Personnel Turnover and the Dynamics of Team Performance: Evidence from German Association Football

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von Dipl.-Kfm. Stefan Göke

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Referent: Prof. Dr. Bernd Frick

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AFC	Asian Football Confederation
CAF	Confédération Africaine de Football
CAGR	Compound Annual Growth Rate
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CONCACAF	Confederation of North and Central American and Caribbean Association Football
CONMEBOL	Confederación Sudamericana de Fútbol
CRM	Competing Risk Model
DEA	Data Envelope Analysis
DFB	Deutscher Fussball-Bund
DFL	DFL Deutsche Fußball Liga GmbH
DM	Deutsche Mark
EUR	Euro
FCB	FC Bayern Munich
FIFA	Fédération Internationale de Football Association
MLB	Major League Baseball
Mn	Million
NBA	National Basketball Association
NFL	National Football League
NHL	National Hockey League
OFC	Oceania Football Confederation
OLS	Ordinary Least Squares
SFA	Stochastic Frontier Analysis

SUR	Seemingly Unrelated Regression
U17	Under-17
U19	Under-19
U21	Under-21
U23	Under-23
UEFA	Union of European Football Associations
US	United States of America

1 Introduction

Despite early works by Slichter (1928) and Reder (1955), it has only been since the 1970s that the field of personnel economics has become an influential part of labor economics. Since then research in personnel economics has produced important results with respect to incentives, matching firms with workers, compensation, skill development, and organization of work (Lazear and Oyer 2007). Influential early works opening this literature include e.g. Lazear and Rosen (1981) contributing to tournament theory and incentives, Lazear (1979) and Harris and Holmström (1982) focusing on upward-sloping age-earnings profiles, Holmström (1982) concentrating on team compensation, or Rosen (1974) including, for the first time, non-pecuniary compensation into the analysis. Recently, so-called insider econometrics have evolved in personnel economics (Ichniowski and Shaw 2009). To pursue insider econometrics, researchers gather rich industry or even firm-specific data, often in cooperation with the firms themselves, and combine the subsequent econometric analyses with knowledge from industry experts. To briefly demonstrate the power of such analyses, three recent and influential works will be summarized in short. Ichniowski et al. (1997) analyze 36 homogeneous steel production lines of 17 companies to find that productivity is higher with lines that use innovative work practices such as incentive pay, teams, flexible job assignment, or on-the-job training. Lazear (2000a) leverages detailed data from Safelite Glass Company to investigate the incentive effects of piece rates. He finds that the switch from hourly wages to piece rates increases worker productivity in this company by 44%, caused by incentive and sorting effects. Mas and Moretti (2009) use high-frequency data from a supermarket chain to examine peer effects in the workplace. The authors find strong evidence of positive productivity spillovers caused by the physical presence of high-performing co-workers. Despite such innovative research design, it is no surprise, however, that many questions within this young field of research still remain unanswered. Indeed, Lazear and Oyer (2007) conclude in their recent review of the literature (pp. 43-44):

"There is plenty of room for more work, especially empirical work, in all areas that we have discussed. But it seems likely that the highest returns will come from careful analyses of the selection, sorting, and matching processes."

According to the authors, empirical evidence based on job matching models, pioneered by Jovanovic (1979a, 1979b) and others in the late 1970s,[1] has so far carved out two key implications. First, turnover rates decrease with job tenure. Second, wages increase with job tenure. Hence, job matching is deeply embedded in labor economics as it is closely related to turnover and thus the theory of human capital (Becker 1962 and 1993). This perspective is underpinned by an earlier view on research in personnel economics stating that new areas of research may focus on many turnover and human capital related research questions such as analyzing hiring and firing decisions, up- and downward career mobility, or the life-cycle of worker-job matches (Lazear 1993).

To further elaborate on these questions posed in the field of job matching and turnover new detailed datasets are necessary. Insider econometrics certainly offers one way to gather adequate data. However, using such private and thus specific data limits possibilities to generalize results. Sometimes data from only one firm is analyzed. Particularly when examining job matching and turnover it seems, however, valuable to observe the same employee at several employers, i.e. during his complete career. With such data requirements given, it seems fruitful to turn to the professional team sports industry. Mainly caused by intense media coverage, professional team sports around the world collect vast amounts of information about employees (players, head coaches, and team managers) and employers (teams). Therefore, many empirical analyses of questions in labor and personnel economics have found the professional team sports industry to be an adequate setting (see Kahn 2000 and Rosen and Sanderson 2001 for a detailed argumentation). Indeed, the relevance of these data for economists has first been demonstrated by Rottenberg (1956) who analyzed the baseball player's labor market in the United States of America (US). His work, that predates Becker's publications on human capital, was actually influenced by Becker as Rottenberg has already mentioned the distinction between general and specific human capital and has discussed general and specific on-the-job training (Sanderson and Siegfried 2006).

Perhaps surprisingly, research with respect to job matching and turnover in the field of sports economics, however, is very limited and focuses only on baseball. Chapman and Southwick (1991) perform a direct test of the matching hypothesis in the setting of Major League Baseball (MLB). They include team-manager dummies to model match

[1] See also Mortensen (1978), Johnson (1978), and Viscusi (1979) for early job matching models.

quality in their estimations to explain team winning percentage. Using an F-test, the authors then test the null hypothesis that the match dummies do not significantly explain team winning percentage to find clear evidence that the matching hypothesis holds in this setting. Prisinzano (2000) finds similar results with a different dataset in the same industry. In a comparable attempt, Ohtake and Ohkusa (1994), however, find contradicting evidence for Japanese Baseball. This difference to MLB is claimed to be caused by less variety in managerial decision-making across Japanese baseball managers, compared to managers in MLB. Ohkusa and Ohtake (1996) test the matching hypothesis also for player-manager matches, again finding no evidence that matching matters in Japanese Baseball.

Yet, to the best of my knowledge, no further analyses in other sports or on player-team level have been undertaken. From a business perspective, though, not only American and Japanese Baseball are important team sport industries. In fact, next to the American Major Leagues for American football (NFL), ice hockey (NHL), basketball (NBA), and baseball (MLB), it is in European football (soccer) where the largest revenues are generated. Interestingly, leagues of these two geographies differ significantly in their organizational form (see Hoehn and Szymanski 1999 for a comparison).[2] This is particularly true when it comes to player turnover since the labor market in the American Major Leagues is highly regulated by rookie draft systems, salary caps, and collective bargaining whereas the so-called transfer market in European football comes close to a competitive market (Szymanski and Smith 1997). The latter has become especially true since the publication of the so-called Bosman-ruling of the European High Court in 1995 that further deregulated the European transfer market with respect to ownership rights of player registrations and the mobility of foreign players (Court of Justice of the European Communities 1995).[3]

Accordingly, the football player's labor market with its competitive transfer market offers an attractive setting for empirical analyses focusing on research questions in the

2 For detailed descriptions of American professional team sport leagues and comprehensive reviews of differences between American and European professional team sport leagues see inter alia El-Hodiri and Quirk (1971), Fort and Quirk (1995), Hoehn and Szymanski (1999), Fort (2000), Vrooman (2000), Flynn and Gilbert (2001), Szymanski (2003), and Sloane (2006).

3 For theoretical and empirical analyses focusing on the Bosman-ruling see inter alia Simmons (1997), Noll (1999), Szymanski (1999), Antonioni and Cubbin (2000), Feess and Muehlheusser (2002), (2003a), (2003b), Bougheas and Downward (2003), Feess et al. (2004), Frick et al. (2007), Dietl et al. (2008), or Frick (2009).

field of job matching and turnover. In this industry, sport and personnel economists have so far concentrated on explaining player salaries and player transfer fees rather than analyzing player transfers themselves (see Frick 2007 for a research overview of the football player's labor market). Existing evidence indicates that player characteristics, experience, and performance as well as team performance significantly explain the observable variations in player salaries and transfer fees. Recently, these findings have been transferred to the analysis of player careers coming to similar results (Frick et al. 2007 and 2008). The rich player transfer data publicly available for this industry, however, have not been leveraged so far and hence, this field seems attractive for further research.

As a consequence of the above argumentation, the present work follows the suggestions by Lazear and Oyer (2007) as it is set out to empirically analyze employee-employer relationships with respect to matching processes and turnover in the field of personnel economics. The European football player's labor market, characterized by its competitive transfer market, is an adequate empirical setting. More precisely, the overall research focuses on personnel turnover and the dynamics of team performance in the Bundesliga, Germany's highest division in association football. This focus is addressed in four separate analyses that are broken down as follows.

- Analysis 1: What explains transfer success of professional players?
- Analysis 2: What explains career success of professional players?
- Analysis 3: What explains career success of youth players?
- Analysis 4: How does turnover of professional players explain team performance?

Several unbalanced panels of professional players, youth players, and professional teams serve as datasets. They mainly cover the 16 Bundesliga seasons from the 1995/1996 season to the 2010/2011 season and have hitherto not been used in empirical research which promises a number of insights for at least three reasons. First, I observe every player-team transaction in the market with precise information about the old employer, the new employer, and the conditions of the transition. Second, these data do not only include the above mentioned covariates known from player salary and transfer fee research but additionally include player market values and player contract data. These data have not been included systematically in previous research as market values and contract length often remain private and undisclosed. Yet, market values are crucial since relative performance, proxied by relative market value, is a key concept in personnel economics as e.g. tournament theory has shown (see above). In addition, it has become a stylized fact in sports economics that money pays out (see Szymanski and Smith 1997 for first evidence in association football or Frick 2012b for a recent and comprehensive analysis). This means that monetary proxies of team values explain variations in team performance to an important extent, which underlines the importance to control for relative market value. The richness of these market value data even allows analyzing changes in market values, i.e. market value of a player at different points in time. Moreover, the market value data also permit weighting player turnover by market value to better proxy the human capital impact of turnover. Furthermore, it is critical to control for contract length when analyzing turnover in a Bundesliga setting since the contracts of players are usually restricted to two to four years. In fact, when in-contract players leave, their new teams generally have to make a cash payment to the former team. In this setup, a player's contractual status may well be assumed to significantly influence turnover. Third, this research includes for the first time data of youth players. Different from the US draft systems, in association football the transition from the youth stage to the professional stage is also managed by the active transfer market where both youth and professional players are traded. As media coverage, however, is limited in youth football, a dataset containing player-season observations of youth players is difficult to gather and has thus not been in the focus of previous research.

The methodology applied follows the common way of analysis well-known from personnel economics. In fact, personnel economists entered the field of human resource management with a clear approach that is structured around the following four building blocks (Lazear 2000b, Lazear and Shaw 2007). First, both the firm and the worker are assumed to be rational maximizing agents. The decision-making of firms is generally assumed to seek profit maximization and the decision-making of workers to seek utility maximization (see below for a discussion of profit maximization of professional sport teams). Second, it is by the tool of equilibrium analysis that labor and product markets are examined. The examined markets are assumed to be competitive with both firms and workers considering actions of the other party when making decisions, leading to a specific market equilibrium. Third, concentrating on efficiency resulting from equilibria is the main target of such analyses. In fact, any analysis is supposed to detect and explain inefficiencies possibly driven by decision-making of firms and workers that is not in favor of both parties and hence does not lead to the expected equilibrium. Fourth, econometrics and experimental design provide the key tools to do so. As mentioned above, this approach is followed in the present work. First, firms and workers are football teams and football players respectively. Players are assumed to be rational utility maximizers. In sports economics, this is also assumed for teams (firms) since, compared to most industries, the professional sport industry is characterized by an important peculiarity (Neale 1964). Teams depend on other teams to produce their product. To account for this complementarity teams compete in leagues. Therefore, a team's main goal is not to make profits but to win games which characterizes a team as a win maximizer or more generally as a utility maximizer (Sloane 1971). This is particularly true for German association football where teams (clubs) are owned by member's associations rather than investment firms. These members are primarily interested in sporting instead of financial success of their team. Second, the football player's labor market is assumed to be a competitive one as already argued above (Szymanski and Smith 1997). Third, any of the four analyses listed above will aim at detecting and explaining inefficiencies in the football player's labor market and more precisely in the football player's transfer market. Fourth, the econometric methodology applied has been tailored to the research questions at hand, taking into account the particularities of the respective datasets. Microeconometric models are carefully estimated for panel data with e.g. fixed- and random-effects models and for cross-section data with e.g. two-step estimations following Heckman (1979) and Seemingly Unrelated Regression models as proposed by Zellner (1962). Furthermore, career data are examined with the help of hazard models, particularly with Cox's (1972) semi-parametric proportional hazard model. Here, the key methodological innovation of the present work is the application of competing risk models using Lunn and McNeil's (1995) data augmentation method. This approach allows for an in-depth analysis of career entries and exits that is rare in sport and personnel economics.

The structure of the work is organized as follows (chapters 2 to 5 respectively).[4] Chapter 2 investigates transfer success of professional players, based on a dataset covering 2,300 relevant signings of German Bundesliga teams during the 16 seasons from 1995/1996 to 2010/2011. The data permits to adress the research question from a sporting and a financial perspective. In fact, with minutes played and delta market value between seasons the two most promising measures for modeling these two perspectives are available. Results show that job matching is a difficult endeavor even in the football player's highly transparent labor market as insights from buying club dummies reveal major differences between buying clubs with regard to turnover management. On the one hand, playing time of new signings is significantly higher at so-called yoyo-teams, i.e. teams that have frequently moved up and down between Bundesliga and 2. Bundesliga. On the other hand, Bundesliga's most successful teams in the last 16 seasons are the ones that report significantly more generated market value from their signings than others. This possible trade-off leads the way to analyze career success of professional football players using detailed transfer data as done in chapter 3. Moreover, the analysis of job matching and transfer success reveals some frictions in the labor market. Perhaps surprisingly, transfers with players from the own youth team lead to significantly less financial success than standard signings from other Bundesliga clubs. This may imply that the transfer market overvalues players that move from the youth team to the professional team at their home club. Indeed, the value of youth players in Germany may potentially be hyped because of recent reforms at the youth level that proved to be particularly successful. This interpretation gives the motivation to analyze career success of youth football players in further detail as carried out in chapter 4.

As already mentioned, chapter 3 focuses on career success of professional football players. On the basis of 8,530 player-season observations for 2,791 players, differences between quits and layoffs and between in-season and end-of-season exits are analyzed. By applying Cox (1972) competing risk models based on Lunn and McNeil's (1995) data augmentation method to model these different exits from Bundesliga football, this chapter clearly addresses a demand in this field of research, articulated by Frick et al.

4 This work is based on four separate manuscripts to be published in the field of personnel and sports economics. As a consequence redundancies concerning literature reviews, data sources, methodological discussions, and the introduction of abbreviations occur across the manuscripts. The author kindly asks for the reader's understanding. Note that tables and figures have not been included more than once.

(2007 and 2008). Distinct player profiles are found. Profiles of involuntary and end-of-season exits, constituting the vast majority of exits, are in line with the previous findings of Frick et al. (2007 and 2008). Voluntary exits, however, occur mainly for highly valued players and around the age of 26. These players leave Bundesliga voluntarily when pre- or in-season head coach turnover takes place. In-season exits similarly happen rather for highly valued players. Furthermore, as with other player profiles, these exits occur shortly before players are becoming free agents at the end of the season. Hence, these players exit the league since their clubs want to monetize their transfer rights before the player can leave the club without a transfer fee.

The careers of youth players are examined in chapter 4, using a dataset of 18 youth rosters, each of them winner of either DFB-U19-Bundesliga or DFB-Youth-Cup between 1998/1999 and 2009/2010. Following Lazear's (1995) approach, these youth football players are defined as risky workers. After a certain probation period, a club has the option to either promote the player to the professional team or not. This fact is modeled by applying semi-parametric duration analysis with competing risks, following again Cox (1972) and Lunn and McNeil (1995). I here distinguish between players debuting with their home club or with another club. Results indicate differences between the careers of players who make their professional debut with their home club and those who debut somewhere else, indicating the existence of a signaling effect in the labor market (Spence 1973). The home club's private information seems to become publicly available when the home club does not execute the option to promote the youth player. Moreover, no robust evidence of a hype on youth football players is found. This may, however, be caused by the selective nature of the dataset since descriptive evidence does highlight the positive effect of talent promotion reforms undertaken in Germany before and after the FIFA World Cup 2006.

Using a hitherto unavailable unbalanced panel of 288 team-season observations from the German Bundesliga and estimating fixed-effects regressions, chapter 5 analyzes the impact of general and specific human capital and turnover on team performance. With the comprehensive use of publicly available data and insider knowledge of the Bundesliga setting, it is possible to analyze all three "key levels" in a professional sport club: players, head coaches, and top managers. Interestingly, losing the general and team specific human capital of players prior to a season disturbs team performance whereas such signings increase chances to succeed. This still holds when weighting player turnover by its market value, suggesting that even when replacing the general human capital of a player, i.e. his market value, the loss of his team specific human capital hurts team performance. In addition, results indicate that teams with high roster stability outperform teams with high player turnover. Finally chapter 6 summarizes the main results and provides an outlook for further research.

2 Job Matching and Transfer Success: Evidence from German Bundesliga Football

2.1 Introduction

Football (soccer) fans in Germany, irrespective of their affiliation to a specific club,[5] discuss ongoing and completed player transfers with great excitement. A recurring topic is whether or not players should transfer to FC Bayern Munich (FCB), the largest market team. Assuming a player is seeking to maximize his utility, FCB possesses two convincing arguments for any player to join. First, FCB offers the highest monetary compensation in the Bundesliga, Germany’s top division in association football (Frick 2008). To give some anecdotal evidence, FC Bayern Munich paid for example Sebastian Deisler at the age of 22 a 10 million (Mn) Euro (EUR) signing fee in order to have him join in the 2002/2003 season (Franzke and Wild 2002), a value corresponding to approximately 16% of the club’s budget at the time. Second, FCB, as Germany’s most successful football team, offers its players a high probability to win championships. Among non-pay related job characteristics, winning championships may well be assumed to be the most important one for professional football players since in any sport a golden career without titles is not complete. Given these arguments, it is no surprise that FCB’s team manager Christian Nerlinger was recently quoted in a German TV interview as follows.

“If FC Bayern Munich wants to sign a particular player, the club will sign him.”
(Sport1, 18.12.2011)

Indeed, this statement seems to be particularly true for young German players as table 2.1 illustrates. The table shows the Top 10 German players ranked by market value that have been transferred within the German Bundesliga with less than 26 years of age since the 1995/1996 season. FC Bayern Munich has signed six out of the ten players which clearly demonstrates its negotiation power.

5 To ease understanding, in the following ‘club’ is used for the organization employing the ‘team’, i.e. the roster of players, the head coach, and the top management.

Table 2.1: Top 10 Transfers of Young Talent Within the Bundesliga, 1995-2011.

Name	**Season**	**From**	**To**	**Position**	**Market Value (Mn EUR)**
Lukas Podolski	2006/2007	1. FC Köln	FC Bayern Munich	Forward	9.0
Mario Gomez	2009/2010	VfB Stuttgart	FC Bayern Munich	Forward	8.0
Per Mertesacker	2006/2007	Hannover 96	SV Werder Bremen	Defender	7.0
Manuel Neuer	2011/2012	FC Schalke 04	FC Bayern Munich	Goalkeeper	7.0
Kevin Kuranyi	2005/2006	VfB Stuttgart	FC Schalke 04	Forward	6.5
Marcel Jansen	2007/2008	Bor. M‘gladbach	FC Bayern Munich	Midfielder	6.0
Lukas Podolski	2009/2010	FC Bayern Munich	1. FC Köln	Forward	5.5
Jens Jeremies	1998/1999	TSV 1860 Munich	FC Bayern Munich	Midfielder	5.1
Jerome Boateng	2011/2012	Manchester City	FC Bayern Munich	Defender	4.5
Stefan Kießling	2006/2007	1. FC Nürnberg	Bayer 04 Leverkusen	Forward	4.5

Note: Transfers are within Bundesliga only, ordered by market value, and for players younger than 26 years. Market values are taken from Kicker Sportmagazin Fantasy Game and may not reflect real-world values but do reflect proportions.

Source: Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012.

Whereas no question arises about the market leader’s negotiation power prior to a transfer, success of such a transfer afterwards remains largely unknown. In sports economics, such transfer success has not been subject of much research. Kuper and Szymanski (2009) write that *“much of the money is wasted on the wrong transfers”* (p. 48), arguing that a club’s transfer fee investments only explain little of its performance. Still, it is rather anecdotal evidence regarding so-called ‘tops’ and ‘flops’, i.e. transfers better or worse than expected, that dominate the discussion. However, explaining transfer success may yield valuable insights since even all-time champion FC Bayern Munich faces the above quoted ‘flop’ danger. The most successful club in Germany had its highest valued player from the selection in table 2.1, Lukas Podolski, retransfer to his former club 1. FC Köln three years after the initial transfer at a loss of market value of approximately 40% (see table 2.1). Interestingly, both times the same transfer fee of 10 Mn EUR was paid.

Salaries and transfer fees represent the most relevant expenses on a club’s income statement. In fact, clubs of the German Bundesliga spent approximately 40% of their revenues for player salaries and bonuses and approximately 15% of their revenues for player transfer fees (DFL Deutsche Fußball Liga GmbH 2011). Furthermore, around 45% of all players leave the Bundesliga after one season (Frick et al. 2007 and 2008, chapter 3), and average contract length is two to three years only (Huebl and Swieter 2002, Feess et al. 2004). Hence, transfers constantly represent substantial business for European football clubs.

Yet, Lukas Podolski's example illustrates that managing player turnover, the head coach's and team manager's main task, is a difficult endeavor. This is particularly true since it is difficult to evaluate a player's fit into a specific team ex ante. Despite the lack of economic evidence around transfer success, player salaries and player transfer fees have been subject of several analyses (see Frick 2007 for an overview). Evidence shows that both, player salaries and player transfer fees, can be explained to an important degree by past player performance. Executives thus use existing, historic information to price players. Still, whether a transfer is a success or not is decided after the player has joined the new team. His performance after the transfer, however, is not observable by any of the agents in the football player's labor market prior to making the signing decision and hence a classical matching problem exists (Jovanovic 1979a, 1979b).

Following the argumentation above, not only player salaries and transfer fees but also transfer success is of interest in the field of labor and sport economics. Consequently, this chapter aims at investigating transfer success in the season after the transfer from a sporting and a financial perspective. Therefore, a dataset covering 2,300 signings of Bundesliga teams during the 16 seasons from 1995/1996 to 2010/2011 is used. The analysis is carried out at player level, more precisely on a transfer-by-transfer basis and additionally provides insights about skills and abilities to manage turnover on team level. Simple Ordinary Least Squares (OLS) as well as a Seemingly Unrelated Regression (SUR) model (Zellner 1962), and a Heckman Two Step Procedure (Heckman 1979) are applied simultaneously, yielding robust results.

The remainder of this chapter is set out as follows. Section 2.2 discusses job matching and turnover in the context of professional team sports and section 2.3 summarizes previous evidence on related research. Data and descriptive evidence are presented in section 2.4. Models and results are the subject of section 2.5. Finally, section 2.6 gives the conclusion and provides implications for further research.

