Edition. Retrieved from http://www.uefa.com/MultimediaFiles/Download/Tech/uefaorg/General/01/50/09/12/1500912_DOWNLOAD.pdf (accessed 9 March 2015).

Wachter, M.L. and R.D Wright (1990) The Economics of Internal Labor Markets, *Industrial Relations*, **29(**2**)**, 240-262.

Wade, J. B., O'Reilly III, C. A. and Pollock, T. G. (2006). Overpaid CEOs and Underpaid Managers: Fairness and Executive Compensation, *Organization Science*, **17(**5**)**, 527-544.

Waldman, M. (2003) Ex Ante versus Ex Post Optimal Promotion Rules: The Case of Internal Promotion, *Economic Inquiry*, **41**(1), 27-41.

Waldman, M. (2007) Theory and evidence in internal labor markets, MPRA Paper 5113, University Library of Munich, Germany. (Forthcoming Handbook of Organizational Economics)

You, T., Chen, X. and Holder, M. E. (2010) Efficiency and its determinants in pharmaceutical industries: ownership, R&D and scale economy, *Applied Economics*, **42**, 2217-2241.

Zabojnik, J. and Bernhardt, D. (2001) Corporate tournaments, human capital acquisition, and the firm Size—Wage relation, *Review of Economic Studies*, **68** (3), 693-716

Zimbalist, A. (2010) Reflections on Salary Shares and Salary Caps, *Journal of Sports Economics*, **11**(1), 17-28.