2.2 Job Matching and Turnover in Professional Team Sports

The theory of job matching has been developed on the basis of the seminal works of Jovanovic (1979a, 1979b). The theory assumes that both employees and jobs are heterogeneous. An employee-job relationship, or more generally an employee-employer relationship is evaluated by its match quality. Along these lines, Jovanovic (1979a) writes that *"there are no 'good' workers or 'good' employers, but only good matches"* (p. 1249). Hence, employee productivity depends on the match quality and the challenge is to optimally assign employees to jobs. In addition, it is assumed that contracts between employees and employers are negotiated on an individual basis. Thus, the employer may pay the employee on the basis of the match quality. It is further assumed that imperfect information exists on both the demand and supply side of the market. Consequently, an initial evaluation of match quality may first be imperfect and may later be adapted when further information about the match quality becomes available to both or either one of the parties.

Match quality is not observable ex ante and classifies the job as well as the worker as an 'experience good' contrary to a 'pure search-good'. As a result, imperfect matches may be formed – not only because of imperfect information prior to the relationship but also because employee and employer may not be in the position to wait for the optimal match to become available. According to theory, match quality drives turnover as employees stay with jobs where their productivity is relatively high and select themselves out of jobs where their productivity is relatively low.

The theory has been subject of several empirical studies across various industries (see e.g. Garen 1988 for an overview). With respect to the field of professional team sports, job matching theory has inter alia been tested in American and Japanese baseball (see e.g. Chapman and Southwick 1991, Ohtake and Ohkusa 1994, Ohkusa and Ohtake 1996, Prisinzano 2000, and Glenn et al. 2001). These studies analyze job matching of player-team, manager-team and player-manager relationships. Most of them perform a direct test of the matching hypothesis. Such a direct test is performed using dummies that capture each employee-employer match separately and thus these variables measure the impact of match quality directly. To perform such a test, highly disaggregated data are needed since the same individuals have to be observed at multiple employers.

Unfortunately, the present dataset does not provide sufficient observations of this kind since only a limited number of players observed work at more than one employer (see section 2.4). Hence, the theory of job matching helps to explain evidence found in this chapter in an indirect way.

In association football job matching and turnover is facilitated by the transfer market (DFL Deutsche Fußball Liga GmbH 2010b), a unique governance mechanism not known from other labor markets. Here, team managers, head coaches, players and players' agents meet to realize player transfers along standardized rules. Clear time frames exist in which transfers are to take place, so-called transfer windows. Generally, one pre-season window exists in summer and one in-season window in winter. Apart from regulating timing, also payments associated with transfers are regulated since players with effective contracts are eligible to be traded for cash. From a theoretical point of view, two different types of cash payments exist. In case of a player under contract (in-contract signing), a transfer fee may be paid by the player's new club to his former club. In case of a free agent (out-of-contract signing), a signing fee may be paid by the player's new club to the player. Compared to American team sports, trading for cash is a unique feature of European football since draft systems and player for player exchanges dominate trade patterns in the US (see e.g. Grier and Tollison 1994 for a discussion of the American draft system and Hoehn and Szymanski 1999 for a comparison of league systems in Europe and the US).

However, the absence of a transfer fee in a transfer involving a free agent is relatively new. In 1995, the so-called Bosman-ruling liberalized player mobility in European football's labor market (Court of Justice of the European Communities 1995). Prior to this ruling, any player's change of clubs had to be associated with a transfer fee. The Bosman-ruling changed this practice, allowing clubs to sign free agents "for free". In line with this deregulation, the number of foreign players eligible to be taken to the field in a team's match was relaxed in three steps in the following years. First, from the 1996/1997 season onwards, restrictions on the employment of foreigners from UEFA countries were withdrawn by the Union of European Football Associations (UEFA), association's football governing body in Europe, and the number of non-UEFA foreigners eligible to play in a match was set to three. Second, the latter regulation was further relaxed to five in the 2001/2002 season along with the so-called Monti-reform that also set maximum contract length of players to five years. Third, UEFA’s local player rule led to a complete abolition of any limit on foreigners in the Bundesliga. However, the local player rule sets the number of German players in a Bundesliga roster to twelve (see Frick et al. 2007 and Frick 2009 for more details on related changes in the Bundesliga).

During the process of a transfer, team managers of Bundesliga clubs undergo sophisticated searching procedures called scouting. Dedicated employees screen the supply of national and international talent leveraging a network of scouts combined with online databases. Interesting players are evaluated along a set of criteria covering athletic performance as well as personality. Potential new players are generally invited for a job interview or a trial practice to further collect information about the match quality. Finally, a legally mandatory medical check is performed before signing the contract (DFL Deutsche Fußball Liga GmbH 2010a).

Despite such search effort, match quality becomes only transparent after the player-team relationship has started since two caveats are inherent in the search process. First, only information about historic performance is available, yet contracts are based on future expectations. Second, association football is a highly interactive sport with the production function depending on a roster of around 25 players. The information available, however, is rather focused on the player as an individual than on the player’s performance in the signing club’s team. Thus, the player-team match, in line with Jovanovic’s matching theory (Jovanovic 1979a, 1979b), is understood as an experience good and employer and employee need to collect and evaluate information about match quality while collaborating. For example, during training and match days additional signals of match quality become transparent. Based on these signals, the working conditions may be adapted over time. Feess et al. (2004) argue for example that a productivity shock of a player may result in a transfer to adapt both the club’s and the player’s rents. That is, assuming a positive productivity shock, a transfer fee for the selling club and higher compensation for the player compared to his existing contract.

2.3 Previous Evidence on Transfers in Professional Team Sports

In this research, the football player's labor market is assumed to be competitive.[6] This assumption follows Szymanski and Smith (1997) who argue that in English football team wage bills and team performance are closely related (see for studies with similar results Forrest and Simmons 2002 and Simmons and Forrest 2004 for empirical works covering several European and American leagues, Frick 2012b covering several European football leagues or Frick 2005 covering the German Bundesliga). Hence, input and output are closely related. This is particularly true since the transfer market of association football has become a global one, matching many buyers and sellers (see Rosen and Sanderson 2001 for a discussion of supply and demand in the professional sports labor market). Globalization has mainly been driven by deregulation, as described in section 2.2, and by the growth of the industry. Industry growth is best reflected by the observed change in TV revenue income. In the German Bundesliga, for example, TV revenues currently represent approximately one third of a club's income and have been multiplied by six between the 1995/1996 season and the 2009/2010 season (DFL Deutsche Fußball Liga GmbH 2006 and 2011).

With a competitive football player labor market given, clubs acting on this market are price takers (Szymanski and Smith 1997). For a player's service, they have to pay a compensation package corresponding to his market value. Generally, this compensation package consists of a base salary, bonuses, and signing fees. However, from a club's perspective, eventual transfer fees have to be added to this package if the player is under contract with another club. This is backed up by Feess et al. (2004) who find evidence that transfer fees have a negative impact on salaries. Both salaries and transfer fees have been subject to research in the past decade and not surprisingly, the same variables explaining player salaries in Mincer-type earning functions (Mincer 1974) do also help explaining transfer fees (see Frick 2007 for a discussion of evidence concerning the football player's labor market).

[6] Because of this assumption a literature explaining transfer fees based on bargaining models is not discussed in the following (see e.g. Carmichael and Thomas 1993, Reilly and Witt 1995, Speight and Thomas 1997a and 1997b for studies explaining transfer fees with bargaining models or Burguet et al. 2002, Feess and Muehlheusser 2002, 2003a, and 2003b, Feess et al. 2004, Dietl et al. 2008, Carbonell-Nicolau and Comin 2009 for studies using bargaining models as underlying theory for testing contract theory and transfer systems).

For the present literature review, the studies by Frick and Lehmann (2001), Feess et al. (2004), and Eschweiler and Vieth (2004) will be summarized since they all analyze transfer fees in the German Bundesliga, the league in focus of the present analysis.[7] Frick and Lehmann (2001) investigate 1,211 out of 1,269 transfers from 1984/1985 to 1999/2000, Feess et al. (2004) focus on 239 transfers between 1994/1995 and 1999/2000 and Eschweiler and Vieth (2004) analyze 254 transfers in the period 1997/1998 to 2002/2003. All authors find a non-linear experience-transfer fee profile e.g. for career games played, international caps, or career goals scored. With respect to player characteristics, the three studies find a quadratic age-transfer fee profile. In fact, the function has an inverted U-shaped form peaking at approximately 23.6 years (Frick and Lehmann 2001), 26.6 years (Eschweiler and Vieth 2004), and 30.2 years (Fees et al. 2004). This owes to the fact that on the one hand, experience increases with age but on the other hand, the scope for development decreases with age. Moreover, positions matter as transfer fees for goalkeepers are significantly lower compared to those of midfielders (Frick and Lehmann 2001) and transfer fees for forwards are significantly higher than those of goalkeepers (Feess et al. 2004). Eschweiler and Vieth (2004) even find transfer fees of defenders, midfielders, and forwards to be significantly higher compared to those of goalkeepers. The relative results of transfer fees for goalkeepers are explained with their highly specialized set of skills compared to field players whereas the relative results of transfer fees for forwards pay tribute to a forward's decisive impact when scoring. Player nationality is found to impact transfer fees positively for South American players (Feess et al. 2004) and for countries with high performing national teams proxied by the FIFA-coefficient (Eschweiler and Vieth 2004).[8] Thus, it seems that nationality is used by decision makers as a proxy for player talent. Significantly lower transfer fees are associated with semi-professional players (Feess et al. 2004). Selling club performance is positively linked to transfer fees (Eschweiler and Vieth 2004) and the selling club's country of origin impacts transfer fees positively if the club is from Western Europe or South America and negatively if it is from North America, Asia, or Germany's third division (Frick and Lehmann 2001).

[7] Note that Carmichael et al. (1999), Dobson and Gerrard (1999), and Dobson et al. (2000) carry out analyses with similar outcomes in English association football.

[8] Fédération Internationale de Football Association (FIFA) is the international governing body in association football. The FIFA-coefficient is a metric evaluating the strength of a country's national team by past performance.

Again, the country of origin is a signal for talent by market participants. A buying club's qualification for the European cup competition, the log of its sponsoring revenues, and of its attendance positively impact transfer fees (Eschweiler and Vieth 2004, Feess et al. 2004). Feess et al. (2004) find that the remaining duration of the contract between the player and the selling club positively influence transfer fees especially since the Bosman-ruling has been implemented.[9] In line with the above quoted increase in TV revenues, Frick and Lehmann (2001) find a positive and significant time trend explaining transfer fees despite holding prices constant.[10]

All three studies use Ordinary Least Squares (OLS) regression for estimation. Yet, transferred players are a subset of all players active in a league and may be transferred for non-random reasons. This potential selection bias is analyzed by Carmichael et al. (1999) when explaining transfer fees with data from English football leagues' 1993/1994 season. In their sample, 240 out of 1789 players have changed clubs. Their Tobit and OLS estimates, estimated with the Heckman Two Step Procedure, yield significant Mills Lambdas clearly indicating selection bias (Heckman 1979). Their instruments used to explain the probability of transfer in the first step of the estimation are the player's number of loans during his time with the team, the player's number of previous transfers, the turnover of the team's manager as well as whether or not the team has been promoted or relegated. Results from corrected and uncorrected OLS estimates, however, are fairly robust.

2.4 Data, Variables, and Descriptive Evidence of Player Transfers

The focus of the present chapter is to explain transfer success of players in German Bundesliga football. To analyze such player turnover, a dataset including 5,722 player transfers has been collected from www.transfermarkt.de. This German website is specialized on documenting player transfers and its use has become common in sports economics research (see e.g. Torgler and Schmidt 2007, Franck and Nüesch 2011,

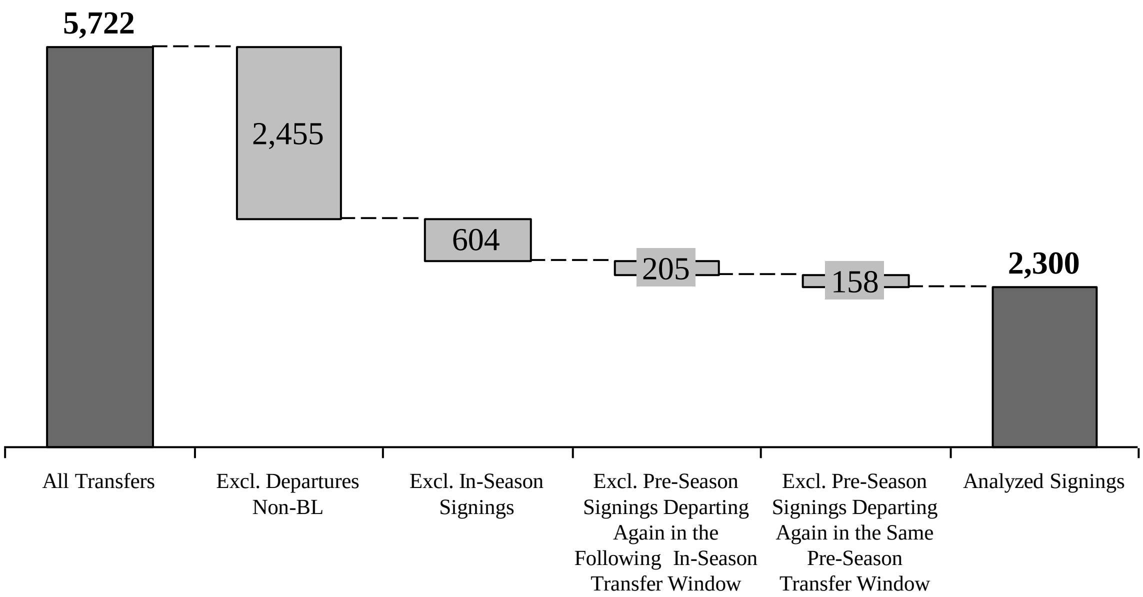
9 Unfortunately, information about contract length still remains private very often and could consequently not be included into the present analysis. However, contract length is partially captured by controlling for starting loans and free agents (see section 2.4). Players that start their loan sign rather short contracts whereas free agents sign rather long contracts. Moreover, the present chapter focuses only on the first year after the transfer. Here, with respect to incentive effects, contract length is not as important as in later years (see Frick 2011 for an analysis of moral hazard in the German Bundesliga).

10 Note that all three studies deflate or standardize prices.

Bryson et al. 2012, or Frick 2012b). For each player-transfer observation the dataset documents timing, the name of buying and selling club, transfer type (e.g. loan), and whether or not the player was a free agent before being transferred. The dataset covers all transfers involving the German Bundesliga from the pre-season transfer window of the 1995/1996 season to the in-season transfer window of the 2010/2011 season. To guarantee consistency between time periods used for measuring of dependent and of independent variables this chapter concentrates on transfer success of pre-season signings that remained the whole season with their new team. In fact, for each player-season observation the point in time of the observation of a variable is always at the beginning or the end of the season. As a result, the following player transfers have been excluded from the dataset leading to a remaining sample of 2,300 analyzed pre-season signings (see figure 2.1).

- Departures to leagues other than the Bundesliga
- In-season signings
- Pre-season signings departing in the following in-season transfer window
- Pre-season signings departing again in the same pre-season transfer window

The data have been extended to include characteristics of players, buying and selling clubs as well as player experience and performance data from various issues of Kicker Sportmagazin, the leading sports newspaper in Germany. Particularly, Kicker Sportmagazin is the key source of player market values that have been published since 1995/1996 in its yearly pre-season special issue. Since player market values are fundamental to empirical studies in this field (see section 2.3), it is this particular lack of consistent time series that restricts the analysis to the period from 1995/1996 to 2010/2011. Consequently, the dataset begins one season prior the Bosman-ruling becoming effective allowing for rather stable transfer rules during the observation period. It is important to note that the dataset compiled from Kicker Sportmagazin also contains 6,370 player-season observations on players that have not been transferred in the respective pre-season transfer window.

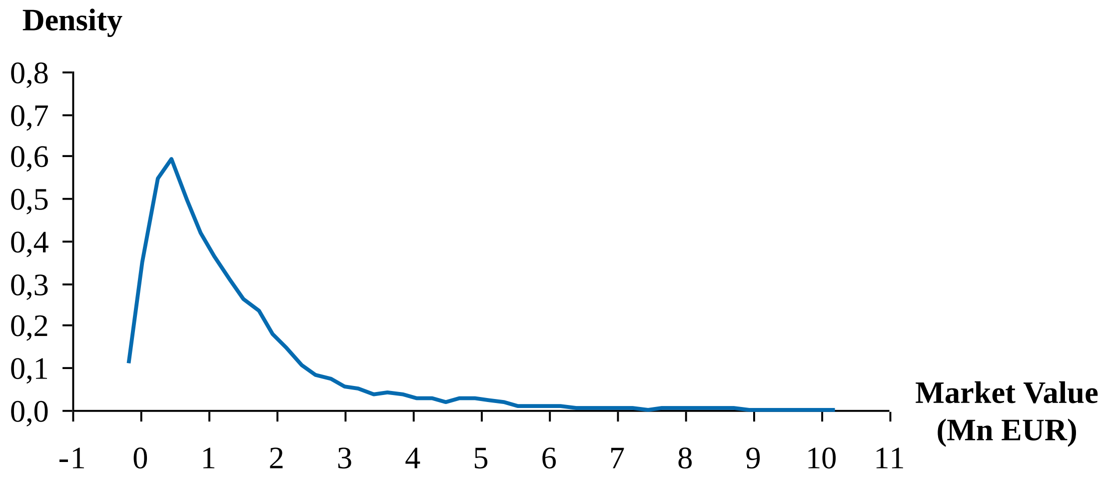


Source: Own calculations based on information provided by www.transfermarkt.de.

Figure 2.1: Transfers Relevant for Present Research.

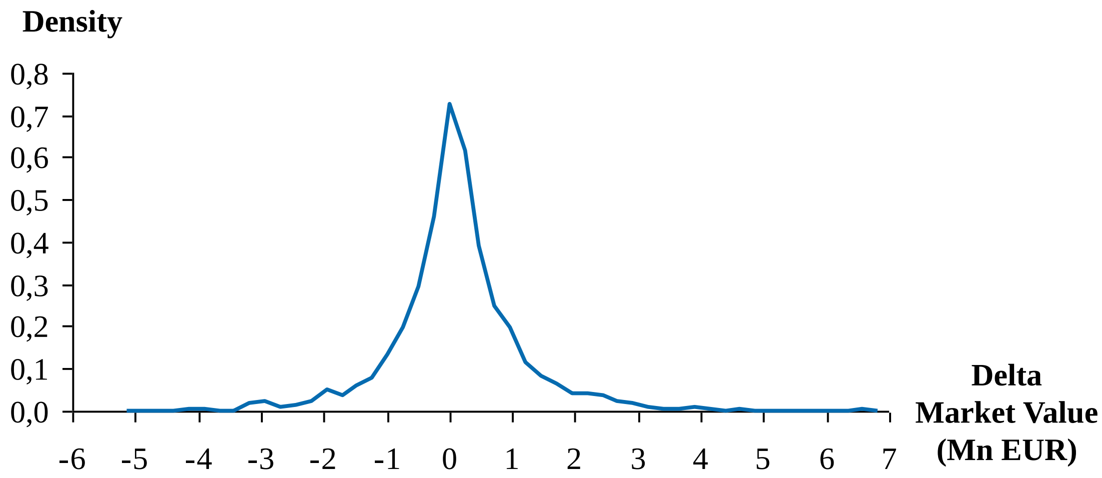
Transfer success, the dependent variable, is measured separately for sporting transfer success and financial transfer success. Sporting transfer success is measured by minutes played during the first season after the transfer. Obviously, in a roster of minimum 25 players, not all players are meant to continuously perform on the pitch. Nevertheless, teams focus during the six week long preparatory phase in summer particularly on integrating new players. These new signings represent on average 26.5% of a roster. Hence, player turnover is a standard procedure in Bundesliga football and it seems reasonable to assume that new signings are meant to perform as starters from the first match day on. This is particularly true when controlling for selling club characteristics as for example signings from lower German divisions than the Bundesliga or even from youth divisions are likely to have longer onboarding periods than the six weeks.

Financial transfer success is proxied by the difference between the player's market value measured during the pre-season transfer window of the actual transfer and during the pre-season transfer window one year later. Increasing market value is a target for both the player and the club since agents in the competitive transfer market price transfer fees and salaries proportional to market value (see section 2.3).



Note: Market values are taken from Kicker Sportmagazin Fantasy Game and may not reflect real-world values but do reflect proportions.
Source: Own calculations.

Figure 2.2: Epanechnikov-Kernel Density Estimates of Market Value.



Note: Market values are taken from Kicker Sportmagazin Fantasy Game and may not reflect real-world values but do reflect proportions.
Source: Own calculations.

Figure 2.3: Epanechnikov-Kernel Density Estimates of Delta Market Value.

Contrary to market value, delta market value is not right-skewed but rather follows a normal distribution (see figures 2.2 and 2.3). In this context, it is essential to note that the market values used are published to serve Kicker Sportmagazin's virtual fantasy game in which users act as team managers. Thus, the fantasy game's monetary values may not exactly correspond to real-world values – a key fact when interpreting descriptive statistics and results. However, using these data as a proxy for market value is very adequate as analyses of Torgler and Schmidt (2007) demonstrate, comparing Kicker Sportmagazin data with market values from www.transfermarkt.de. More importantly, these values are deflated because the buying power of a user in the fantasy game is capped each year and market values are normalized to this user buying power. The cap varies slightly between 25.6 Mn EUR (50 Mn Deutsche Mark (DM)), 30.7 Mn EUR (60 Mn DM) and 30.0 Mn EUR which will be accounted for in the regressions by including season dummies (see table 2.2).[11] Hence, neither inflation as measured by the relevant retail price index nor inflation driven by industry growth are likely to bias the present analysis (see section 2.3).

Table 2.2: Fantasy Game Budgets, Transfer Fees, and TV Revenues.

Season	Kicker Sportmagazin Fantasy Game Budget (Mn EUR)	Bundesliga Transfer Fees for Summer Signings (Mn EUR)	Bundesliga TV Revenues (Mn EUR)
1995/1996	25.6	62.9	99.6
1996/1997	25.6	38.1	104.8
1997/1998	30.7	52.1	122.7
1998/1999	30.7	57.8	163.6
1999/2000	30.7	116.3	166.2
2000/2001	30.7	66.6	355.4
2001/2002	30.7	148.2	339.5
2002/2003	30.0	112.0	291.0
2003/2004	30.0	78.1	298.5
2004/2005	30.0	76.7	301.5
2005/2006	30.0	87.8	300.0
2006/2007	30.0	119.6	400.0
2007/2008	30.0	199.9	580.1
2008/2009	30.0	146.9	574.7
2009/2010	30.0	220.6	594.0
2010/2011	30.0	155.6	N/A

Source: Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2010/2011, DFL Deutsche Fußball Liga GmbH Bundesliga Reports 2006 and 2011, www.transfermarkt.de.

[11] Capturing this development of caps by defining regimes instead of season dummies did not change results. Note that some of the market value data were not published in the Kicker Sportmagazin pre-season special issue and was only accessible in the Kicker Sportmagazin Fantasy Game online. A dummy controlling for this fact, however, turned out to be insignificant.

The set of independent variables principally follows those sets used in previous studies concerning player salaries and transfer fees (see section 2.3) and is structured as follows.

- **Player performance:** relative market value
- **Player experience:** number of previous career transfers to Bundesliga teams
- **Player characteristics:** age, position (goalkeeper, defender, midfielder, forward), nationality (aggregated by the six FIFA confederations Asian Football Confederation (AFC), Confédération Africaine de Football (CAF), Confederation of North and Central American and Caribbean Association Football (CONCACAF), Confederación Sudamericana de Fútbol (CONMEBOL), Oceania Football Confederation (OFC), and Union of European Football Associations (UEFA) with a separate category for Germany)
- **Transfer characteristics:** free agent (no transfer fee paid), standard signing (no loan), start of loan (on loan), return from loan
- **Selling club characteristics:** club from Germany's top division (Bundesliga), club from Germany's second division (2. Bundesliga), club from Germany's third division or from lower divisions (3. Liga and below), top foreign club (first division club in England, France, Italy or Spain), other foreign club, no club (player unemployed), own club's youth team, other club's youth team
- **Buying club characteristics:** coach turnover (pre-season), team dummies
- **Controls:** season dummies

Table 2.3: Summary Statistics of Selected Variables.

Variable	Type	Obs.	Mean	Std. Dev.	Min.	Max.
Minutes Played	Dependent	2,300	1027.380	954.833	0.000	3060.000
Delta Market Value (Mn EUR)	Dependent	1,472	0.116	1.026	-5.000	6.700
Relative Market Value	PLAYER	2,014	0.906	0.903	0.020	9.050
Transfer Experience	PLAYER	2,300	0.538	0.918	0.000	6.000
Age (Years)	PLAYER	2,300	24.367	4.106	15.930	39.840
Goalkeeper	PLAYER	2,241	0.090	-	0.000	1.000
Defender	PLAYER	2,241	0.266	-	0.000	1.000
Midfielder (Ref. Cat.)	PLAYER	2,241	0.402	-	0.000	1.000
Forward	PLAYER	2,241	0.243	-	0.000	1.000
Free Agent	TRANSFER	2,147	0.315	-	0.000	1.000
Standard Signing (Ref. Cat.)	TRANSFER	2,300	0.906	-	0.000	1.000
On Loan	TRANSFER	2,300	0.050	-	0.000	1.000
Return Loan	TRANSFER	2,300	0.044	-	0.000	1.000
From Bundesliga (Ref. Cat.)	SELLING	2,300	0.264	-	0.000	1.000
From 2. Bundesliga	SELLING	2,300	0.130	-	0.000	1.000
From 3. Liga and below	SELLING	2,300	0.075	-	0.000	1.000
From Top Foreign League	SELLING	2,300	0.077	-	0.000	1.000
From Other Foreign League	SELLING	2,300	0.250	-	0.000	1.000
From Unemployment	SELLING	2,300	0.013	-	0.000	1.000
From Own Youth Team	SELLING	2,300	0.177	-	0.000	1.000
From Other Youth Team	SELLING	2,300	0.014	-	0.000	1.000
Coach Turnover (Pre-Season)	BUYING	2,300	0.173	-	0.000	1.000

Note: The column ‘Type’ refers to the vectors defined in the general equation in section 2.5. Further control variables include dummies for teams (BUYING), seasons (CONT) and the respective FIFA confederation of the player's home country (PLAYER).

Source: Own calculations.

A summary of the respective descriptive statistics is presented in table 2.3. Complete data exist for 1,924 records when using minutes played as the dependent variable and for 1,423 records when using delta market value as the dependent variable. Market value for players varies between zero and 10 Mn EUR according to Kicker Sportmagazin Fantasy Game values and is included as a relative term into the regressions to better approximate differences between players. Relative market value is expected to positively influence playing time and to negatively influence delta market value. Player transfer experience in the Bundesliga is expected to have an inverted U-shaped form. During the observation period the highest number of transfers by one player was six, whereas on average the observed players transfer 0.5 times within the league. The experience of some previous transfers is expected to support the player's integration into the new team. Frequent transfers, however, and consequently short player-team relationships are understood to indicate players with integration problems, i.e. chronic movers. Similarly, age is expected to have the inverted U-shaped form shown in salary and transfer fee research (see section 2.3).[12] Positional dummies include goalkeepers, defenders, midfielders and forwards. Midfielders are selected as reference category since these players represent the most flexible position on the pitch. To control for player nationality dummies for the respective FIFA confederation of the player's home country have been included. The six FIFA confederations are the AFC, the CAF, the CONCACAF, the CONMEBOL, the OFC and the UEFA. No transfers of players belonging to OFC have been observed between 1995/1996 and 2010/2011. Reference category is Germany, that has therefore been separated from the UEFA dummy. Results for these regional variables remained mainly insignificant and are hence not reported in the regressions in section 2.5.[13]

31.5% of transfers included free agents, i.e. players out-of-contract. In fact, this proportion varied over time as shown in table 2.4. At the beginning of the observation period, right after the implementation of the Bosman-ruling, the proportion of transfers involving free agents increased to approximately 52% (1997/1998) but decreased to levels around 20% to 30% afterwards. This is not surprising since Huebl and Swieter

[12] Note that the five oldest players observed were goalkeepers.

[13] In fact, only the CONCACAF dummy had a significant and positive effect at the 10% and 5% level for minutes played and delta market value respectively. Nevertheless, this is the region accounting for the fewest number of signings as only 26 out of the 2,300 signings had a country of origin belonging to the CONCACAF confederation. To analyze cultural effects on transfer success in more depth, three further steps had been undertaken that all resulted in insignificant results. First, the number of players from the same FIFA confederation in the team's roster, i.e. the number of integration advisors, had been included. This variable was significant when team dummies were excluded but turned insignificant when team dummies were included. Hence, team dummies control for such team specific effects. Second, the FIFA-coefficient of the player's country of origin, measuring the national team's strength, had been included to control for human capital accumulated during a player's youth career. However, this link was not strong enough to produce significant results. Third, cultural distance between the player's home country and Germany along the model of Hofstede (1980) and quantified following Kogut and Singh (1988) had been included. Again, no significant results were obtained. Yet, the accuracy of Hofestede's model is highly questioned in the literature (see e.g. Shenkar 2001, McSweeney 2002, or Kirkman et al. 2006 for discussions).

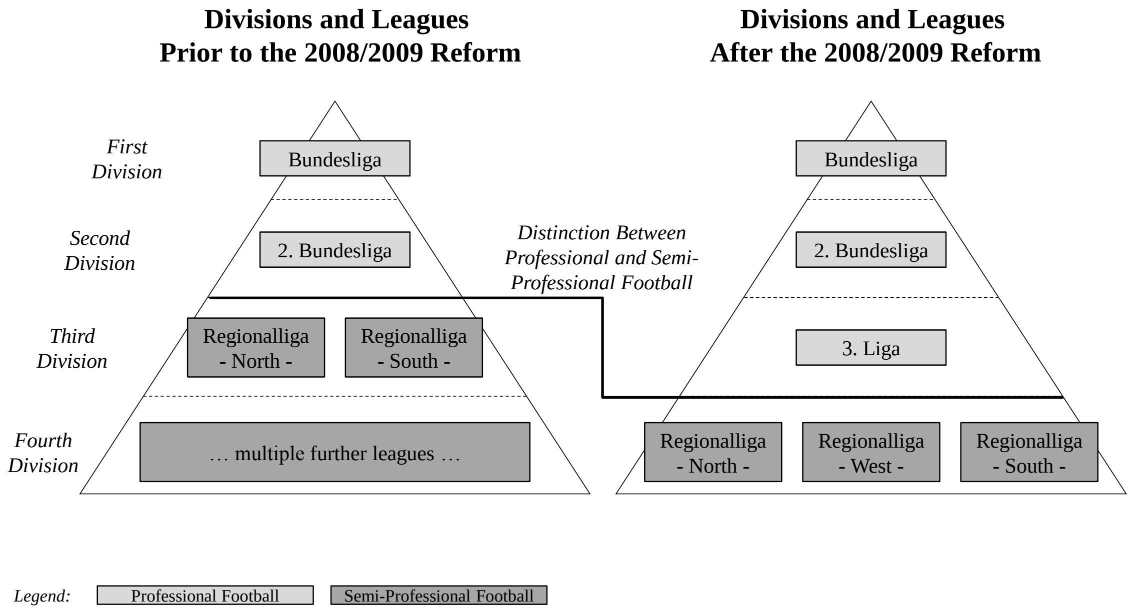
(2002) and Feess et al. (2004) find that contract length has increased by approximately six months (25%) between the pre-Bosman and the Bosman era. Clubs have adapted to the new regulation in order to preserve their transfer fee income. In a perfect transfer market, however, a free agent is expected to neither impact playing time nor delta market value compared to a transfer with a player in-contract. As discussed in section 2.3, clubs are assumed to invest in a player according to his market value and in the absence of a transfer fee, the player's compensation package is adjusted by increasing either his base salary or the signing fee (Feess et al. 2004). 217 out of the 2,300 signings concern loans. Here, the transfer type dummies differentiate between standard signings (reference category), a signed player starting a loan and a signed player returning from a loan.

Table 2.4: Summer Signings and Free Agents.

Season	**All Summer Signings (no.)**	**Free Agent Summer Signings (no.)**	**Free Agent Summer Signings (%)**
1995/1996	125	17	0.136
1996/1997	92	28	0.304
1997/1998	100	52	0.520
1998/1999	136	51	0.375
1999/2000	143	51	0.357
2000/2001	130	47	0.362
2001/2002	135	36	0.267
2002/2003	123	45	0.366
2003/2004	135	54	0.400
2004/2005	141	55	0.390
2005/2006	150	44	0.293
2006/2007	154	45	0.292
2007/2008	162	48	0.296
2008/2009	129	34	0.264
2009/2010	147	30	0.204
2010/2011	145	39	0.269
Total	**2147**	**676**	**0.315**

Source: Own calculations based on information provided by www.transfermarkt.de.

The selling club type dummies define which league the club's team belonged to during the season prior to the transfer or rather if the player still played in a selling club's youth



Source: Own illustration based on Kicker Sportmagazin Pre-Season Special Issue 2008/2009.

Figure 2.4: Divisions and Leagues in German Association Football.

team. As a matter of fact, association football is a system involving professional, semi-professional and youth football (see DFL Deutsche Fußball Liga GmbH 2011, Deutscher Fussball-Bund 2007, and Deutscher Fussball-Bund 2006 for details of the three levels respectively). The professional and semi-professional levels consist of a league system, a so-called division hierarchy. In German association football, 'Bundesliga' is the first division, '2. Bundesliga' the second division, and '3. Liga' the third division (see figure 2.4 for an illustration). This hierarchy has existed in this form only since 2008/2009 when 3. Liga was introduced to give younger players a professional setting for further skills development. Before this reform, third division was constituted by a two-conference regional setup. Since this setup existed for 13 out of the 16 seasons covered by the present dataset professional football is defined in this chapter by Bundesliga and 2. Bundesliga only. All leagues including 3. Liga and below are called semi-professional. Opposed to closed leagues that dominate professional team sports in the US, the described league system is an open one (see Noll 2002 for a discussion of promotion and relegation in English football). As a consequence, teams can move along the league hierarchy based on their performance by getting promoted (moving up) or relegated (moving down).

In European football, supply and demand for talent meet on the transfer market. This step into professional football is not organized by a draft system known from American sports where drafts facilitate the step from college to the professional level. To analyze this transition as a selling club type, players signed from ‘Under-19’ (U19) and ‘Under-17’ (U17) teams have been aggregated in the ‘From Youth Team’ dummy variable with the distinction between signing the player from the own youth team or not.[14] In German association football, clubs have to run a youth academy in order to obtain the license to participate in Bundesliga and 2. Bundesliga. These youth academies deploy youth teams in the respective age groups to perform in competitions and provide training and often also schooling through boarding schools. Hence, signing a player from the own youth academy or from another youth academy is a different type of transfer (see chapter 4 for an analysis of youth players entering the Bundesliga). With respect to signing home-grown talents, the club possesses private information about the player’s development and is very flexible in his deployment as players are eligible to compete in professional and youth football during one season. Interestingly, the club’s own youth academy is with 17.7% the number three source of signings after signings from Bundesliga clubs (26.4%) and from foreign clubs outside the top four foreign leagues (25.0%).

To control for a change in club’s executives, a dummy for pre-season head coach turnover has been included. 17.3% of the transfers observed were signed by a club that changed its head coach during the pre-season transfer window. Team dummies for buying clubs are included for the teams observed in the Bundesliga during the 16 season period. Even though only 18 teams compete in the Bundesliga at a given time, relegation to and promotion from 2. Bundesliga of up to three teams each year leads to a total of 31 teams observed. The reference category is Hamburger SV, a team that has never been relegated since the foundation of the Bundesliga in 1963 and is thus observed over the 16 year period. Moreover, Hamburger SV has signed the highest number of players in absolute terms (144) and the fourth highest number per season (9.63 vs. 8.07 on average; see table 2.5). The lowest number of signings per season has SC Freiburg (5.60) followed by FC Bayern Munich (6.06). Furthermore, Hamburger SV is characterized by an average league rank of 7.19 (vs. 11.20 on average) and is hence a

[14] The youth level is organized in age groups (Deutscher Fussball-Bund 2006). As a rule, one age group combines two years with e.g. age group ‘Under-19’ (U19) containing 18 and 17 year old players or ‘Under-17’ (U17) containing players of 16 and 15 years of age.

team of medium to upper strength. Seasonal dummies control for time effects and changes in the budget of the Kicker Sportmagazin Fantasy Game as discussed above.[15]

Table 2.5: Summer Signings by Team, 1995-2010.

Team	Summer Signings (no.)	Seasons Observed (no.)	Summer Signings per Season (no.)
Hamburger SV	154	16	9.63
VfB Stuttgart	130	16	8.13
VfL Wolfsburg	125	14	8.93
FC Schalke 04	124	16	7.75
SV Werder Bremen	120	16	7.50
Bayer 04 Leverkusen	119	16	7.44
Bor. Dortmund	111	16	6.94
Hertha BSC Berlin	102	13	7.85
FC Bayern Munich	97	16	6.06
Bor. M‘gladbach	96	13	7.38
Eintracht Frankfurt	95	11	8.64
Hannover 96	91	9	10.11
VfL Bochum	88	11	8.00
1. FC Nürnberg	86	9	9.56
Arminia Bielefeld	85	9	9.44
1. FC K‘lautern	85	11	7.73
Hansa Rostock	84	11	7.64
1. FC Köln	83	10	8.30
TSV 1860 Munich	66	9	7.33
Energie Cottbus	63	6	10.50
SC Freiburg	56	10	5.60
MSV Duisburg	54	6	9.00
1. FSV Mainz 05	41	5	8.20
FC St. Pauli	34	4	8.50
Karlsruher SC	31	5	6.20
1899 Hoffenheim	22	3	7.33
Fortuna Düsseldorf	21	2	10.50
SpVgg Unterhaching	14	2	7.00
SSV Ulm 1846	9	1	9.00
Alemannia Aachen	7	1	7.00
KFC Uerdingen	7	1	7.00

Source: Own calculations based on information provided by www.transfermarkt.de.

15 Further variables in the dataset that were not used in the regressions reported in section 2.5 include player weight and height information. Respective variables – as well as a body mass index variable – did not yield any significant results.

2.5 Models and Empirical Results

To adequately estimate the equations at hand, three peculiarities of the data have to be taken into account. First, 23.3% of the signings, more precisely of the signing-season observations, involved players with multiple transfers (406 out of 1,739 players). 281 players have been transferred twice whereas 125 players have been transferred three times or more. This sample may be interpreted as an unbalanced panel generating the need to test for an application of panel econometrics. However, results from Breusch-Pagan Lagrange-Multiplier tests (Breusch and Pagan 1980) not significant across all models, indicating that unobserved player characteristics do not affect the results.

Second, market value data availability restricts the sample size to 1,423 signings for models estimated using delta market value as a dependent variable, compared to 1,924 signings for the regressions on the minutes played dependent variable. When comparing results it is hence necessary to re-estimate regressions for minutes played with the sample size of regressions for delta market value. Furthermore, it is possible that the error terms of both estimations are correlated suggesting the estimation of a Seemingly Unrelated Regression (SUR; Zellner 1962). In fact, the Breusch-Pagan test of independence rejects the hypothesis that error terms are independent at the 1% significance level (Breusch and Pagan 1979). Still, results from OLS and SUR estimations only differ slightly (see table A.1 in the appendix). Thus, OLS results, including all complete records, are taken as standard reference when interpreting the findings.

Third, the 2,300 signings analyzed in the present research question are most likely not a random sample of 8,670 player-season observations forming the rosters of the 288 team-season observations in the 16 year period.[16] On the one hand, Carmichael et al. (1999) argue that this represents a selection bias since players that have been signed, or more generally, that have been transferred, are not a random sub-group of all players. On the other hand, Feess et al. (2004) argue that there is no reason for a selection bias as the sample includes all information about all transfers reported by the media. Both author groups, however, correct their estimations for selection bias by applying a Two Step Procedure following Heckman (1979). In the two studies, the Heckman Two Step

[16] With 16 seasons and 18 teams each, there are 288 team-season observations for rosters during the observation period.

Procedure estimates, in a first step, the probability of transfer with a probability of transfer equation and, in a second step, the transfer fees with a transfer fee equation corrected for the probability of transfer. Whereas Carmichael et al. (1999) find evidence of selection bias, Feess et al. (2004) do not. Nevertheless, in both cases results of uncorrected estimates are very similar to corrected estimates.

Whether or not estimates have to be corrected by the Heckman Two Step Procedure is of key importance since all independent variables of the second equation have also to be included into the first equation, the selection equation. In the present context, this means that all independent variables used to explain transfer success also have to explain the probability of transfer. As a consequence, variables that are only observable for transfers such as transfer or selling club characteristics cannot be included. However, the effect of these variables on transfer success is of key interest for the present research question. To investigate the effect of a potential selection bias, uncorrected and corrected OLS models for each dependent variable that exclude transfer and selling club characteristics have been estimated (see table A.2 in the appendix for results of the four models). Similar to Feess et al. (2004), a player's tenure, measured by the number of league appearances for the current team during his current engagement with the team, has been used as the instrument to estimate the probability of transfer.[17] A significant Mills Lambda, indicating selection bias, is reported only for the model using minutes played as the dependent variable.[18] Moreover, results of uncorrected and corrected OLS estimates for both dependent variables are virtually identical. Hence, uncorrected OLS estimation will be presented in this chapter in order to include transfer and selling club characteristics.

The estimated equation has the following general form.

$$SUCCESS = \alpha + \beta\ PLAYER + \gamma\ TRANSFER + \delta\ SELLING$$
$$+ \varphi\ BUYING + \omega\ CONT + \varepsilon$$

---

[17] Note that 'tenure' is generally defined as years of experience at a specific team opposed to 'experience' that is defined as years spent in the league during a career.

[18] In fact, Mills Lambda is negative and significant indicating negative sample selection effects discussed by Ermisch and Wright (1994). Following the authors' argumentation, in this case, any component of the error that increases the probability of a transfer decreases the number of minutes played in the season after the transfer since rho is the correlation between the errors in the selection and outcome equations.

Where:

- α is a constant
- $PLAYER$ a vector of variables measuring player performance, experience, and player characteristics such as age, position, and the FIFA confederation of the player's country of origin
- $TRANSFER$ is a vector of variables measuring transfer characteristics
- $SELLING$ is a vector of variables measuring selling club characteristics
- $BUYING$ is a vector of variables measuring the characteristics of buying clubs
- $CONT$ is a vector of additional control variables
- $\beta, \gamma, \delta, \varphi$, and ω are vectors of parameters to be estimated
- ε is a random error term

The key results are reported in tables 2.6, 2.7, and 2.8. First, results concerning sporting and financial transfer success on player level are discussed (see tables 2.6 and 2.7). Second, the specific results for buying clubs (team dummies) are used to discuss results at the team level (see table 2.8). Overall, results are generally in line with evidence from salary and transfer fee research for player variables such as performance, experience, and player characteristics as well as for characteristics of professional signing clubs. Transfer characteristics, selling club characteristics at the youth level, and buying club dummies certainly provide new and interesting insights about the football player's labor market.

Table 2.6: OLS Estimates for Sporting and Financial Success (1).

	(1A) OLS Minutes Played		(2A) OLS Delta Market Value	
VARIABLES	**Coefficient**	**Robust SE**	**Coefficient**	**SE**
Relative Market Value	368.195***	(28.730)	-0.417***	(0.037)
Transfer Experience	77.899	(61.878)	0.049	(0.084)
Transfer Experience2	-7.823	(14.738)	-0.010	(0.020)
Age	104.331*	(56.781)	-0.043	(0.081)
Age2	-1.463	(1.104)	0.000	(0.002)
Goalkeeper	-220.238***	(75.445)	-0.241**	(0.099)
Defender	123.220***	(46.156)	-0.143**	(0.064)
Midfielder	Ref. Cat.	-	Ref. Cat.	-
Forward	-146.610***	(42.888)	-0.127*	(0.067)
Free Agent	-200.236***	(48.299)	-0.172***	(0.065)
Standard Signing	Ref. Cat.	-	Ref. Cat.	-
On Loan	132.031	(86.414)	0.179	(0.133)
Return Loan	-591.861***	(102.216)	0.112	(0.165)
From Bundesliga	Ref. Cat.	-	Ref. Cat.	-
From 2. Bundesliga	-2.184	(73.993)	0.043	(0.098)
From 3. Liga and Below	-500.662***	(95.403)	-0.073	(0.148)
From Top Foreign League	-141.393	(87.607)	0.071	(0.119)
From Other Foreign League	-95.874	(71.210)	0.007	(0.099)
From Unemployment	-482.903**	(207.357)	-0.359	(0.440)
From Own Youth Team	-596.684***	(85.315)	-0.235*	(0.127)
From Other Youth Team	-100.725	(167.702)	0.023	(0.260)
Coach Turnover Pre-Season	130.766**	(52.998)	0.058	(0.078)
Constant	-739.620	(737.738)	1.167	(1.066)
Observations	1,924		1,423	
R-squared	0.382		0.215	
Chi2 BP LM Test	1.924		0.827	

Note: Robust standard errors (SE) in parentheses for (1A) and standard errors in parentheses for (2A) (White 1980). Dummies for teams, seasons, and the respective FIFA confederation of the player's home country included but not reported. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 2.7: OLS Estimates for Sporting and Financial Success (2).

VARIABLES	(1B) OLS Minutes Played Coefficient	Robust SE	(2B) OLS Delta Market Value Coefficient	SE
Relative Market Value	366.265***	(28.632)	-0.419***	(0.037)
Transfer Experience	59.350	(62.134)	0.028	(0.086)
Transfer Experience2	-2.323	(14.644)	-0.004	(0.020)
Age	113.799**	(56.682)	-0.036	(0.081)
Age2	-1.592	(1.102)	0.000	(0.002)
Goalkeeper	-217.052***	(75.496)	-0.237**	(0.099)
Defender	120.244***	(46.091)	-0.146**	(0.064)
Midfielder	Ref. Cat.	-	Ref. Cat.	-
Forward	-144.295***	(42.867)	-0.125*	(0.067)
Free Agent	-203.394***	(48.326)	-0.175***	(0.065)
Standard Signing	Ref. Cat.	-	Ref. Cat.	-
On Loan	135.428	(86.556)	0.181	(0.133)
Return Loan	678.856	(575.351)	1.485	(0.941)
Age and Return Loan	-51.837**	(23.278)	-0.058	(0.039)
From Bundesliga	Ref. Cat.	-	Ref. Cat.	-
From 2. Bundesliga	-13.456	(74.124)	0.027	(0.099)
From 3. Liga and Below	-503.845***	(95.321)	-0.080	(0.148)
From Top Foreign League	-146.713*	(87.461)	0.068	(0.119)
From Other Foreign League	-101.539	(71.373)	0.001	(0.099)
From Unemployment	-483.541**	(209.269)	-0.361	(0.440)
From Own Youth Team	-589.474***	(85.004)	-0.233*	(0.127)
From Other Youth Team	-94.643	(167.512)	0.023	(0.260)
Coach Turnover Pre-Season	125.663**	(52.983)	0.052	(0.078)
Constant	-880.248	(737.290)	1.072	(1.068)
Observations	1,924		1,423	
R-squared	0.383		0.216	
Chi2 BP LM Test	1.870		0.708	

Note: Robust standard errors in parentheses for (1B) and standard errors in parentheses for (2B) (White 1980). Dummies for teams, seasons, and the respective FIFA confederation of the player's home country included but not reported. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 2.8: OLS Estimates for Team Dummies.

	(1A) OLS Minutes Played		(2A) OLS Delta Market Value	
VARIABLES	**Coefficient**	**Robust SE**	**Coefficient**	**SE**
FC Bayern Munich (2)	-349.804***	(117.311)	0.687***	(0.150)
Bayer 04 Leverkusen (5)	8.508	(103.200)	0.271**	(0.137)
Bor. Dortmund (6)	37.453	(105.837)	0.392***	(0.138)
FC Schalke 04 (6)	76.676	(100.569)	0.310**	(0.134)
SV Werder Bremen (6)	37.341	(98.190)	0.263*	(0.138)
VfB Stuttgart (7)	34.329	(103.777)	0.106	(0.137)
Hamburger SV (7)	Ref. Cat.	-	Ref. Cat.	-
Hertha BSC Berlin (11)	33.827	(101.432)	0.242*	(0.141)
VfL Wolfsburg (11)	75.987	(107.500)	0.211	(0.137)
1. FC K'lautern (14)	249.165**	(114.679)	0.126	(0.156)
Bor. M'gladbach (14)	99.585	(108.836)	0.150	(0.154)
VfL Bochum (15)	392.403***	(116.872)	0.337*	(0.186)
SC Freiburg (16)	287.152**	(129.028)	0.128	(0.197)
Eintracht Frankfurt (17)	270.713***	(103.273)	0.111	(0.166)
1. FC Köln (17)	80.374	(126.797)	-0.123	(0.173)
TSV 1860 Munich (17)	98.427	(130.018)	0.115	(0.179)
1. FC Nürnberg (18)	188.041*	(106.597)	0.216	(0.170)
Hansa Rostock (18)	325.346***	(123.583)	0.114	(0.173)
Hannover 96 (19)	140.854	(114.832)	0.111	(0.155)
Arminia Bielefeld (19)	208.703	(128.998)	0.218	(0.180)
1. FSV Mainz 05 (20)	279.808**	(139.508)	0.131	(0.214)
MSV Duisburg (20)	281.039*	(149.443)	0.272	(0.304)
Energie Cottbus (23)	250.734*	(135.187)	0.239	(0.197)
Karlsruher SC (24)	637.352***	(222.032)	0.418	(0.354)
FC St. Pauli (28)	614.741***	(177.577)	0.201	(0.573)
Alemannia Aachen (29)	492.293	(403.305)	Excl.	Excl.
SpVgg Unterhaching (31)	-12.504	(336.069)	-0.290	(0.413)
Fortuna Düsseldorf (38)	240.075	(297.554)	0.222	(0.496)
SSV Ulm 1846 (46)	509.566	(383.554)	0.016	(0.687)
1899 Hoffenheim (47)	275.943*	(153.557)	0.025	(0.237)
KFC Uerdingen (54)	439.171	(614.994)	0.658	(0.959)

Note: Results based on regressions presented in table 2.6. Robust standard errors in parentheses for (1A) and standard errors in parentheses for (2A) (White 1980). Ordered by average team league rank for observation period (in brackets after team name). *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

To start the discussion with player variables, it is no surprise that relative market value positively impacts playing time but negatively impacts a market value increase. On the one hand, a change of one standard deviation in relative market value increases playing time by approximately 368 minutes, i.e. by more than four Bundesliga appearances. On the other hand, such a change in market value negatively impacts delta market value by approximately 0.42 Mn EUR. As a consequence, buying highly valued players supports sporting success but is a costly endeavor. Since, though, a club's target is rather utility maximization than profit maximization and, as with players, utility comes from winning championships (Sloane 1971), this seems to be perfectly in line with a club's transfer market business. With a club focusing on sporting transfer success, signing players with high market value seems to guarantee good matches which is in line with previous evidence showing that that salaries and market values explain team performance (see section 2.3).[19] Player experience with transfers, however, is not significant in any of the models. Hence, no robust evidence for a negative effect of players that transfer frequently, i.e. chronic movers, is found.

Reported player characteristics are age and positional variables. Contrary to evidence from player salary and transfer fee research (see section 2.3), the age profile underlying the results for sporting and financial transfer success has not the inverted U-shape. At the 10% significance level, one additional year of age leads to approximately 104 more minutes played, a little more than one Bundesliga appearance, in the season after the transfer. The other age variables are not significant. Interestingly and opposed to the development of player transfer fees discussed above, this means that players that are transferred rather succeed in a later stage of a player's career than in the early years.

In line with evidence from player salary and transfer fee research presented in section 2.3, player positions indeed have an impact on transfer success. The selected reference category are midfielders, the most flexible position on the pitch. Results demonstrate that goalkeepers and forwards face the largest challenge when signing a new contract at a new club. For both positions signs of coefficients in both models are negative and mostly significant at the 1% and 5% level. Holding other factors constant, goalkeepers and forwards respectively play approximately 220 and 147 minutes less than midfielders in their first season with the new club. This seems reasonable since for both

[19] Further evidence on player transfers and team performance in provided in chapter 5.

positions slots in the core team (starting 11) are limited. Only one goalkeeper is eligible to play and only rarely teams play with more than two forwards. For both positions continuous starts are important to perform well and hence head coaches decide in the pre-season whom to trust. Since this decision is almost a binary one, transferring on this position is highly risky. This risk is also reflected in the regressions using delta market value as the dependent variable. Here, goalkeepers and forwards increase market value in their first year by approximately 0.24 Mn EUR and 0.13 Mn EUR respectively less than midfielders. Finally, defenders present a mixed picture. Ceteris paribus, they play approximately 123 minutes more than midfielders but increase their market value by approximately 0.14 Mn EUR less.[20]

Transfer characteristics exhibit new insights about transfer success which underlines the importance of including such variables into the analysis. To begin with, transfers with players that are signed from a competing club after the player's contract has expired are less successful than transfers with in-contract signings. At the 1% significance level, results reveal that free agents play approximately 200 minutes less than in-contract signings. Similarly and also at the 1% significance level, the market value of a free agent increases by approximately 0.17 Mn EUR less compared to the in-contract signing (see table 2.6). As discussed above, a club pays for a free agent, i.e. an out-of-contract signing, a signing fee and for an in-contract signing a transfer fee. With respect to signing fees, results may reveal that signing fees seem to lead to player opportunism. Players reduce effort levels and hence play less. This interpretation is in line with Frick et al. (2002) who showed with data on signing fees paid in the National Football League (NFL) that an increasing share of signing fees negatively and significantly impacts team performance. With respect to transfer fees, results may reveal that a sunk-cost effect impacts team manager and head coach decision making. The irreversible transfer fee paid may bias team managers or head coaches to subsequently provide in-contract signings with more playing time than their free agent counterparts. This interpretation is in line with Staw and Hoang (1995) who found that a better draft number of a player in the National Basketball Association (NBA), as a measure for sunk-costs, positively and

[20] A descriptive analysis shows that goalkeepers do not realize as high market values as players on other positions. Moreover, goalkeepers represent the smallest fraction of players in the dataset (see table 2.3). However, regressions run for each of the four positions separately yielded robust results.

significantly impacts playing time.[21] Moreover, transfer fees seem to positively influence market values as results from delta market value regressions show. Indeed, transfer fees are in general publicly available whereas signing fees remain mostly private. Such an information asymmetry contradicts the above discussed assumption of a competitive transfer market.

Apart from in- and out-of-contract transfers (free agents), loans are another relevant type of transfer. Such agreements are indeed special since the selling club does not sell the transfer rights to the buying club but only loans the player for a defined period of time, generally one season. Hence, after this period the player returns to his former club. According to the results presented above, being on loan increases minutes played by approximately 132, however, at a t-value of only 1.53. Returning from a loan, though, means having approximately 592 minutes less playing time than a comparable player that has been bought (standard signing). That is equal to more than six games. Generally, both the club owning the transfer rights and the player interpret the period on loan as a shop floor window in which a transfer is supposed to be arranged (see Simmons and Deutscher 2012 for an analysis of the FIFA World Cup as a shop floor window for players). In other words, players that go on loan have been a bad match. In addition, a player returning from loan is someone who has also been a bad match since he did not find a different club. Hence, adverse selection may explain the dramatic decrease of playing time upon return (Akerlof 1970). To further analyse this effect, an interaction term of the return loan variable and the age variable has been included in the regressions shown in table 2.7. Here, clear evidence is found that the selection effect is more relevant for older player than for younger players since the interaction term is significant at the 5% level and has a negative sign. It seems that particularly younger player return from loans because the club wants to further develop these players and hence there minutes on the pitch are more than older players that return.

[21] The effect of player opportunism or sunk costs seems to be weaker, however, when the head coach changed prior to the season. When including an interaction term for free agent status and head coach turnover, the coefficient of that term is positive and not significant and the negative coefficient of the free agent variable is smaller than in the regression excluding the interaction term. Hence, in case of head coach turnover, players and head coaches seem to evaluate match quality somewhat less influenced by the free agent status as both parties collect and use new information gained from their recently established working relationship. See also Hentschel et al. (2012) for a recent discussion of heterogeneity among teams with respect to head coach survival. Such team heterogeneity also is in the present setting a possible independent variable but can unfortunately not be controlled for.

Finally, results from table 2.6 provide interesting insights on the impact of selling club characteristics. With respect to signings from professional clubs, results are generally in line with previous evidence from transfer fee research discussed in section 2.3. Players signed from foreign professional clubs or from clubs playing in 2. Bundesliga do not significantly differ from players signed from other Bundesliga clubs. Yet, signings from Germany's 3. Liga and lower divisions do play approximately 501 minutes less than signings from Bundesliga clubs. As described in section 2.4, these players are mostly semi-professional players for whom Feess et al. (2004) and Frick and Lehmann (2001) find comparable evidence. Actually, these players are rather used as substitutes reflected by the status' negative impact on playing time of more than five games. Similarly, previously unemployed players play, ceteris paribus, approximately 483 minutes less than signings from the Bundesliga.[22] Still, neither of the two categories significantly deviates from Bundesliga signings in terms of financial transfer success. Players signed from foreign leagues, regardless of whether or not the league is comparable to Bundesliga, do not differ from Bundesliga players in terms of minutes played or delta market value.

However, with regard to signings from the youth level that are analyzed in this work for the first time, this is different. As with semi-professional or unemployed signings, these young players recruited from the own youth team do also have significantly less playing time than their teammates coming from other clubs. Again, these players are merely meant to be substitutes or sparring partners in training sessions which again underlines the importance to include these selling club characteristics into the regressions. Yet, perhaps surprisingly, these transfers have significantly less financial success than signings from Bundesliga clubs as the significant coefficient of approximately -0.24 indicates. This may be a hint at inefficiency with respect to the valuation of youth players. The value of such players at the time of entry may potentially be overestimated because the league has undergone major reforms at the youth level since the start of the millennium. These reforms were meant to spur development of young German talent mainly targeted at building a strong national team for the FIFA World Cup 2006 hosted

[22] Note that signings of unemployed players are rare events. Only 31 out of the 2,300 signings observed fall into this category. Generally, these players are unemployed for only one year or even for only six months and join reserve teams for training purposes during their unemployment.

in Germany (see chapter 4 for an analysis of youth player careers in Germany and Deutscher Fussball-Bund 2006 and 2009b for a summary of the reforms).[23]

After having discussed results concerning sporting and financial transfer success on player level, attention will now be paid to results at the club level. These come from buying club characteristics, i.e. dummies controlling for unobserved team heterogeneity. Table 2.8 shows the results and reveals two key insights. First, differences of playing time across teams are substantial with a maximum of approximately 637 minutes when comparing Karlsruher SC and Hamburger SV. Further insights concerning these teams may be gained from also looking at team performance based on descriptive evidence. Table 2.8 includes a team's average league rank during the observation period in brackets behind the team's name as a descriptive measure of team performance.[24] With these data at hand, players seem to get significantly more playing time at clubs in the middle of the league. Actually, these teams that provide their signings with more minutes played than others are so-called yoyo-teams (Frick and Wallbrecht 2012), i.e. teams that have been relegated from and promoted to Bundesliga repeatedly. Every time these teams are promoted they have to adjust their rosters to the new performance level faced in Bundesliga in order to prevent relegation. As a consequence, several new players are signed and replace former players who were only talented enough to compete in 2. Bundesliga. In that case, it is not match quality but quality itself that explains signs and significance levels of the coefficients.[25] Similarly, it is only with FC Bayern Munich, the best team in the league, where new signings play significantly less than with Hamburger SV.

Second, no team creates significantly less market value than Hamburger SV. Yet, five large market teams create significantly more. These are in descending order of coefficients FC Bayern Munich, Borussia Dortmund, FC Schalke 04, Bayer 04

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[23] Youth categories are particularly dominated with players of low market value. Hence, little downside for these players exists which may potentially bias results. However, results from regressions excluding players with low market values are not notably different.

[24] The league rank was calculated by adding league ranks across the league hierarchy. For example a team ranked 2nd in the 2. Bundesliga was attributed league rank 20 since 18 teams compete in the Bundesliga. Ranks in multi-conference setups were treated equally, i.e. the team on first position in conference one did get the same rank attributed as the team with first position in conference two. The average of this rank was calculated over the observation period. Table 2.8 includes rounded average league ranks only.

[25] However, including a variable controlling for runner-ups into the regressions presented in section 2.5 did not produce significant results and left the other results unchanged.

Leverkusen, and SV Werder Bremen. Next to Hamburger SV and VfB Stuttgart these five teams are the only ones that have not been relegated during the observation period. Moreover, it is not surprising that the five teams generating more market value than Hamburger SV are also the most successful ones during the observation period as it is one of the stylized facts in sports economics that salaries and market values explain team performance. Furthermore and perhaps surprisingly, Hertha BSC Berlin and VfL Bochum create more market value than Hamburger SV at the 10% significance level.

As already mentioned, FC Bayern Munich is by far the most successful team with regard to increasing market value. Hence, the club is a good example for superior turnover management. As mentioned above, the club on average only signs six new players per season compared to an average of eight across the league. This low turnover is result of good matching since it is facilitated by both players and teams wanting job stability. In turn, this again puts only limited pressure on the club when acting on the transfer market. Thus, the club has rarely the need to fill up the roster with whatever players are available which then again limits the probability of bad matches. As a result, FCB clearly possesses a competitive advantage from its job matching skills and abilities.[26]

2.6 Summary and Implications for Further Research

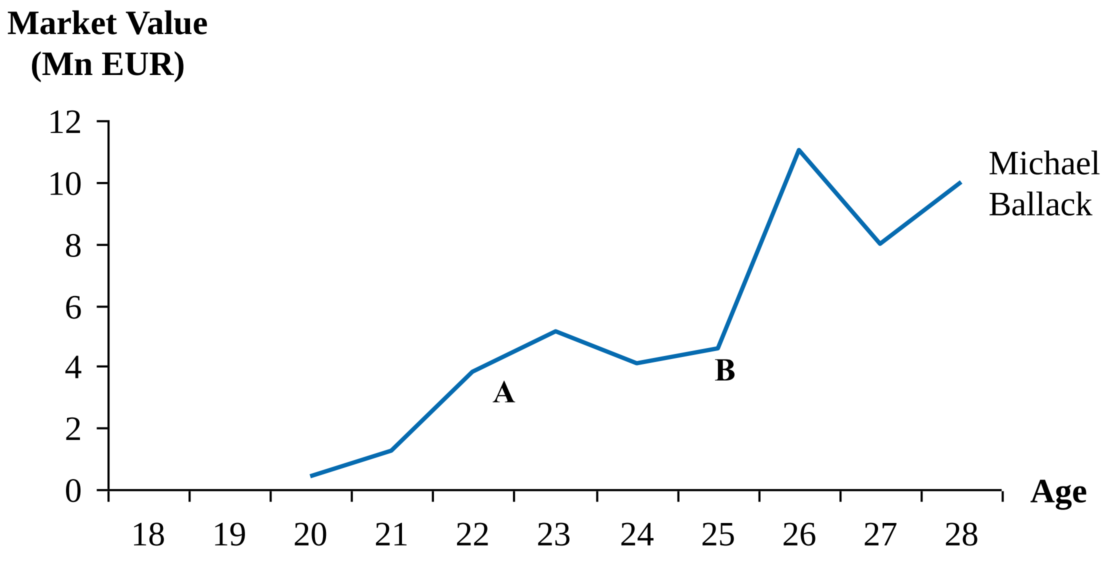
This chapter has analyzed transfer success from a sporting and a financial perspective based on a dataset covering 2,300 signings of Bundesliga teams during 16 seasons from 1995/1996 to 2010/2011. Simple Ordinary Least Squares (OLS) as well as a Seemingly Unrelated Regression (SUR) model (Zellner 1962), and a Heckman Two Step Procedure (Heckman 1979) have been applied to document the robustness of findings.

[26] To perform further robustness checks on the results presented, the models have been estimated for six different samples. First, two types of models have been estimated including only German or foreign players respectively. Second, two types of models only focused on transfers with Bundesliga clubs or only on transfers with non-Bundesliga clubs. Third, time periods were split at the implementation of the so-called Monti-reform. As described in section 2.2, transfer rules are stable throughout the observation period. Yet, the number of players from non-UEFA countries eligible to play on the pitch was relaxed from three to five in 2001/2002. Consequently, two types of models were estimated including observations from 1995/1996 to 2000/2001 and from 2001/2002 to 2010/2011 respectively. However, across all sample variations results did not notably change. In fact, Wald tests of equality of coefficients performed on stratified versions of the models showed only significant changes on positional dummies and selected market values (Wald 1943, Kodde and Palm 1986).

Since the analysis has been carried out on a transfer-by-transfer basis and includes not only player data and transfer characteristics but also selling and buying club information, results are relevant both on a player and a club level. For player variables such as performance, experience, and player characteristics as well as for characteristics of signing clubs on the professional level, results are generally in line with evidence from salary and transfer fee research (see Frick 2007 for related evidence). Transfer characteristics, selling club characteristics on the youth level, and buying club dummies indeed provide new and interesting insights into the football player's labor market.

First of all, free agents have less sporting and financial success than in-contract signings. It seems that signing fees paid up-front reduce player effort levels indicating player opportunism (Frick et al. 2002) and that transfer fees lead to a sunk-cost effect because team managers and head coaches provide expensive players with more playing time than others (Staw and Hoang 1995). In fact, the ex-ante evaluation of match quality does not seem to be adapted despite the availability of more information. Moreover, transfer fees are used as a proxy for valuation independent of more current information. This is surprising since in a competitive transfer market a club's investment should be proportional to a player's market value. Furthermore, loans, as a special type of transfer agreement, turn out to be a double-edged sword from both a player's and a club's perspective. Whereas the player is likely to get more playing time while being on loan, the opposite occurs upon his return to the former club. This demonstrates adverse selection since these players that are not successful after returning do only return because they were not able to leverage the loan period as a shop floor window to find another club in Bundesliga football. Hence, these players have been bad matches at their initial and new employer.

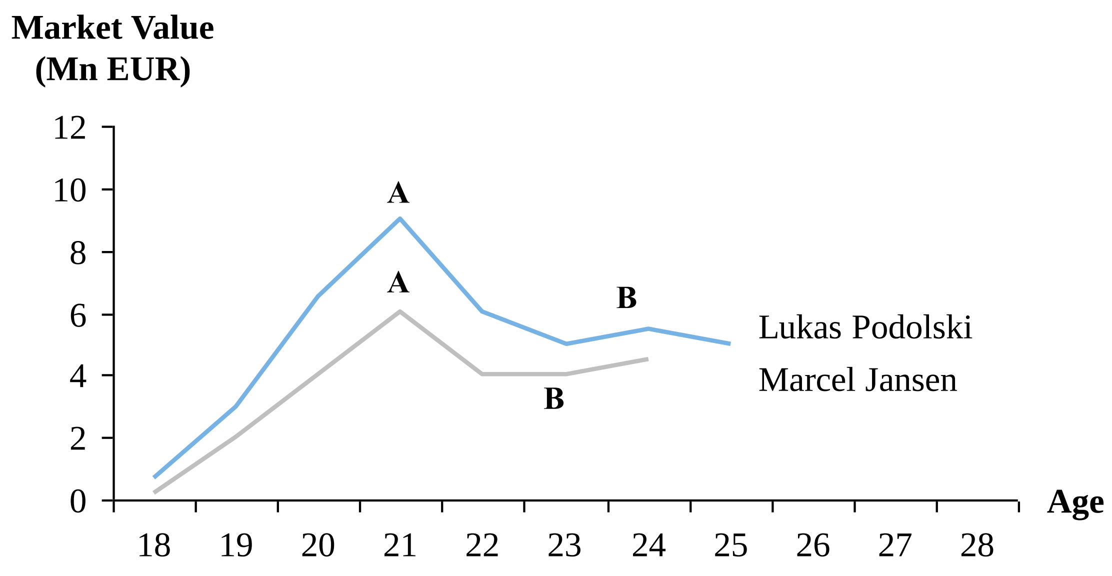
Perhaps surprisingly, transfers with players from the own youth team have significantly less financial success than standard signings from other Bundesliga clubs. This may imply that the transfer market overvalues players who move from the youth team to the professional team in their home club. The value of youth players may be hyped because the league has undergone major reforms at the youth level since the start of the millennium to spur the performance of the German national team (see chapter 4 for an analysis of youth football players' careers).



Note: Market values are taken from Kicker Sportmagazin Fantasy Game and may not reflect real-world values but do reflect proportions.
A: Transfer not to FC Bayern Munich.
B: Transfer to FC Bayern Munich.
Source: Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012.

Figure 2.5: Market Values Michael Ballack.

Insights from buying club dummies reveal major differences between buying clubs. On the one hand, Bundesliga's most successful teams in the last 16 seasons are also the ones that significantly report more generated market value from their signings than others. This is no surprise since it is one of the stylized facts in sports economics that salaries and market values explain team performance (see e.g. Simmons and Forrest 2004 or Frick 2012b for related evidence). On the other hand, playing time is significantly higher in so-called yoyo-teams, i.e. teams that have frequently moved up and down between Bundesliga and 2. Bundesliga. This also seems reasonable since after promotions replacements in the roster have to be made to achieve competitiveness (see Frick and Wallbrecht 2012 for related research). Moreover, the impact of buying club characteristics is also underlined by the consistency of OLS and SUR results. Despite an important difference in sample size (1,924 to 1,423 observations) coefficients are nearly the same. Hence, although historic data on player performance is largely available to all agents in the transfer market, matching capabilities matter.



Note: Market values are taken from Kicker Sportmagazin Fantasy Game and may not reflect real-world values but do reflect proportions.
A: Transfer to FC Bayern Munich.
B: Transfer from FC Bayern Munich.
Source: Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012.

Figure 2.6: Market Values Lukas Podolski and Marcel Jansen.

As a potential conclusion, one may suppose that it is more difficult to get playing time in a club with higher average league rank than in a club with a lower one. Yet, as shown above, a club with a higher average league rank seems to generate more delta market value. This combination is perfectly illustrated by FC Bayern Munich's coefficients. The club's signings have the largest markdown in playing time (approximately 3.6 games of 90 minutes) but the highest markup in market value (approximately 0.69 Mn EUR). Hence, whether or not to transfer to FCB, the market leader, depends on the definition of transfer success. For a player focused on playing time, an early transfer may not be the right decision since chances to fail are high. An example of such a player is Michael Ballack who did not transfer to FCB in the early days of his career but rather focused on gaining experience at Bayer 04 Leverkusen. After finally transferring to FCB, his market value more than doubled in the first year after the transfer (see figure 2.5). For a player focused on monetary incentives, however, transferring to FCB may be the best option. In fact, this seems to even hold true when playing time at FCB becomes so low that the player is sold again. Prominent examples of such cases are the two players Lukas Podolski and Marcel Jansen who have already appeared in table 2.1. Figure 2.6 shows the development of their market values and provides information about the timing of their transfers. Clearly, the market values of both players have dropped when market participants realized that these players had no minutes with FCB on the pitch. However, this drop seems to be capped at a certain level. Supposedly, having played for FCB preserves high salaries throughout the remainder of the career independent of whether or not the player stayed there. Yet, robust evidence on this particular line of argumentation is beyond the scope of this chapter and further research is needed to answer these puzzles. Consequently, the transfer data used in this chapter could be used in player career research (see chapter 3). Moreover, these data could be used on an aggregated team level to investigate team performance (see chapter 5).

Further research may also tackle a potential limitation of the present chapter. Transfer success is investigated only in the first season of a transfer that has been realized in the pre-season transfer window. Clearly, the first season is an important one since around 45% of spells only last one season (Frick et al. 2007 and 2008, chapter 3). Moreover, a club's target may well be assumed to make the new player an integral part of the team during the six-week preparatory phase prior to the season's start. Yet, an investigation of transfer success during the complete length of a player-team relationship or a contract and an inclusion of in-season transfers may reveal further insights into the football player's labor market.

3 Labor Market Dynamics and Career Success: A Duration Analysis for German Bundesliga Football with Competing Risks

3.1 Introduction

Labor market dynamics, more precisely turnover and unemployment, have been subject to intense research in labor economics. In fact, this strand of literature has started to develop in the Brookings Papers on Economic Activity with Hall (1972), Clark and Summers (1979) and Akerlof et al. (1988) being some of the most influential works. In this context, an individual in the labor market is defined to be either employed or unemployed. Thus, transitions from unemployment to employment or from employment to unemployment represent the most basic labor market dynamics. Yet, not only unemployed but also employed individuals search for jobs and consequently job-to-job transitions occur, i.e. employees change employers without interruptions. Overall, the following transitions summarize labor market dynamics when focusing on turnover and unemployment.

- Enter employment (new entrant)
- Stay in employment with the same employer (stayer)
- Move from job to job without interruption (mover)
- Exit employment (drop-out)

In his insightful survey, Farber (1999) summarizes empirical findings in the field of labor market dynamics as follows (p. 2439):

"Three central facts describe inter-firm worker mobility in modern labor markets: (1) long-term employment relationships are common; (2) most new jobs end early; and (3) the probability of turnover declines with tenure."

These key facts have been carved out by several previous studies. For example, Hall (1982) and Ureta (1992) have shown that long-term jobs are the rule and short-term jobs the exception. In line with this, Topel and Ward (1992) find that workers change jobs approximately ten times during their career but two thirds of these ten changes happen in the first ten years of their career. This already indicates that tenure and turnover are negatively correlated. Moreover, the authors find evidence of chronic movers, i.e.

movers that move again and again, which again leads to a negative correlation of tenure and turnover.

When analyzing movers and drop-outs, particular attention has to be paid to differentiating between voluntarily and involuntarily transitions, i.e. between quits and layoffs. Evidence shows that career perspectives differ dramatically between these two groups with better perspectives after quitting than after having been laid-off (see Kletzer 1998 for a literature survey). Most prominently, wage development differs. As an example, Bartel and Borjas (1981) find that young male workers who leave their job voluntarily experience a 5% wage increase compared to stayers whereas young men who leave their job involuntarily experience a 3% wage decrease compared to stayers. Similar evidence is found e.g. by Jacobson et al. (1993), Farber (2005) and von Wachter et al. (2007).

These different consequences of quits and lay-offs underline the importance of distinguishing between the two in empirical research. However, such a differentiation is not always possible due to a lack of data. Here, as described by Kahn (2000), the professional team sports industry can serve as a labor market laboratory providing large amounts of data publicly available. Still, even when focusing on this industry, previous studies on player careers have not been able to distinguish between voluntary and involuntary exits but rather ask for such a differentiation in further research (Frick et al. 2007 and 2008). Consequently, the present chapter aims at contributing to the literature by doing so. This chapter analyzes a dataset that observes every player transition between 1995 and 2010 in the labor market of Germany's first division in association football (soccer), the so-called Bundesliga. The data permit to differentiate between players that exit the league (drop-outs) by exit target and exit timing and thus permit to apply duration analysis (also known as 'event history analysis' or 'survival analysis') with competing risks. Duration analysis examines factors that impact the time until a certain event occurs and has been developed in medical research with death as the event in focus. Lately, this technique has seen increasing attention in sports economics (see for analyses in association football e.g. Barros et al. 2009, Frick et al. 2010 focusing on head coaches, or Frick and Wallbrecht 2012 concentrating on teams). Nevertheless, competing risk analyses have so far been limited in number. Hence, with this technique, distinct profiles of voluntary and involuntary player drop-outs will be examined for the first time in association football.

The remaining sections of the chapter are conceived as follows. Section 3.2 surveys the relevant literature on career success in professional team sports. Data, variables, and descriptive evidence are presented in section 3.3. Section 3.4 explains the competing risk methodology and presents the results. Finally, section 3.5 offers a conclusion.

3.2 Previous Evidence of Career Success in Professional Team Sports

Rottenberg's (1956) article on the baseball player's labor market is widely regarded as the first study of the economics of professional team sports. With respect to the present research question on player careers, Rottenberg (1956) argued that *"players will be distributed among teams so that they are put to their most 'productive' use; each will play for the team that is able to get the highest return from his services"* (p. 256). Accordingly, a player's marginal revenue product drives labor market dynamics. A player's positive (negative) productivity shock will lead to a move to a larger (smaller) market team, that is e.g. a team playing in a higher (lower) league. From a player's perspective, the move to a higher league may well be interpreted as 'voluntary' and the move to a lower league as 'involuntary' since teams playing in higher leagues generate significantly more revenues and pay significantly higher salaries than teams in lower leagues (Noll 2002).

Rottenberg (1956) focused his analysis on Major League Baseball (MLB), a labor market that was at the time highly regulated. In general, the US team sports industry largely regulates its labor markets with team owners acting as profit maximizers (Sanderson and Siegfried 2006) whereas the European team sports industry, namely association football, is rather deregulated with team owners acting as utility maximizers (Sloane 1971). In European football, there exists a deregulated transfer market on which players and teams meet. This is true for professional players as well as for youth players who are aiming at a professional career since no draft system for youth players comparable to that in US sports exists (see Hoehn and Szymanski 1999 for a comparison of US and European league systems). Moreover, the Bosman-ruling by the European High Court in 1995 has started a set of deregulations abolishing restrictions on player transfers after contract expiration and restrictions on employment of foreign players (Court of Justice of the European Communities 1995). As a consequence, the transfer market has been assumed to be competitive in previous research (see e.g. Szymanski and Smith 1997). In addition, European team sports are organized by a system of open leagues, a so-called league hierarchy, and consist of multiple league hierarchies, one for each country. In the US, only closed leagues without promotion and relegation exist. Thus, observing player transitions along the above derived definition of voluntary and involuntary exits is only possible in the European setting which is consequently the focus of the following literature review.

Furthermore, to design this research adequately, it is necessary to learn not only from previous evidence regarding the survival of players but to also review related research on head coaches and teams. Indeed, the success of players, head coaches and teams is not independent of each other as it is one of the stylized facts in sports economics that salaries and market values explain team performance (see Szymanski and Smith 1997 for first evidence in association football or Frick 2012b for a recent and comprehensive analysis). With respect to players, Frick et al. (2007) analyze career duration in the Bundesliga, using a dataset that starts with the league's founding season 1963/1964 and ends with its 2002/2003 season. The authors apply single risk Cox (1972) semi-parametric, proportional hazard models with the exit from Bundesliga as the event in focus. Key findings focus on player characteristics. Player age is found to have a linear and negative impact on career duration while variables measuring tenure turn out to be not significant. Player performance, measured by the number of games played or the number of goals scored, decreases the hazard to exit from the league. Moreover, player position and nationality make a difference since goalkeepers have significantly longer spells and careers than other players, and foreign players exit Bundesliga faster than German ones. A linear time trend, however, is not significant. In Frick et al. (2008) the authors extend their analysis one year later to include team characteristics. Results are robust to their previous analysis with team relegation and poor team performance, measured by league rank at the end of the season, increasing the hazard significantly. Chapter 4 analyzes the careers of youth football players in Germany by investigating entry into Bundesliga. Applying Cox competing risk models (CRM) to a dataset of 18 youth rosters, each of them winner of either DFB-U19-Bundesliga or DFB-Youth-Cup between the 1998/1999 season and the 2009/2010 season, the research finds clear differences between the careers of players who make their professional debut with their home club and those who debut somewhere else. In fact, the age-debut profile for players debuting with their home club is inverted U-shaped peaking at the age of 18 whereas the age-debut profile for players debuting with another but their home club is upward-sloping and linear. Furthermore, youth player entry into professional football is also supported by physical attributes such as height. Positional dummies, though, are not significant in this sample that, however, does not include all youth players but only U19 champions.

Head coach career duration has been examined in English and German association football. Audas et al. (1999) distinguish between voluntary exits (n=127) and involuntary exits (n=669) applying a Cox competing risk model when analyzing a head coach dataset covering the English premier league from 1972/1973 to 1996/1997. Voluntary exits are defined by voluntary retirement or by moves to a job abroad or to the national team manager's position. The authors find that both exits are influenced more by recent team performance rather than by past team performance. A higher win ratio prevents dismissals but does not influence voluntary resignation that are rather impacted by head coach age and experience. Bachan et al. (2005, 2008) perform a similar analysis for first the 2002/2003 season only and then the period 2001/2002 to 2003/2004. However, they exclude voluntary resignations from their sample. Inter alia the authors find that team characteristics impact head coach survival in English association football. In fact, for head coaches of teams that are threatened to be relegated the hazard to be dismissed is significantly larger than for head coaches of other teams. Dawson and Dobson (2006) investigate the labor market of head coaches in English football from a different perspective. They focus on unemployed head coaches with the aim to test whether or not the length of unemployment impacts chances of re-employment. Estimating Cox models on the basis of a dataset covering the period from January 1973 to August 2002, the authors find evidence indicating that a good recent win ratio positively impacts the re-employment probability. For the German Bundesliga two recent studies on head coach careers have been carried out by Barros et al. (2009) with a proportional hazard approach and by Frick et al. (2010) with a mixed logit approach, both using a dataset covering the period 1981/1982 to 2002/2003. Barros et al. (2009) find that head coach career win percentage impacts the hazard to be dismissed negatively whereas relative head coach salary reveals no significant results. Team characteristics analyzed are relative team wage bill and relative team points won. Results indicate that larger market teams dismiss their head coaches earlier and that poor sporting performance of their team increases the hazard to be dismissed. Corresponding to Audas (1999), Frick et al. (2010) differentiate between involuntary dismissals (n=115) and voluntary resignations (n=27) as events in focus. The authors estimate two separate models for the two exits types defined and although results differ with respect to significance levels it is argued that voluntary and involuntary exits have similar profiles. Again, recent team performance and head coach career win percentage impact head coach exits in the expected ways. Opposed to Barros et al. (2009) who did not find significant evidence on this covariate, Frick et al. (2010) find that relative head coach salary negatively impacts career duration, i.e. that higher paid head coaches have more risky careers. Moreover, a linear time trend reveals that chances to be dismissed have decreased over time.

Survival of teams has lately come into focus in sports economics. Frick and Prinz (2004) analyze the survival of teams in 12 European leagues in the period from 1976 to 2000 with a Cox model to find that recently promoted teams have fewer chances to survive in the league than other teams. Both Oberhofer et al. (2010) and Frick and Wallbrecht (2012) examine the event of being relegated from an organizational ecology perspective. Whereas Oberhofer et al. (2010) focus only on a Bundesliga dataset starting in the 1981/1982 season and ending in the 2009/2010 season, Frick and Wallbrecht (2012) include apart from association football also ice hockey, handball, and basketball in Germany and apart from Bundesliga also first divisions from England, Italy, and Spain. All seven leagues are analyzed, mainly starting after the Second World War. Results demonstrate that team experience, previous team performance, and average attendance help avoiding relegation.

With respect to study design, four works on player careers in the US will briefly be summarized since they reveal some interesting yet contradictory findings. Hoang and Rascher (1999) examine exit discrimination of black players in the National Basketball Association (NBA) using a dataset with all drafted players between 1980 and 1986. Key finding is that white players have a 36% lower risk of exiting the NBA than black players. A similar analysis for the NBA was carried out by Groothuis and Hill (2004) with data on all observed players between 1989 and 1999. The authors find, however, no evidence of racial discrimination. While the first study uses only flow data, i.e. data on newly starting careers, the second study also includes stock data, i.e. data on careers that began before the start of the observation period. While in flow data long careers are underrepresented, in stock data short careers are underrepresented. In MLB, Jiobu (1988) examines exit discrimination of black players with flow and stock data on players from 1971 to 1985. Evidence of discrimination of black players is found. Using data from 1990 to 2004, Groothuis and Hill (2008) focus on the same research question to find, though, no evidence of discrimination. Study designs differ since Jiobu (1988) only includes time-invariant covariates such as 'age at career start' and Groothuis and Hill (2008) also use time-variant covariates such as 'tenure' implying more accuracy.

Two key implications follow from this literature review for the research question revised in this chapter. First, it is necessary to control for player characteristics, head coach characteristics, and team characteristics and to observe these covariates season per season. Second, it is most appropriate to use both stock and flow data to produce robust results.

3.3 Data, Variables, and Descriptive Evidence of Player Careers

The data used in this chapter build on 8,530 player-season observations of all players that have been employed in Germany's top division of professional football, the Bundesliga, in the period from 1995/1996 to 2010/2011. Main source has been Kicker Sportmagazin, Germany's most reliable source for publicly available sports data, providing data on player characteristics (age, position, and nationality), player market value and playing time as well as information on team performance and head coach turnover.[27] Based on these player-season observations, 3,498 spells and 2,791 careers (individuals) have been registered (see table 3.1 for a detailed description of the size of the player population).[28] Using detailed transfer data from www.transfermarkt.de, exit

[27] In this context, it is essential to note that the market values used are published to serve Kicker Sportmagazin's virtual fantasy game in which users act as team managers. Thus, the fantasy game's monetary values may not exactly correspond to real-world values. However, using these data as a proxy for market value is adequate as analyses of Torgler and Schmidt (2007) demonstrate that compare Kicker Sportmagazin data with market values from www.transfermarkt.de.

[28] A spell is a period of time a player has spent in the league without interruption, i.e. without exiting and re-entering. A career is a period of time a player has spent in the league ignoring interruptions. Consequently, a player has only one career but may have multiple spells during his career. The

types, i.e. the destination and the timing of the exit, have been added to the dataset. This German website collects transfer data in a very comprehensive way and has been used, like Kicker Sportmagazin, in previous research in sports economics (see e.g. Torgler and Schmidt 2007, Franck and Nüesch 2011, Bryson et al. 2012, or Frick 2012b). The data from www.transfermarkt.de consist of 5,722 player transfers that occurred between the pre-season transfer periods of 1995/1996 and 2011/2012 and reveal also whether or not the player has been a free agent. Complete information on all variables exist for 6,405 player-season observations with market value and free agent status being responsible for missings.

Table 3.1: The Size of the Player Population, 1995-2010.

	Spells		Careers	
	All Records	**Complete Records Only**	**All Records**	**Complete Records Only**
Number of Different Subjects	**3,498**	**2,664**	**2,791**	**2,153**
Number of Failures for Subjects by Exit Target	**3,147**	**2,262**	**2,440**	**1,743**
- Thereof Exit to 2. Bundesliga	1,305	946	811	576
- Thereof Exit to 3. Liga or Below	304	212	276	193
- Thereof Exit to Reserve or Youth Team	322	110	276	100
- Thereof Exit to Top Foreign League	227	197	171	149
- Thereof Exit to Other Foreign League	721	581	640	511
- Thereof Exit to Unemployment	253	213	251	211
- Thereof Missing Exit Information	15	3	15	3
Number of Failures for Subjects by Exit Timing	**3,147**	**2,262**	**2,440**	**1,743**
- Thereof Exit End-Of-Season	2,745	1,990	2,090	1,505
- Thereof Exit In-Season	387	269	335	235
- Thereof Missing Exit Information	15	3	15	3
Number of Right-Censored Subjects	**351**	**402**	**351**	**410**
Number of Player-Season Observations	**8,530**	**6,405**	**8,530**	**6,405**

Source: Own calculations based on information provided by Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012 and www.transfermarkt.de.

Exit type is grouped by target and timing, two dimensions clustering the same exits from a different perspective.[29] Exit targets are other leagues within the league hierarchy

difference between spells and careers is illustrated using the example of Markus Babbel in table B.1 in the appendix.

29 Note that the event of an exit is called 'failure'.

of German association football (2. Bundesliga, 3. Liga and below, and reserve or youth teams), foreign leagues (top foreign leagues and other foreign leagues), or unemployment. Top foreign leagues are the first divisions in England, France, Italy, and Spain that have been ranked higher or close to Bundesliga in UEFA's coefficient ranking during the observation period.[30] Overall, 3,147 exits from Bundesliga have been observed. More than 40% of players exit to 2. Bundesliga, Germany's second division, indicating the importance of including relegation and team performance into the econometric analysis to be performed.[31] Foreign leagues are the target of more than 30% of players. However, only roughly 25% of these exits to foreign leagues see players joining a league ranked equal or even higher than Bundesliga. As discussed only this limited number of exits can be defined as voluntary from a sporting and financial perspective.

Exit timing is split in end-of-season and in-season exits following Bundesliga's two existing transfer windows in summer (end-of-season) and winter (in-season) respectively. Almost 90% of exits happen end-of-season. Yet, the data reveal than the number of in-season exits has been increasing over time from a minimum of 13 in the winter 1995 to a maximum of 41 in the winter 2008. Consequently, a linear time trend will be entered into the regressions in section 3.4.

Since Bundesliga was inaugurated with the 1963/1964 season and the observation period starts with the 1995/1996 season, the first season for which market values from Kicker Sportmagazin are available, left-censoring occurs. However, using the Bundesliga dataset employed by Frick et al. (2007 and 2008) all left-censored cases were identified and their complete spell and career duration were entered. Hence, stock and flow data were used to compile the dataset and left-censoring is not expected to impact the estimations. Actually, results presented in section 3.4 remain robust when excluding left-censored cases. Moreover, since both stock and flow data are used in the analysis it is neither biased by an overrepresentation of short nor of long spells and careers (see Hoang and Rascher 1999 and Groothuis and Hill 2004). This is also

[30] Union of European Football Associations (UEFA) is association football's governing body in Europe. The coefficient ranking measures the strength of a league on the basis of the results of the league's clubs in European cup competitions.

[31] Note that a player whose club has been relegated but who subsequently transferred to, say, a different Bundesliga club is not recorded to exit to 2. Bundesliga. This holds in analogy for other transfers to other destinations in that case.

underlined by the similarity of summary statistics with Frick et al. (2007) shown in tables 3.1 and 3.2 and discussed below. Furthermore, since Bundesliga is still ongoing, all players that did not exit Bundesliga at the end of the 2010/2011 season are right-censored.[32] For spells this is not troublesome since information of right-censored cases can be used in duration analysis (see figure B.1 in the appendix for an illustration of censoring). For careers, though, the definition of right-censoring needs to be discussed. In table 3.1, a player's career is right-censored if he was active in the league in the last season observed, 2010/2011, and did not exit the league at the end of that season. Since for careers interruptions are neglected, all these players may return to the league at some point in time to continue their Bundesliga career. Although returning is rather a possibility for younger players than for older ones, in a dataset covering only 16 seasons, continuation is naturally still an option for the majority of the players.[33] To prevent biased results from such undetected right-censored cases, the models presented in section 3.4 focus on spells only. Besides, concentrating on spells leads to the observation of a higher number of failures and is hence more applicable when examining competing risks.[34]

Based on the dataset described above, the set of independent variables used here differs from the datasets used in Frick et al. (2007 and 2008) by including player market value, minutes played instead of games played, team roster size, head coach turnover, and a player's free agent status. Player market value is expected to be a key predictor of labor market dynamics in the free and competitive transfer market of the Bundesliga. Minutes played offers more accuracy than games played. However, coefficients presented in section 3.4 did not differ when controlling for one or the other or even both. Note that team league rank has been transformed by the expression -ln(rank/(n+1-rank)), where n stands for the 18 teams in the league, to accentuate differences at the top and at the bottom of the league (Szymanski and Smith 1997; see figure B.2 in the appendix for the

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32 Note that when excluding incomplete player-season observations, players who have been active prior to the 2010/2011 season, then exit Bundesliga at the end of the 2010/2011 season, and have missing information in their record for the 2010/2011 season are already right-censored earlier. This explains the differences in right-censored cases presented in table 3.1.

33 This is particularly true since players in the present dataset are only observed in the labor market of Bundesliga football and not, for example, in the labor market of European football. Note that apart from hazard rates for the age variables results for careers where robust to results for spells (see tables B.2 and B.3 in the appendix).

34 See also Preisendörfer and Wallaschek (1987) for a comprehensive discussion of alternative study designs when analyzing career data.

distribution). When including all players in the dataset, regardless of whether they have appeared on the pitch or not, it seems adequate to control for team roster size. Moreover, to fully acknowledge the interdependence of success of players, head coaches and teams, head coach turnover at different points in time has been included. In fact, these variables are supposed to capture to some extent the relationship between the head coach and the player. The free agent status is expected to explain player moves to a large extent since the fact that the contract will expire end-of-season reveals that the contract has not been prolonged before and hence separation is likely.

Except for player characteristics and team dummies, all variables are time-variant since the dataset is originally based on player-season observations. Capturing such time-variant developments adds valuable information to the analysis as pointed out by differences between Jiobu (1988) and Groothuis and Hill (2008) discussed in the literature review. In summary, the set of independent variables is structured as follows.

- **Player performance:** relative market value, minutes played divided by 90
- **Player characteristics:** age, position (goalkeeper, defender, midfielder, forward), nationality (aggregated by the six FIFA confederations Asian Football Confederation (AFC), Confédération Africaine de Football (CAF), Confederation of North and Central American and Caribbean Association Football (CONCACAF), Confederación Sudamericana de Fútbol (CONMEBOL), Oceania Football Confederation (OFC), and Union of European Football Associations (UEFA) with a separate category for Germany)
- **Team characteristics:** transformed team rank, team relegated, team roster size
- **Head coach turnover:** head coach turnover pre-, in-, and end-of-season
- **Transfer characteristics:** free agent
- **Controls:** linear time trend, team dummies

Table 3.2 provides the summary statistics. Similar to Frick et al. (2007 and 2008) on average spells last 3.1 years whereas careers last 3.9 years and players on average are 26 years old. Only 11% of players are goalkeepers whereas as defenders, midfielders, and forwards account for 28%, 39%, and 22% of the player-season observations respectively. 55% and 30% of the observations are players from Germany and other

UEFA countries respectively. Note that no players from OFC confederation have been observed. Team rosters range from 22 to 40 players and most head coach turnover is observed in-season. Approximately 30% of all player-season observations are free agents at the end of the season.[35]

Apart from the observation period and the variables included, another difference between the present dataset and the datasets used in Frick et al. (2007 and 2008) needs to be addressed. Frick et al. (2007 and 2008) observe only players that have appeared at least in one game for their team whereas the present dataset observes all players that have been in a team's roster, i.e. that have been employed in the Bundesliga. However, this does not affect results as the distribution of spells and careers presented in table 3.3 is almost identical to the one presented in Frick et al. (2007). Approximately 43% of spells end after one season and only one career out of twelve lasts for 10 years or more. In the 16 seasons observed, the number of players employed in the labor market has risen steadily from 473 in the 1995/1996 season to 571 in the 2010/2011 (see figure B.3 in the appendix).

35 The dataset also contains all variables that have been used in Frick et al. (2007 and 2008) but have not been mentioned here. With the similarity of descriptive statistics given, it is no surprise that major results from these two previous studies could be reproduced with this dataset.

Table 3.2: Summary Statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Spell Length	8,530	3.136	2.799	1.000	18.000
Career Length	8,530	3.916	3.258	1.000	20.000
Relative Market Value	7,931	1.000	0.928	0.000	9.697
Minutes Played (90)	8,530	12.424	10.899	0.000	34.000
Age	8,530	25.793	4.510	16.520	41.840
Goalkeeper (Ref. Cat.)	8,530	0.108	-	0.000	1.000
Defender	8,530	0.280	-	0.000	1.000
Midfielder	8,530	0.392	-	0.000	1.000
Forward	8,530	0.220	-	0.000	1.000
Germany (Ref. Cat.)	8,530	0.553	-	0.000	1.000
UEFA (excl. Germany)	8,530	0.300	-	0.000	1.000
CONCACAF	8,530	0.012	-	0.000	1.000
CONMEBOL	8,530	0.060	-	0.000	1.000
AFC	8,530	0.016	-	0.000	1.000
CAF	8,530	0.058	-	0.000	1.000
Team Lnrank	8,530	-0.017	1.469	-2.890	2.890
Team Relegated	8,530	0.162	-	0.000	1.000
Team Roster Size	8,530	29.740	3.237	22.000	40.000
Coach Turnover Pre-Season	8,530	0.181	-	0.000	1.000
Coach Turnover In-Season	8,530	0.361	-	0.000	1.000
Coach Turnover End-Of-Season	8,530	0.233	-	0.000	1.000
Free Agent (End-Of-Season)	6,595	0.303	-	0.000	1.000
Linear Time Trend	8,530	8.698	4.589	1.000	16.000

Note: Summary statistics based on player-season observations and not on careers or spells.
Source: Own calculations.

Table 3.3: Spells and Careers in the Bundesliga, 1995-2010.

Number	**Spell Duration**		**Career Duration**	
of Years	**No.**	**%**	**No.**	**%**
1	1,507	43.08	910	32.60
2	765	21.87	538	19.28
3	436	12.46	350	12.54
4	230	6.58	229	8.20
5	114	3.26	145	5.20
6	95	2.72	113	4.05
7	81	2.32	114	4.08
8	63	1.80	91	3.26
9	62	1.77	70	2.51
10	44	1.26	56	2.01
11	26	0.74	49	1.76
12	26	0.74	40	1.43
13	14	0.40	27	0.97
14	12	0.34	16	0.57
15	12	0.34	19	0.68
16	4	0.11	8	0.29
17	3	0.09	7	0.25
18	4	0.11	6	0.21
19	0	0.00	2	0.07
20	0	0.00	1	0.04
	3,498	100.00	2,791	100.00

Source: Own calculations.

3.4 Models and Empirical Results

As discussed in section 3.3, the present dataset to analyze career success of professional football players in the German Bundesliga includes several time-variant variables as well as several right-censored observations. These two econometric challenges can be handled adequately using duration analysis (also called ‘survival analysis’ or ‘event history analysis’) compared to logistic regression (Kiefer 1988). Duration analysis focuses on explaining the occurrence of a certain event and was developed in medical research with death as the event in focus. In this chapter two competing events, i.e. risks, will be examined simultaneously in one model. The risk type in focus is always the exit of a player from Bundesliga football in his current spell (see section 3.3 for the consideration of spells and careers). In fact, the first set of models will differentiate between exit target and the second set of models between exit timing. Following discussions in Frick et al. (2007 and 2008) the two competing exit targets are voluntary exits (exits to first divisions in England, France, Italy or Spain) and involuntary exits (exits to all other but the four leagues listed above). Exit timing will differentiate between in-season and end-of-season exits.

In duration analysis, the key concept is the hazard rate giving the probability that the event in focus occurs at a given time. Here, as in other player career research, time is measured in seasons and a proportional hazard model is applied.[36] Proportional hazard models assume that the hazard rates for different values of covariates are proportional. This class of hazard models can further be divided into parametric models such as exponential or Weibull models and semi-parametric models such as the Cox model. Semi-parametric models are more flexible since they do not assume a distribution of the baseline hazard, the hazard rate when all covariates are zero. Hence, this class of models leaves all the explanatory power to the covariates which is particularly true for data without repeated events (Kalbfleisch and Prentice 2002). Thus, Cox's (1972) semi-parametric proportional hazard model is applied in this chapter to explain career success of football players following Frick et al. (2007 and 2008). In a single risk setting, for time t, a vector of covariates x, the baseline hazard $h_0(t)$ and a vector of regression coefficients β, the hazard of exiting Bundesliga has the following general form:

$$h(t \mid x) = h_0(t) \exp(\beta x)$$

The regression coefficients $\hat{\beta}$ in this single risk model are estimated by maximizing the partial log-likelihood function:

$$LL_{SRM} = \sum_{j=1}^{D} \left\{ \sum_{k \epsilon D_j} x_k \beta - d_j \ln \left[\sum_{i \epsilon R_j} \exp(x_i \beta) \right] \right\}$$

where j indicates the ordered failure times t_j, D_j is the set of d_j observations that fail at time t_j, and R_j is the set of observations that are at risk at time t_j.

This single risk methodology is extended to perform the competing risk analyses of the cause-specific hazards for involuntary exits and for voluntary exits as well as for end-

[36] Measuring time in seasons compared to measuring it in match days seems reasonable since, in general, players can only exit the league in defined transfer periods in winter (in-season) and summer (end-of-season) and about 90% of them exit end-of-season, i.e. on a yearly basis.

of-season exits and in-season exits. Following Cleves et al. (2010), at each time *t* the cause-specific hazard for risk type *m* is:

$$h_m(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t, failure\ from\ risk\ type\ m \mid T \geq t)}{\Delta t}$$

With this differentiation by risk type given, the cause-specific hazard function is:

$$h_m(t \mid x_m) = h_{0_m}(t)\ \exp(\beta_m\ x_m), \qquad (m = 1, 2, \dots, n)$$

The partial log-likelihood function for the Cox competing risk model is accordingly:

$$LL_{CRM} = \sum_{m=1}^{n} \sum_{j=1}^{D} \left\{ \sum_{k \epsilon D_j} x_{mk}\ \beta_m - d_{mj}\ ln \left[\sum_{i \epsilon R_j} \exp(x_{mi}\ \beta_m) \right] \right\}$$

To estimate the competing risk models of football players' exits, a method introduced by Lunn and McNeil (1995) is used. Following this method, a football player exits the league only because of one out of the two competing risks as the two competing risks are independent of each other. For example, a football player exits the league only voluntarily or only involuntarily. Thus, time to failure of a football player is the minimum of the failure times for risk type one and risk type two. To allow for this, Lunn and McNeil (1995) propose data augmentation (see table B.4 in the appendix for an example of the performed augmentation). For each risk type *m* the dataset is replicated once. In the present context, the size of the dataset has been doubled since two competing risks in each set of competing risks have been defined. In each of the two replications all exits are right-censored except for those associated with the risk type of this respective replication. Consequently, the total number of exits is not affected by the data augmentation.[37] *m-1* indicator variables that are coded one for the respective risk type and zero otherwise are included to identify the risk type. In the case of two competing risks, one indicator variable is sufficient. In the first augmentation for the set of competing risks on exit targets, the indicator variable is coded one for voluntary exits and zero for involuntary exits and in the set of competing risks on exit timing, the indicator variable is coded one for in-season exits and zero for end-of-season exits.

[37] As Lunn and McNeil (1995) perform the augmentation for single record data per subject and the present dataset contains multiple record data per subject due to the incorporation of time-variant covariates an adjustment had to be made. To prevent events per subject to occur at the same instant a small constant of 0.001 has been added to one of the two risk types within one set of competing risks.

This augmentation allows then to estimate the Cox competing risk models simultaneously by stratifying by risk type, i.e. by the indicator variable. Moreover, the stratification permits to model different baseline hazards for each risk type. Furthermore, the estimation is performed per risk type with identical sets of covariates and with the covariates interacted with each risk type. As a result, hazard rates for each covariate and risk type are estimated.

Results for hazard rates on spells are presented in tables 3.4 and 3.5 containing competing risk results for involuntary and voluntary exits and for end-of-season and in-season exits respectively. Clearly, involuntary and end-of-season exits are the standard case since they represent approximately 90% of the observed failures. Hence, it is no surprise that the findings from these regressions, i.e. model 1A and model 2A, are largely in line with the literature, namely Frick et al. (2007 and 2008). Results for involuntary exits, presented in table 3.4, show that player performance reduces the hazard to exit involuntarily from the league significantly. Both at the 1% significance level, one standard deviation increase in player market value and 90 minutes more playing time during the season reduce this hazard by 36.0% and 6.2% respectively. This is in line with findings from games played and goals scored, presented by Frick et al. (2007). The same holds for player characteristics as player age has a linear and positive effect on the hazard,[38] goalkeepers have significantly longer spells than field players, and players from other European countries than Germany (UEFA dummy) and from South America (CONMEBOL dummy) have a significantly higher risk to exit the league. In addition, the risk to exit the league involuntarily is higher for players who have been relegated with their team by a factor of 3.1, which is consistent with Frick et al. (2008).

[38] Note that the squared term of age has been coded zero for players below the age of 26 following Cleves et al. (2010) in order to include a linear age-spell profile for the one competing risk and an inverted U-shaped age-spell profile for the other competing risk. This coding is based on results from single risk models that included only one exit type and showed an inverted U-shaped age-spell profile peaking at approximately 26 years for voluntary exits.

Table 3.4: Cox CRM Estimates for Spells Split by Involuntary and Voluntary Exit.

	(1) Cox CRM for Spells			
	(A) Involuntary Exit		(B) Voluntary Exit	
VARIABLES	**_t**	**SE**	**_t**	**SE**
Relative Market Value	0.640***	(0.036)	1.494***	(0.094)
Minutes Played (90)	0.938***	(0.003)	0.989	(0.008)
Age	1.045***	(0.009)	1.062*	(0.036)
Age2 (Starting at 26 Years)	1.002	(0.001)	0.979***	(0.007)
Goalkeeper	Ref. Cat.	-	Ref. Cat.	-
Defender	1.593***	(0.138)	1.736	(0.710)
Midfielder	1.586***	(0.134)	1.507	(0.610)
Forward	1.717***	(0.158)	1.322	(0.557)
Germany	Ref. Cat.	-	Ref. Cat.	-
UEFA (excl. Germany)	1.246***	(0.066)	4.093***	(0.827)
CONCACAF	1.234	(0.232)	6.667***	(3.053)
CONMEBOL	1.361***	(0.148)	2.991***	(0.803)
AFC	0.938	(0.153)	1.570	(1.155)
CAF	1.004	(0.099)	3.227***	(0.993)
Team Lnrank	0.962	(0.032)	1.044	(0.099)
Team Relegated	4.078***	(0.349)	1.052	(0.384)
Team Roster Size	1.036***	(0.009)	1.010	(0.029)
Coach Turnover Pre-Season	1.017	(0.067)	1.421**	(0.239)
Coach Turnover In-Season	1.040	(0.061)	1.556**	(0.282)
Coach Turnover End-Of-Season	1.009	(0.060)	1.095	(0.190)
Free Agent (End-Of-Season)	1.432***	(0.069)	2.329***	(0.373)
Linear Time Trend	1.003	(0.006)	1.036*	(0.020)
Player-Season Observations	6,405			
Team Dummies (Fixed-Effects)	Yes			
Subjects (Spells)	2,664			
Failures (League Exits)	2,262			
Log-Likelihood	-13,612			
Chi2	2,702***			

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 3.5: Cox CRM Estimates for Spells Split by End-Of-Season and In-Season Exit.

	(2) Cox CRM for Spells			
	(A) End-Of-Season Exit		(B) In-Season Exit	
VARIABLES	**_t**	**SE**	**_t**	**SE**
Relative Market Value	0.811***	(0.038)	1.566***	(0.152)
Minutes Played (90)	0.944***	(0.003)	0.826***	(0.011)
Age	1.034***	(0.009)	1.132***	(0.029)
Age2 (Starting at 26 Years)	1.003**	(0.001)	0.994	(0.004)
Goalkeeper	Ref. Cat.	-	Ref. Cat.	-
Defender	1.502***	(0.131)	3.529***	(1.185)
Midfielder	1.425***	(0.123)	4.790***	(1.563)
Forward	1.539***	(0.144)	4.290***	(1.462)
Germany	Ref. Cat.	-	Ref. Cat.	-
UEFA (excl. Germany)	1.315***	(0.071)	1.319*	(0.196)
CONCACAF	1.537**	(0.289)	1.558	(0.672)
CONMEBOL	1.401***	(0.150)	1.393	(0.353)
AFC	0.926	(0.157)	0.896	(0.419)
CAF	1.074	(0.107)	0.934	(0.249)
Team Lnrank	0.963	(0.032)	0.931	(0.080)
Team Relegated	4.554***	(0.401)	0.987	(0.244)
Team Roster Size	1.030***	(0.009)	1.042*	(0.024)
Coach Turnover Pre-Season	1.019	(0.067)	1.454**	(0.235)
Coach Turnover In-Season	1.056	(0.063)	1.355*	(0.212)
Coach Turnover End-Season	1.021	(0.061)	1.037	(0.168)
Free Agent (End-Of-Season)	1.540***	(0.076)	1.626***	(0.219)
Linear Time Trend	1.002	(0.006)	1.049***	(0.019)
Player-Season Observations	6,405			
Team Dummies (Fixed-Effects)	Yes			
Subjects (Spells)	2,664			
Failures (League Exits)	2,262			
Log-Likelihood	-13,670			
Chi2	2,586***			

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.
Source: Own calculations.

Opposed to Frick et al. (2008), team league rank is not significant. However, the newly included variable team roster size is. One additional player on the team's roster increases the hazard to exit the league involuntarily by 3.6% at the 1% significance level. The range of rosters observed shows a maximum difference of 18 players (22 players at minimum and 40 players at maximum) leading to a 64.8% higher hazard in the 40 player roster than in the 22 player roster. Head coach turnover, however, has no significant impact on involuntary exits.

Player free agency is a key determinant of exits from the Bundesliga. In fact, a player whose contract expires at the end of the season faces a 43.2% higher risk to exit to a less prestigious football league, a reserve team, or even unemployment. The fact that a player’s contract length decreased to one year, i.e. a player is becoming a free agent end-of-season, means that the contract has not been extended in the pre-season and is hence already an indication for an exit. Consequently, exits of these players are more likely than exits of players with longer contracts. This is in line with an observation regarding contract length in the Bundesliga made by Huebl and Swieter (2002) and Feess et al. (2004). The authors find that average contract length has increased by approximately six months since the Bosman-ruling has become effective indicating that clubs prolong contracts not only with players they want to retain but also with players they want to sell for a transfer fee. Contrary to the explained implication of the free agent status, one could argue that free agents are more likely to find a subsequent job in Bundesliga since the signing club saves the transfer fee usually attached to an in-contract signing. Yet, in a competitive transfer market, a club invests into a new player according to his market value. This investment should be independent of a player’s contractual status. Players monetize their market value by salaries, bonuses or signing fees and selling clubs monetize their transfer rights on in-contract players proportional to the player’s market value by transfer fees. Thus, a buying club’s investment is split between payments to players and to selling clubs as shown by Fees et al. (2004) observing that salaries of players signed as free agents are significantly higher than salaries of players signed with a transfer fee. As a result, it should not be cheaper for a buying club to sign a free agent compared to signing an in-contract player. Note that the linear time trend is not significant indicating that no significant variation of the hazard has occurred over time.

Results for end-of-season exits from model 2A presented in table 3.5 are generally in line with evidence for involuntary exits and accordingly in line with Frick et al. (2007 and 2008). However, one difference needs to be mentioned. Next to players from UEFA and CONMEBOL countries, the hazard to exit the league is also higher for players from North America (CONCACAF dummy) than for German players. In fact the hazard increases for such players by 53.7% at the 5% significance level. Yet, only 40 such players out of 2,791 players in total have been observed and therefore this difference is likely to be driven by heterogeneity in the different subsamples of involuntary and end-of-season exits.

Evidence for players that exit Bundesliga on a voluntary basis to top clubs in England, France, Italy, or Spain and evidence for players exiting the league in winter are quite different from the results just described. Starting with results from voluntary exits, it is important to note that market value has an effect contrary to the one described above. One standard deviation increase in market value increases the hazard to exit the league voluntarily by 49.4% at the 1% significance level. Hence, the higher a player's market value, the higher the chance to receive an offer from a European club competing in one of UEFA's top leagues. Put differently, only such highly valued players have the option to accomplish such a transfer. Unlike market value, minutes played during the season prior to the transfer do not significantly impact this career step. Key difference between the natures of the two covariates is that market value includes future expectations on a player's performance whereas minutes played is only a historic performance measure. Cleary, there is a positive correlation between relative market value and minutes played (approximately 0.48). Yet, insignificance of the hazard rates for minutes played indicates that there are players with high market value that did not have much playing time and therefore leave Bundesliga at the end of the season or even already in-season voluntarily. Indeed, there are 1,488 player-season observations that were marked with both an above average market value and below average minutes played. 556 of these observations left the league at the end of the season. Many of these are newly signed, foreign stars that presumably did not integrate well into the Bundesliga team and consequently return to their home country. They did not get much playing time during the season but given their track record and future expectations of their performance in a different setting, their market value is still high and they have the opportunity to transfer.

The impact of age on the hazard to exit voluntarily has an inverted U-shaped form as both age and the squared term of age are significant with a positive and negative sign of the coefficients respectively. As a consequence, there is a clear time window for players to take this step in their career as the chances to transfer to another top European league increase until the age of 26 and then decrease. Besides, position does not matter for these players leaving Bundesliga voluntarily since all positional dummies are insignificant. Player nationality, still, is a key predictor of voluntary exits since players from all observed FIFA confederations but the AFC confederation are more likely to move to another top European league than German players. This potentially has two reasons. First, these foreign players may fit better in these four leagues since some may even be born in these countries (represented by the UEFA dummy) and others may feel culturally close, e.g. speak the same language. In fact, there is anecdotal evidence that players from South America (CONMEBOL), Africa (CAF), and North America (CONCACAF) prefer to play in Spain, France, and England respectively. Second, players from CONMEBOL, CAF, and CONCACAF represent with respectively 6%, 6%, and 1% of players a minority in the Bundesliga. Although it is controlled for market value, these top performing foreigners seem to have more career options than other players.

Team characteristics are not important for players exiting Bundesliga voluntarily. Pre-season and in-season head coach turnover, though, is important. Both at the 5% significance level, the former increases the hazard to exit the league voluntarily by 42.1% and the latter by 55.6%. In case of disagreement between the star player and the new head coach, the player is likely to leave Bundesliga since based on his valuation he has the option to do so. In-season head coach turnover may be interpreted along the same lines. In addition, in-season head coach turnover also indicates a situation where the team has been performing worse than expected. Consequently, sporting success is not optimal and the star player may transfer to a club where his chances to win titles are higher. Besides, also financial restrictions due to worse than expected sporting performance may drive the selling of highly valued players since sporting and financial success of clubs are closely related (Stadtmann 2006).

As with involuntary exits, player free agency has a positive and significant impact on the hazard to exit voluntarily, yet the effect is significantly larger. Chances of free agents to transfer to a top European league are higher than those of in-contract players by a factor of 1.3 as the hazard rate at the 1% significance level indicates. This importance of free agency may be driven by so-called veto sums (Feess et al. 2004). In order to keep their best players, clubs sometimes allow in-contract players to leave the team only when a contractually fixed transfer fee is paid to the club. Fixing very high transfer fees, that may not correspond to a player's market value and the remaining contract length, then enable the club to control transfer timing. In that case, it is only free agency that gives decision power to the player and makes a transfer possible.

The linear time trend is positive and significant at the 10% level. Thus, with every additional year over the past 16 seasons the hazard to voluntarily exit Bundesliga has increased by 3.6%. This may reflect an increasing strength of Bundesliga football as players from Germany and other countries more and more have the opportunity to move to another top European football league. This development may also be driven by reforms undertaken by Deutscher Fussball-Bund (DFB), the German football association and DFL Deutsche Fußball Liga GmbH (DFL), the legal entity that runs Bundesliga, at the turn of the millennium to spur performance of young German talent (see chapter 4).

Results from in-season exits reveal similarities but also differences to results from voluntary exits. Market value has a very similar effect showing that players leaving in-season are highly valued. Such a valuation is needed in order to find promising job offers in the winter transfer market. Since only 10% to 20% of transfers happen in winter, the winter transfer market may not as efficient as the summer one (see chapter 5). Minutes played, however, is significant at the 1% level indicating that 90 more minutes played decrease the hazard to exit Bundesliga in-season by 17.4%. Age has a linear effect as for players that exit end-of-season. Positional dummies are highly significant with hazard rates for in-season exits are almost twice as high as hazard rates for end-of-season exits. This evidence clearly demonstrates that it is highly unlikely that goalkeepers are transferred in the in-season transfer market. Perhaps surprisingly, the FIFA confederation of origin does not matter in this case implying that chances to exit in-season are the same for most nationalities. Only the UEFA dummy is significant at the 10% level showing that UEFA foreigners have a 31.9% higher chance to exit in-season than German players.

Since in winter, after half of the season has been played, no decision has yet been made on relegation, team rank and the relegation dummy are not significant for players exiting then. As with end-of-season exits, team roster size has a positive effect on exiting the league in-season, though, only at the 10% significance level.

Similar to voluntary exits, pre-season and in-season head coach turnover increase the hazard to exit in-season. At the 5% significance level pre-season head coach turnover increases the hazard by 45.4% and at the 10% significance level in-season head coach turnover increases the hazard by 35.5%. After having gathered sufficient information about his new player, the new head coach hired pre-season thus executes the separation in the first upcoming transfer window. This interpretation similarly holds for the newly hired head coach in-season. Obviously, this new head coach has less time to gather the necessary information in order to make decisions. With these interpretations given, it becomes clear why end-of-season head coach turnover is not significant across all models. The new head coach needs to get to know his new roster first before he is able to act on the transfer market.

Free agency has a positive and significant impact on in-season exits, comparable to results from the other models. This reflects the clubs' intention to realize a transfer fee shortly before the player becomes a free agent six months later. As the positive effect of market value indicates these players transferred in-season have high quality. Potentially they have tried to leave their current club but their club vetoed any potential offers in order to have the player support the team. Now with only six months contract length left, i.e. with the last opportunity to realize a transfer fee, it is economically viable for the club to make the transfer.

Interestingly, the linear time trend has a positive sign and is significant at the 1% level. Hence, activity on the in-season transfer market has significantly increased over time. This may be driven by economic growth of the Bundesliga which has seen an increase of revenues from TV rights by a factor of six during the period of observation (DFL Deutsche Fußball Liga GmbH 2006 and 2011). As the industry grows the opportunity costs of relegation becomes more and more relevant as the gap between Bundesliga and 2. Bundesliga becomes larger. This may well lead to faster reactions of the clubs and consequently higher player turnover as reflected in the result here. Another argument may be that clubs have adapted to the consequences of the Bosman-ruling by focusing on selling players who are becoming free agents end-of-season in the in-season transfer window to realize transfer fees.

Given the detailed dataset, robustness checks with single risk definitions on involuntary exits for the different exit targets along table 3.1 have been performed. Apart from obvious results, e.g. a higher impact of the relegation dummy for exits to 2. Bundesliga, some results are worth being mentioned. When focusing on exits to 2. Bundesliga only, the free agent dummy does not yield significant results indicating that most contracts of Bundesliga players are not valid for 2. Bundesliga. Furthermore, for players exiting to 3. Liga or below, pre-season head coach turnover significantly explains involuntary exits, a variable that is not significant in the models presented above. Since players exiting to 3. Liga or below are presumably the weakest players in the team, new head coaches do not need a long time to gather the necessary information to take a decision. The "clear" cases are directly identified. Additionally, when concentrating on players exiting to youth or reserve teams, it is interesting to note that for these players market value and minutes played have a more important impact than in models concentrating on other exits. Hence, only small differences in performance make the difference for these rather young players between staying in the team and exiting professional football. Exits to unemployment have a clearly linear age profile. This seems reasonable since exiting to unemployment from Bundesliga means that these players do not join any other team in in professional football (2. Bundesliga, top foreign league, other foreign league) or in semi-professional football (3. Liga and below, youth and reserve teams). However, a player previously employed in Bundesliga should have the option to do so. Hence, the linear age profile indicates that exiting to unemployment may well be interpreted as voluntarily exiting the football player's labor market, i.e. terminating the career.

3.5 Summary and Implications for Further Research

This chapter has analyzed differences between quits and layoffs and between in-season and end-of-season exits in the context of German association football. By applying Cox (1972) competing risk models to a dataset of 8,530 player-season observations for 2,791 players, three extensions to previous research, namely Frick et al. (2007 and 2008), were made.

First, evidence from players that exit involuntary and that exit end-of-season, representing the vast majority of exits, are in line with previous findings. Second, voluntary exits and those for in-season exits have been observed for the first time. Voluntary exits occur mainly for highly valued players and in a career window around the age of 26. For such players, neither being a goalkeeper, a position with a rather fewer number of transfers, nor playing in a weak team is a hurdle when taking the next career step. On the contrary, these players leverage existing job offers and leave Bundesliga voluntarily when pre- or in-season head coach turnover takes place, i.e. when the team's situation does not develop as expected. Similarly, rather highly valued players rather exit in-season. Moreover, these exits occur shortly before players are becoming free agents at the end of the season. Hence, these players exit the league since their clubs want to monetize their transfer rights before the players can leave the club without a transfer fee. In addition, it appears that players exiting in-season suffer from head coach turnover occurring in the last six months. Consequently, new head coaches use the first upcoming transfer period in winter to adjust the roster. Third, the new covariates included shed light on the impact of market value, of free agency, and of head coach turnover. These findings can be set into context with Rottenberg's (1956) view on player allocation. He argues that in a free transfer market a player joins the team where he is most productive. In line with this argument, players with high market value quit and players with low market value are laid-off. In addition, this underlines the different development of wages after quitting or after having been laid-off, discussed in the introduction. In a competitive labor market for professional football players wages are expected to develop in line with market value and rather the highly valued players leave voluntarily whereas the poorly valued players leave involuntarily. Furthermore, head coach turnover induces turnover of certain players since a change in supervisor is likely to impact productivity. However, the positive impact of becoming a free agent for all exits across all models indicates some frictions in the market, contradicting perfect player allocation. It seems that contract length is a determinant of spell length. In that case, player allocation will only be adapted after a positive productivity shock without delay since in that case both club and player can capture the value of this productivity shock and will hence agree to a transfer. The selling club can realize a transfer fee and the player can realize a higher salary. In the case of a negative productivity shock, however, the club will be eager to sell the player. Yet, with the negative productivity shock known by other market participants, no buying club will offer to the player a salary that is equal to or even higher than his salary under the current contract. Consequently, the player will not agree to be transferred and player productivity will impact player allocation in this case only after the contract has expired. Hence, there is some stickiness in the market observed due to contract length.

Although the present chapter's analysis benefits from detailed data, further research may use even more precise data. The differentiation between quits and layoffs could be captured not on a league level but also on a club level using every job-to-job transition as an exit and categorizing the exits by the UEFA team ranking. Moreover, contract length as a continuous variable instead of the free agency dummy may reveal further insights on frictions in the football player's labor market due to existing contracts and contractually fixed transfer fees.

4 Career Success of Risky Workers: A Duration Analysis for German Youth Football with Competing Risks

4.1 Introduction

Successful leverage of youth academies in professional football (soccer) reached a recent peak when FC Barcelona employed seven players trained in its own youth academy La Masia to win the UEFA Champions League final 2011 – perhaps the most prominent match in association football. In the past decade, however, it was particularly in Germany where increasing attention was paid to careers of young players in professional football. The German football association 'Deutscher Fussball-Bund' (DFB) and the German football league 'DFL Deutsche Fußball Liga GmbH' (DFL) started a joint set of reforms in this field at the turn of the millennium, including inter alia new, state-of-the-art requirements for youth academies. This effort aimed at a stronger performance of both the German national team and the German Bundesliga clubs. In European football, both targets had been accomplished by Ajax Amsterdam's youth program in the early 1990s. The club won the 1995 UEFA Champions League final with nine former Jong Ajax players on the pitch, even two more than FC Barcelona recently. Plus, apart from their impact on the club, these players also shaped the performance of the Dutch national team for several years.

From a football club's point of view, running a youth academy provides the club with private information about the expected value of a young football player. When making investment decisions, the club may benefit from this private information e.g. by systematically underpaying the player compared to his market value (Poppo and Weigelt 2000). In the field of labor economics, such a youth player can be understood as a risky worker, following Lazear (1995) since there is high uncertainty about his future performance. This uncertainty is valuable because a contract with a player who exceeds expectations can be retained or even extended and a contract with a player who does not fulfill expectations can be terminated. This situation can be interpreted as the club having the option to promote the player or not.

Despite this promising perspective on youth academies and the subsequent effect on career success of youth football players, to the best of my knowledge no research in the field of labor and sports economics has yet focused on this area. A reason for this may be the insufficient data publicly available. Because of limited media coverage, youth football in Europe does unfortunately not provide a labor market laboratory environment as described by Kahn (2000) for professional sports. Nevertheless, this chapter aims at shedding light on the career success of young football players in Germany. In this context, careers of German youth league and cup champions are analyzed with regard to their entry in professional football. More specifically, executed and non-executed youth player options are examined with regard to the subsequent effect on youth player career outcomes. These career outcomes are interpreted as competing risks since a player can either join the professional team of his club or another club when entering professional football. Competing risk duration analysis (also known as 'event history analysis' or 'survival analysis') is applied to explain whether a young, promising player enters professional football or not. This technique focuses on factors that influence the time until a certain event occurs and has its origin in medical research with death as the event in focus. Duration analysis has lately been applied to sports career research. Yet so far merely career exits as opposed to career entries have been the event of study in association football. Hence, with the research presented in this chapter, a rarely discussed field in this strand of literature is addressed.

The remainder of this chapter is organized as follows. In section 4.2 Lazear's (1995) risky worker theory is briefly explained and empirical tests are presented. In section 4.3 the available literature on sports careers is reviewed. Section 4.4 presents background information on DFB's and DFL's institutional changes in German association football. Section 4.5 presents the dataset and offers descriptive evidence. Models and results are discussed in section 4.6. Finally, section 4.7 gives the conclusion.

4.2 Risky Workers and Private Information in the Context of Professional Team Sports

The sorting of and investing in employees is a widely discussed topic in labor economics. With regard to young workers and their initial employers, Lazear (1995) contributed a theoretical framework focusing on 'risky workers' (see also Lazear and Gibbs 2009). The framework assumes two types of workers, a safe and a risky one. The safe worker has output $\bar{M}$ that is certain and the risky worker has output that is random with mean $\bar{M}$. Ex ante both the firm and the young worker are not informed about the worker's future performance. Over time, this uncertainty diminishes since both the firm and the worker collect information about the worker's performance. In fact, Lazear operates in a two period model with first a probation period and second a post-probation period. In case of good performance during probation, the employer will retain the worker and benefit from his productivity. In case of poor performance during probation, the employer will terminate the labor contract. As a consequence, the upside potential for the employer is to employ a highly productive worker who generates value for the firm and the downside risk is to employ a non-productive worker who destroys value. This situation can be interpreted in analogy to financial call options. Key factors to value the option associated with hiring a risky worker are the downside risk, i.e. the value the worker can destroy, the upside potential, i.e. the profit the worker can make for the firm, and the termination costs, i.e. the costs that occur when terminating the contract of the non-productive worker. Moreover, the firm has to be capable of evaluating the risky worker's productivity during the first period. Furthermore, when taking the perspective of a multi-period model, changes in market value of the risky worker may occur based on his performance. Thus, a pay raise may become necessary to retain a good performing worker and the associated profits for the firm decline. However, during probation, the firm gathered private information about the worker's productivity and can still use this competitive advantage to underpay the employee with respect to his market value. This positively impacts option value. Similarly, firm-specific productivity positively impacts option value since firm-specific components do not affect market value but do affect the value the worker creates for the firm.

In this setting, Lazear shows, among other things, that risky workers are preferred to safe ones at a given wage and that young workers are favored over old ones with the same expected value. The relevance of this result is also underlined by the analysis of Bollinger and Hotchkiss (2003) who test the theory empirically with data from Major League Baseball (MLB). Focusing on wage differentials the authors find that one standard deviation increase in performance uncertainty is associated with a 7% increase in salary.

Bollinger and Hotchkiss (2003) interpret young baseball athletes in the US as risky workers since according to the authors MLB constitutes a labor market that fits Lazear's setting. The authors argue that MLB represents an adequate labor market inter alia because of two reasons that also hold for German association football (see section 4.4 for further details on association football in Germany). First, players can be observed in minor leagues where MLB teams employ so-called farm teams with young athletes. This provides teams with private information about young players and is similar to running youth academies in association football. It seems that these information asymmetries exist although some information about the young players' performance becomes public when the Minor League teams or youth football teams compete. Indeed, in youth academies youth coaches observe the abilities and skills of young players seven days a week in training sessions, matches, boarding school, and leisure time activities producing numerous opportunities to collect private information. Second, a player's time spend in Minor League can be seen as a probation period after which the player is or is not promoted to the MLB team. Similarly, in German association football, players have to move from youth teams to professional teams at the age of 19 since no youth tournaments are held for older age groups.

In both MLB and association football, the club is free in its decision whether or not to retain the player. This is important to note because generally in US sports the transition from the youth to the professional level is managed by the draft system and not by a deregulated transfer market as in European football (see Hoehn and Szymanski 1999 for a discussion of the differences between American and European systems in professional team sports). The US draft system is a centralized matching system intended to foster competitive balance (Grier and Tollison 1994). Player selection occurs in a set order with last season's weakest team naming the first choice. After the draft pick, players generally join the club's professional team. Only in MLB, players usually move to the club's minor league team. Thus, a literature focusing on career outcomes with respect to the draft systems used in the National Basketball Association (NBA), National Football League (NFL), or National Hockey League (NHL) is not discussed here (see e.g. Hendricks et al. 2003, Massey and Thaler 2010, and Boulier et al. 2010 for the NFL or Staw and Hoang 1995, Camerer and Weber 1999, Groothuis et al. 2007 and 2009, Coates and Oguntimein 2010, or Arel and Thomas III 2011 for other related analyses).

In summary, the market for talent in youth football fits Lazear's market for risky workers. In this chapter, Lazear's idea is thus used in the context of youth football. Since in professional football, small differences in talent may decide matches there is much upside potential and much downside risk for such a risky worker. On the one hand, a decisive impact of a young forward, entering the game in the last 15 minutes and marking the game winning goal, may create substantial value for the team. On the other hand, opposite effects can occur for a young goalkeeper not saving an easy shot. In any case, clubs are eager to gain private information about a player's expected productivity in order to outperform their competitors when making the investment decision. The investment decision at hand is whether the youth player should get a contract for the professional team or not. This situation will be interpreted as the club having the option to promote the player or not. This chapter, though, does not set out to test Lazear's theory but to explain career success of youth players using the theory. In fact, executed and non-executed youth player options are analyzed with regard to the subsequent effect on youth player career outcomes. These career outcomes are interpreted as competing risks since a player can either join the professional team of his youth team ('Pro Home Club') or another professional team ('Pro Other Club') when entering professional football.

4.3 Previous Evidence in Professional Team Sports

In the sports-related literature, the careers of football players are subject to research focusing on the football player's labor market (see Frick 2007 for an overview). For the German Bundesliga Frick et al. (2007) analyze career duration of professionals in the 1963/1964 to 2002/2003 period, by applying Cox models. They find that player age has a linear and negative impact on career duration while performance indicators such as number of games played or number of goals scored contribute positively to staying a professional. In addition, goalkeepers are found to have longer spells and careers than players on other positions. With respect to nationality, the authors find that foreign players exit Bundesliga faster than German ones. Moreover, the authors' model institutional changes and find inter alia evidence that after the so-called Bosman-ruling career length in the Bundesliga increased.[39] A linear time trend, however, is not significant. The authors extend their analysis one year later (Frick et al. 2008) by including team performance in the set of covariates. Inter alia they find that the hazard

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[39] In 1995, the so-called Bosman-ruling liberalized player mobility in European football's labor market and allowed free agents, i.e. out-of-contract players, to transfer "for free" (Court of Justice of the European Communities 1995).

to exit the league is influenced by team performance. Relegation and poor performance in terms of league rank at the end of the season increase the hazard significantly.

Chapter 3 analyzes differences between quits and layoffs and between in-season and end-of-season exits, also in the Bundesliga, applying Cox competing risk models to a dataset of 8,530 player-season observations and 2,791 players. According to the results, voluntary exits occur mainly for highly valued players and in a time window during their career around the age of 26. Moreover, these players leverage existing job offers and leave Bundesliga voluntarily when pre- or in-season head coach turnover takes place. Highly valued players exit rather in-season. Furthermore, these exits occur for players who are becoming free agents at the end of the season. In conclusion, variables measuring player characteristics (e.g. age, nationality, position, experience, performance), team characteristics (e.g. team strength), and institutional characteristics (e.g. changes in league regulation) explain career duration in association football.

For youth football, so far, no such analyses exist. Yet, in Minor League Baseball, a work by Spurr and Barber (1994) uses a multiple state duration model to allow for exits and entries of youth players. Minor League Baseball consists, in fact, of a hierarchy of five leagues. Players can exit Minor League Baseball to either join a Major League team or to exit professional baseball. Moreover, players can move within the hierarchy of the Minor Leagues, i.e. players can, for example, exit a lower league to enter a higher one. The authors estimate hazard parameters for four different final states: two entries, i.e. two promotions within the Minor League hierarchy, and two exits, i.e. one demotion within the Minor League hierarchy and the exit from Minor League to unemployment. The authors find that player performance positively impacts promotions and negatively impacts demotions underlying the importance of analyzing these events separately. Perhaps surprisingly, age positively influences any transition regardless of its direction. Furthermore, parameters reveal that duration dependence is upward-sloping and concave, i.e. probabilities to enter or exit increase with time at a declining rate as known from several learning models in labor economics.

In analogy to Spurr and Barber (1994), the present chapter will focus on entries, i.e. promotions from youth to professional football. Competing risks, i.e. multiple states, are introduced. With respect to Lazear's (1995) option model, it is differentiated between two risks. First, a player can enter professional football with the professional team of his youth academy, i.e. the home club executed the option to retain the contract with risky worker. Second, a player can enter professional football with the professional team of another club, i.e. the home club did not execute the option and terminated the contract with the risky worker.

Further career research using duration analysis has also been performed in other sports (see e.g. Atkinson and Tschirhart 1986 for an application in the NFL, Hoang and Rascher 1999, Groothuis and Hill 2004 for NBA, Jiobu 1988, Groothuis and Hill 2008 for MLB, or Ohkusa 1999 and 2001 for Japanese baseball).[40] Interestingly, some of these findings are contradictory. In the NBA exit discrimination of black players has been found inter alia by Hoang and Rascher (1999) with data on all drafted players between 1980 and 1986. The authors found that white players have a 36% lower risk of exiting the NBA. Groothuis and Hill (2004) carried out a similar analysis for the NBA using data on all players between 1989 and 1999 to find, however, no evidence of racial discrimination. Key difference in the studies is that Hoang and Rascher (1999) use flow data, i.e. data on newly starting careers only while Groothuis and Hill (2004) also include stock data, i.e. players who were active at the start of the observation period and had started their NBA career earlier. While in flow data long careers are underrepresented, in stock data short careers are underrepresented. Moreover, in MLB exit discrimination of black players has been analyzed inter alia by Jiobu (1988) with flow and stock data on players from 1971 to 1985. The author found evidence of discrimination of black players but none of discrimination of Hispanics. Groothuis and Hill (2008) analyzed exit discrimination with data from 1990 to 2004 to find, though, no evidence of discrimination. Methodologically, one key difference between the studies is that Jiobu (1988) only uses time-invariant covariates such as 'age at career start' whereas Groothuis and Hill (2008) also use time-variant covariates such as 'tenure'. Both examples reveal the impact of study design, a fact that also needs to be discussed in detail, given the highly selected sample used in the present chapter (see section 4.5).

[40] Duration analysis has also been applied in other contexts in sports economics such as careers of head coaches (Barros et al. 2009, Frick et al. 2010), careers of referees (Frick 2012a), or the survival of clubs (Frick and Prinz 2004, Oberhofer et al. 2010, Frick and Wallbrecht 2012).

4.4 Recent Institutional Changes in German Football

In the year 2000, German football experienced two far-reaching events. First, in UEFA's EURO 2000 in Belgium and the Netherlands, the German national team was eliminated in the preliminary round as the defending champion. Second, a couple of weeks after this elimination FIFA announced that Germany was to host the FIFA World Cup 2006.[41] The national team's failure combined with the pressure for a successful performance in the World Cup to be hosted led DFB and DFL to start several sets of reforms dedicated to foster talents (see figure 4.1).

Before illustrating these sets of reforms in further detail, three general levels in men's association football in Germany need to be explained: the professional, the semi-professional, and the youth level. The professional and semi-professional levels are framed in a hierarchy of leagues called divisions. The first division is called 'Bundesliga', the second division '2. Bundesliga' and the third division '3. Liga'. These three divisions are single-conference leagues, i.e. teams compete in these leagues on a national level. The fourth division consists of three conferences with each of the three leagues, named 'Regionalliga', covering a regional area of Germany. From the fifth division onwards, the multiple-conference mode prevails and here, the amateur level starts (see figure 2.4 in chapter 2 for an illustration).

Contrary to closed leagues that dominate professional team sports in the US, the league system in European football is an open one (see Hoehn and Szymanski 1999 for a discussion of the differences between American and European systems in professional team sports and Noll 2002 for a discussion of promotion and relegation). As a consequence, teams can move along the league hierarchy based on their performance by getting promoted (moving up) or relegated (moving down). Next to the competition in the open league system, clubs also compete in the DFB-Cup competition. This tournament run by DFB is organized as a classical knock-out tournament.

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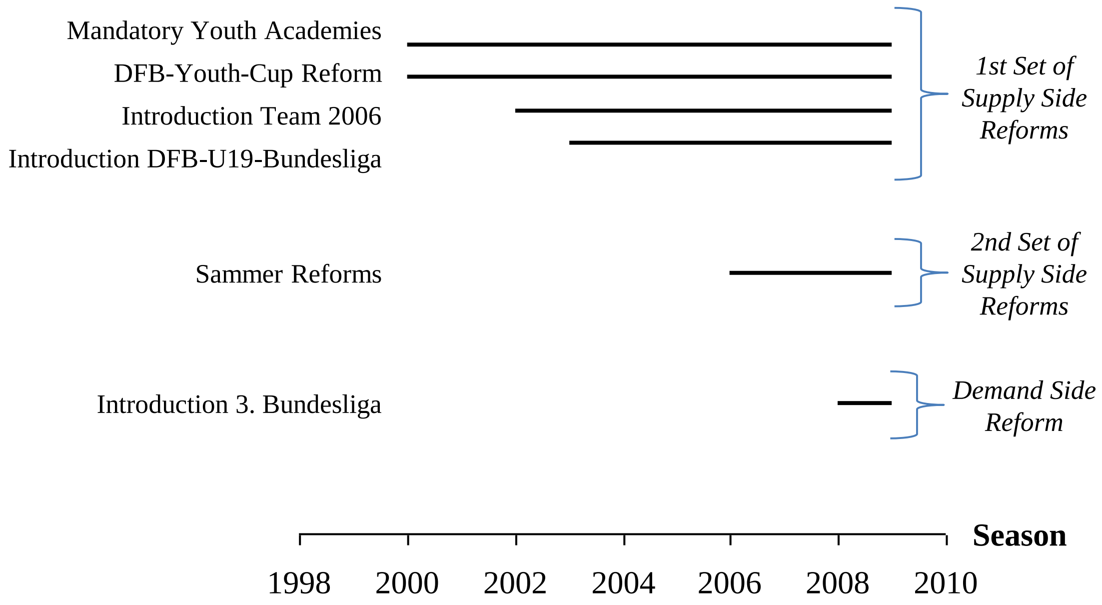
41 Fédération Internationale de Football Association (FIFA) and Union of European Football Associations (UEFA) are the international and European governing bodies in association football respectively.



Source: Own illustration based on Kicker Sportmagazin Pre-Season Special Issues 1998/1997 to 2010/2011.

Figure 4.1: Reform Timeline.

Generally, clubs having their professional team compete in the first two divisions are referred to as Bundesliga clubs. However, since the '3. Liga' is also a single-conference league professional football is generally defined by the first three divisions while the semi-professional level covers the three leagues in the fourth division. DFL runs the two top divisions; '3. Liga' and 'Regionalliga' are run by DFB.

DFB also runs the youth level that is organized in age groups. As a rule, one age group combines two years with for example age group 'Under-19' (U19) containing 17 and 18 year old players or 'Under-17' (U17) containing players of 15 and 16 years of age. Players are eligible to play in older age groups but not in younger ones. Under-23 (U23) is the oldest age group defined internationally, but youth competitions in Germany are only held up to the U19 age group. Similar to professional and semi-professional football, youth teams compete in open league systems with one league system for one age group each (there is e.g. a U17 and a U19 league system). Apart from leagues, a cup competition, DFB-Youth-Cup, exists for the U19 age group.

Since competitions are designed up to the U19 age group only, youth players need to qualify for a professional team at the age of 19. This step into professional football is not organized by a draft system known from American sports where drafts facilitate the step from college to the professional level (see section 4.3). In European football, supply of and demand for talent meet on the transfer market.

The institutional changes presented in the following impact the professional, the semi-professional, and the youth level in German association football. From the 2000/2001 season onwards, running a professional youth academy became a mandatory requirement for German Bundesliga clubs to obtain DFL's Bundesliga license. These youth academies deploy youth teams in the respective youth age groups to perform in league and cup competitions, provide training and often also schooling through boarding schools. In addition to making such youth academies obligatory, the system of youth tournaments was adjusted to spur competition at higher levels of performance. Since 2000/2001, the final rounds of DFB-Youth-Cup have no longer been held in parallel to the final rounds of U19 leagues, enabling the best performing teams to theoretically win both league and cup in one season. Plus, in 2003/2004 the DFB-U19-Bundesliga was introduced, grouping together the best performing regional U19 teams from a five-conference setup to a three-conference setup with a consecutive playoff tournament to identify the DFB-U19-Bundesliga champion.

These new standards were accompanied by the foundation of 'Team 2006' in 2002/2003, an extra youth national team composed of talents that could potentially be capped for Germany's national team at the FIFA World Cup 2006. Around this team, key talent promotion measures were implemented impacting DFB's overall talent promotion program in professional and semi-professional football.

After successfully competing in FIFA World Cup 2006, Matthias Sammer became head of the DFB youth program and started a second set of reforms. Sammer implemented an auditing process for the youth academies, performed by an external auditor to further spur professionalism in this area, a project called 'Foot PASS Germany'. Furthermore, DFB's promotion program was built around 'basic promotion' for kids, 'talent promotion', and 'elite promotion'. Basic promotion targets players younger than eight years, talent promotion focuses on eight to 19 year olds along the youth age groups, and elite promotion follows the youth national team structure where one national team per youth age group exists. Moreover, a unified philosophy in training and competition games within all DFB teams was introduced and new performance diagnostics through databases for technical and tactical skills as well as personality development were pursued.

Overall, these changes targeted the supply side of football talent in Germany (see Rosen and Sanderson 2001 for a discussion of supply and demand in the professional sports labor market). However, DFB and DFL also influenced the demand side by introducing '3. Liga' in 2008/2009 with the clear intention to give younger players a professional setting for further skills development. In fact, many teams in semi-professional football employ a high proportion of young players and some first division clubs even let their reserve teams perform in Regionalliga or 3. Liga. Before this reform, third division was constituted by a two-conference regional setup. Being now a single-conference national league, 3. Liga became also more attractive economically with e.g. income from TV revenues growing from 10 Mn EUR per season in 2008/2009 to 12.8 Mn EUR per season in 2009/2010 (Deutscher Fussball-Bund 2009a and 2011). This institutional change hence moved the separator line from professional to semi-professional football, i.e. third division moved from a two-conference, semi-professional setup to a single-conference, professional setup. As a result, the demand in the market for professional football talent increased, driven by the teams competing now in 3. Liga (see figure 2.4 in chapter 2).

In this chapter, effects of institutional changes on both the supply and the demand side of young football talent will be investigated, based on players' entries into professional football careers over time. The overview presented in figure 4.1 shows that almost every year under observation an institutional change has been implemented. Unfortunately, the time of impact of these changes is not accurately measurable with the data available. Assuming an additive relationship between the changes, the overall phenomenon is best captured by a linear time trend. Nevertheless, it is possible to separate supply side and demand side effects to a certain extent by using different definition of an entry. In fact, entering professional football can be defined be entering Bundesliga and 2. Bundesliga or by entering Bundesliga, 2. Bundesliga, and 3. Liga (see section 4.5 for further details).

4.5 Labor Market Entry of U19 Players: Data and Descriptive Evidence

Because of limited media coverage of German youth football compared to German professional football, it is difficult to follow careers of youth football players. Often, data on the youth career of a player is only available when the player has become a professional (see e.g. Shughart and Goff 1992 for an analysis in Minor League Baseball that only includes players that became professionals). Thus, it becomes particularly difficult to gather a dataset that contains both players who became professionals and players who did not become professionals. The data used here to understand the driving forces of labor market entry of U19 football players in Germany consists of 347 players during the U19 seasons 1998/1999 to 2009/2010. These players were on the rosters of 12 DFB-U19-Bundesliga champion teams and six DFB-Youth-Cup champion teams (see table 4.1 for a summary). Ever since DFB-Youth-Cup finals were scheduled independently from DFB-U19-Bundesliga finals, only youth teams of established Bundesliga clubs have become champions as the five year average league ranks of the club's professional teams ('Pro Team Rank') indicate.[42]

The 18 rosters represent all available U19 rosters that can be taken from consistent, reliable, and publicly available sources, namely Kicker Sportmagazin. Adding to the rosters player characteristics from www.transfermarkt.de, a German website with comprehensive football data, allows comparing players who became professionals with players who did not. Both data sources are known for their comprehensiveness and reliability and have been used repeatedly in empirical research (see e.g. Torgler and Schmidt 2007, Franck and Nüesch 2011, Bryson et al. 2012, or Frick 2012b).

[42] The league rank was calculated by adding league ranks across the league hierarchy. For example, a team ranked 2nd in the 2. Bundesliga was attributed league rank 20 since 18 teams compete in the Bundesliga. Ranks in multi-conference setups were treated equally, i.e. the team on first position in conference one got the same rank attributed as the team with first position in conference two. When including the five year average league rank into the regressions presented in section 4.6 this variable turned out to be insignificant and left the other coefficients unchanged.

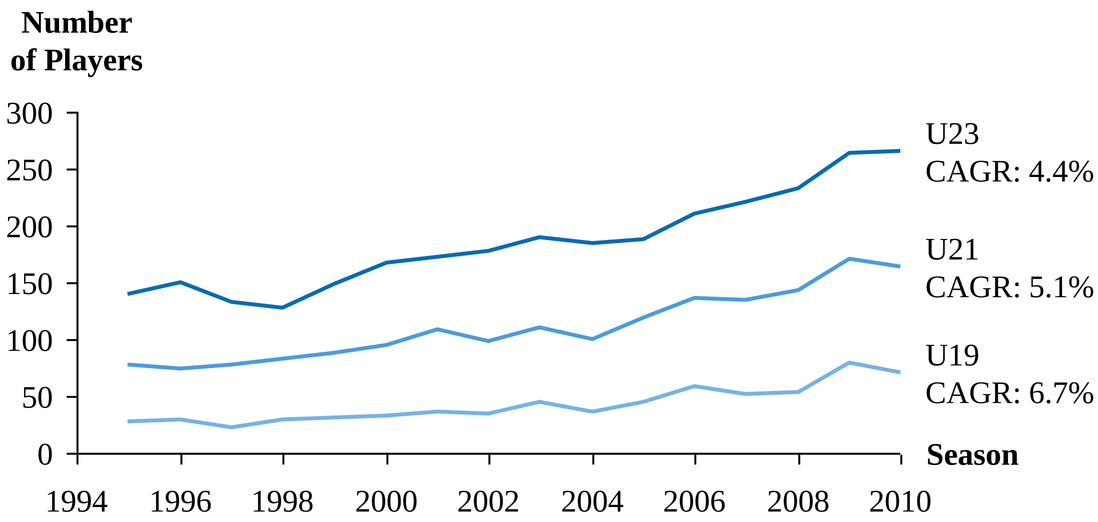
Table 4.1: Summary of Roster Observations.

Season	Competition	Champion	Roster Size	Complete Observations	Pro Team Rank
1998/1999	Cup	1. FC Magdeburg	17	9	55
1998/1999	League	SV Werder Bremen	19	9	5
1999/2000	Cup	TSV 1860 Munich	18	14	10
1999/2000	League	Bayer 04 Leverkusen	21	19	6
2000/2001	Cup	VfB Stuttgart	23	20	7
2000/2001	League	FC Bayern Munich	16	12	1
2001/2002	Cup	FC Schalke 04	19	16	8
2001/2002	League	FC Bayern Munich	15	14	1
2002/2003	Cup	1. FC Kaiserslautern	19	13	5
2002/2003	League	VfB Stuttgart	20	14	9
2003/2004	Cup	Hertha BSC Berlin	21	16	5
2003/2004	League	FC Bayern Munich	14	10	1
2004/2005	League	VfB Stuttgart	22	20	7
2005/2006	League	FC Schalke 04	21	17	5
2006/2007	League	Bayer 04 Leverkusen	21	18	6
2007/2008	League	SC Freiburg	18	16	19
2008/2009	League	FSV Mainz 05	21	20	16
2009/2010	League	Hansa Rostock	22	22	23
		Total	**347**	**279**	

Note: Roster sizes and observations are net of players who won multiple titles. Seven players of FC Bayern Munich's 2001 team, four players of the club's 2003 team and one player of VfB Stuttgart's 2004 team had won a U19-title before. In fact, 10 players have won two titles and one player has won three titles. Thus, for example, the original roster size of FC Bayern Munich's 2001 team is 22 and complete observations exist for 21 players.

Source: Own calculations based on information provided by Kicker Sportmagazin Pre-Season Special Issues 1998/1999 to 2009/2010 and www.transfermarkt.de.

Although the present dataset includes both players who became professionals and players who did not, the pool of individuals represents not a random sample of German U19 football players as it includes only the age group's top tier of talent. In addition, complete data across all variables exist for 279 players only. This suggests that the 68 players with missing information must have finished their careers after winning the youth title since www.transfermarkt.de covers all semi-professional and professional players in Germany. Moreover, given the broad coverage of players on www.transfermarkt.de it is likely that the players with missing information did not contribute much to winning the title.



Note: U23 (U21, U19) includes all players that have not turned 23 (21, 19) on January 1st of the calendar year in which the season starts. CAGR stands for Compound Annual Growth Rate.
Source: Own calculations based on Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012.

Figure 4.2: Youth Players in the Bundesliga, 1995-2010.

In order to further examine the selective nature of the youth player dataset used here it is necessary to discuss descriptive statistics of youth players and young professional players in Germany. Taking as a baseline player data from Germany's first division published by Kicker Sportmagazin and used in Battré et al. (2009), one finds that the present U19 champions dataset captures 20% of all German players' debuts below the age of 23 years in Bundesliga during 1995/1996 and 2008/2009. However, these 20% of all German player's debuts come from only approximately 2% of all teams that participated in DFB-U19-Bundesliga and DFB-Youth-Cup during the observation period. In fact, the dataset covers only 18 winning teams out of 630 teams that originally participated.

Table 4.2: Success of German National Teams, 1995-2010.

Year	Men's National Team	U19 National Team (UEFA European Cup)
1995	-	Not qualified for semifinals
1996	UEFA EURO Cup: **Winner**	Not qualified for semifinals
1997	-	Not qualified for semifinals
1998	FIFA World Cup: Not qualified for semifinals	**Runner-up**
1999	-	Not qualified for semifinals
2000	UEFA EURO Cup: Not qualified for semifinals	**3rd place**
2001	-	Not qualified for semifinals
2002	FIFA World Cup: **Runner-up**	**Runner-up**
2003	-	Not qualified for semifinals
2004	UEFA EURO Cup: Not qualified for semifinals	Not qualified for semifinals
2005	-	**Semifinals**
2006	FIFA World Cup: **3rd place**	Not qualified for semifinals
2007	-	**Semifinals**
2008	UEFA EURO Cup: **Runner-up**	**Winner**
2009	-	Not qualified for semifinals
2010	FIFA World Cup: **3rd place**	Not qualified for semifinals

Note: Men's UEFA EURO Cup and FIFA World Cup are held every four years only. Prior to 2002 U19 UEFA European Cup was U18 UEFA European Cup. No FIFA tournaments exist for the U19 age group.

Source: Kicker Sportmagazin Pre-Season Special Issues 1995/1996 to 2011/2012.

Table 4.3: Debuts by Division and Target Club.

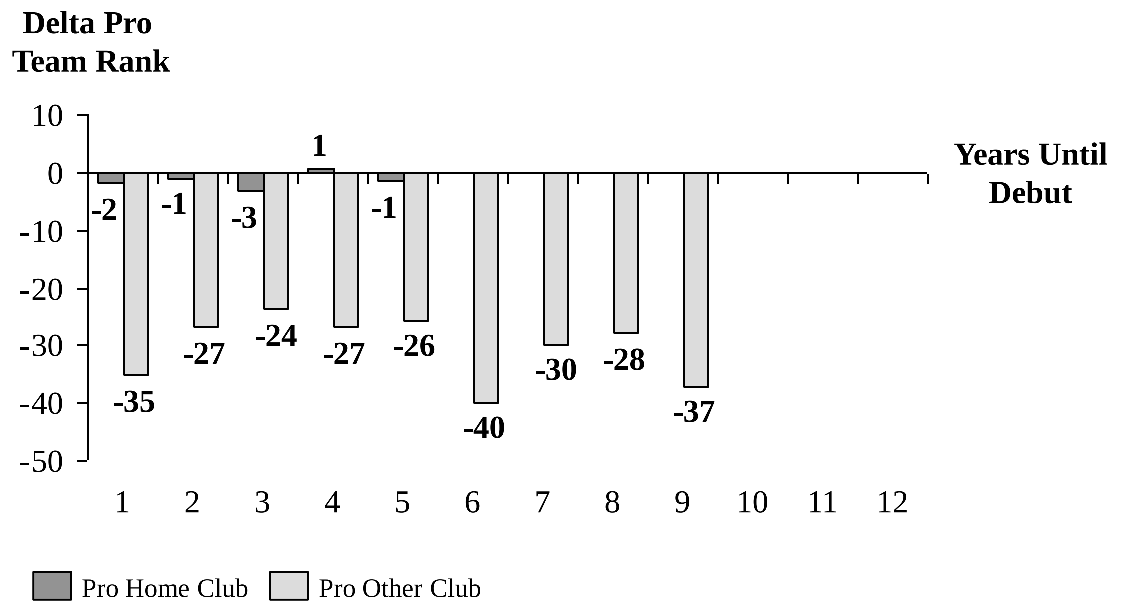
	Total	Pro Home Club	Pro Other Club
No. of Debuts in Bundesliga Only	71	51	20
No. of Debuts in Bundesliga and 2. Bundesliga	29	1	28
No. of Debuts in Bundesliga, 2. Bundesliga and 3. Liga	24	5	19

Note: During their careers players may debut in multiple leagues. Debuts in Bundesliga count all players that debuted in Bundesliga at any point in their career. Debuts in 2. Bundesliga count all players that debuted in 2. Bundesliga but did not debut in Bundesliga. Debuts in 3. Liga count all players that debuted in 3. Liga but did not debut in a higher division. When excluding 1. FC Magdeburg from the sample, numbers are not affected since none of the team's players debuted during the observation period.

Source: Own calculations.

Since the U19 champions represent Germany's top tier of football talent, the career success of the players under observation here may not be aided by the recent DFB/DFL reforms to the same extent as the career success of their less talented colleagues. Once more taking a broader perspective, the Bundesliga dataset used in chapter 3 shows that the number of U23-players employed in Bundesliga, Germany's top division in association football, has increased by a factor of 1.91 between 1995/1996 and 2010/2011 (see figure 4.2). This effect is even more accentuated when looking at the Under-21 (U21) age group (factor 2.10) or the U19 age group (factor 2.63). This tendency may well be a consequence of the recent DFB/DFL reforms – at least, it has been one of the reform's targets. Another target has been to increase playing strength of the German national team. Table 4.2 provides an overview of the German men's and U19 national teams' performance between 1995 and 2010. Both teams have experienced increased success in the major UEFA and FIFA tournaments since the turn of the millennium, i.e. since the DFB/DFL reforms started. Furthermore, strong performing U19 national teams in 2005, 2007, and 2008 may well have nurtured the subsequent success of the men's national team in 2006, 2008, and 2010. Again, such growth of talent along the age group hierarchy has been another target of the reforms.

As described in section 4.4, the DFB/DFL reforms can be split in supply and demand side effects in the talent market. Whereas supply side effects impact all age groups and divisions, demand side effects focus purely on the division hierarchy with the implementation of a new 3. Liga. Consequently, when discussing debuts in professional football these debuts can be clustered by debuts in Bundesliga, in 2. Bundesliga, and in 3. Liga. Table 4.3 provides such an overview for the 124 debuts observed by division and target club (home club, other club). Approximately 57% of all debuts occur in Bundesliga only while approximately 80% occur in Bundesliga and 2. Bundesliga. Approximately 46% of all debuts are made with the home club's professional team. Interestingly, players who debut with their home club make their debut almost exclusively in Bundesliga. Hence, the fact that mostly established Bundesliga clubs have won the youth titles seems to help the players to make their debut in Bundesliga. This is also reflected when comparing league ranks of the home club and the other club when a player debuts with another club (see figure 4.3). Here the difference between the average of a club's league ranks of the last five years ('Delta Pro Team Rank') is



Note: Pro Team Rank of the Home Club minus Pro Team Rank of the Other Club equals Delta Pro Team Rank. Delta Pro Team Ranks different from zero for players debuting with their home club may occur although in this case two identical professional teams are compared. However, teams may finish at different ranks each season and Delta Pro Team Rank is observed at two different points in time.

Source: Own calculations.

Figure 4.3: Debut Timing and Delta Pro Team Rank.

calculated between the home club and the other club. By definition there is no difference between the two five year average league ranks if the player debuts at the home club. Moreover, players debuting with their home team debut with strong performing teams as only U19 teams of established Bundesliga clubs have won the U19-titles since the reform of DFB-Youth-Cup. Yet, players debuting with another club but their home club see dramatic decreases in the level of the professional team's performance. In fact, these players on average debut in teams playing up to two divisions lower than they would have when debuting with their home club. Indeed, with each division having generally 18 teams, a 'Delta Pro Team Rank' of 40 indicates a division difference of approximately 2.2. Thus, when running a competing risk model with debuts with the home club ('Pro Home Club') and with another club ('Pro Other Club'), it is important to note that the 'Pro Home Club' debuts occur primarily in first division and the 'Pro Other Club' debuts occur primarily in lower divisions. Figure 4.3 reveals another interesting result. The time until debut is quite different for players debuting with their home club compared to players debuting with another club. In fact, no debuts with the home club occur later than five years after winning the title. For debuts with another club the respective number is ten.

To further elaborate on the different target clubs for a player's debut, an analysis of the dataset used in Battré et al. (2009) yields an important fact with regards to the number of debuts of players below the age of 23 in Bundesliga during 1995/1996 and 2008/2009. Here, the number of debuts of players that were not trained at the end of their youth career at a club whose professional team played in Bundesliga and 2. Bundesliga decreased from approximately 30% in the early years to approximately 10% now. Hence, clubs seem to have started to recruit more and more from their own youth academies. This again clearly supports a positive impact of the DFB/DFL reforms. It also becomes clear that debuts of German youth players who were not trained in such a prestigious youth academy become more and more extinct.

In summary, analyzing the available dataset promises interesting insights despite the described non-random selection of U19 players. Nevertheless, broader generalizations are to be discussed carefully. For the analysis, two sets of competing risks are defined. The first class of models takes debuts in all three divisions with the home club or with another club into account whereas the second class of models restricts the analysis to those debuts in Bundesliga and 2. Bundesliga only. Independent variables include age measured in months, a title age dummy, player height measured in centimeters, player position, and the number of U19-titles the player has won during his youth career. The title age dummy is zero if the player won the U19-title in the last year in which he was eligible to play in the U19 age group. Put differently, the dummy is coded one if the player was still eligible to play in the 19 team in the season after winning the title, i.e. did not have to move to a professional team immediately. Moreover a competition dummy controls for league or cup being one if the U19-title was won in the DFB-U19-Bundesliga. Based on the Bundesliga dataset used in chapter 3 the number of U23-players employed by the respective player's home club has been included for each year a player was under observation. Unfortunately these data were not available for 1. FC Magdeburg's professional team and, consequently, the youth players of 1. FC Magdeburg have to be excluded from the analysis when using these data in the regression. To measure the eventual impact of the DFB/DFL reforms a linear time trend starting in 1998 will be used. As an alternative, a dummy for the success of the U19 national team, measuring the strength of the overall U19 age group in a particular year, is used. It has been coded one whenever the U19 national team reached at least the semifinals in the UEFA European championship and zero otherwise.

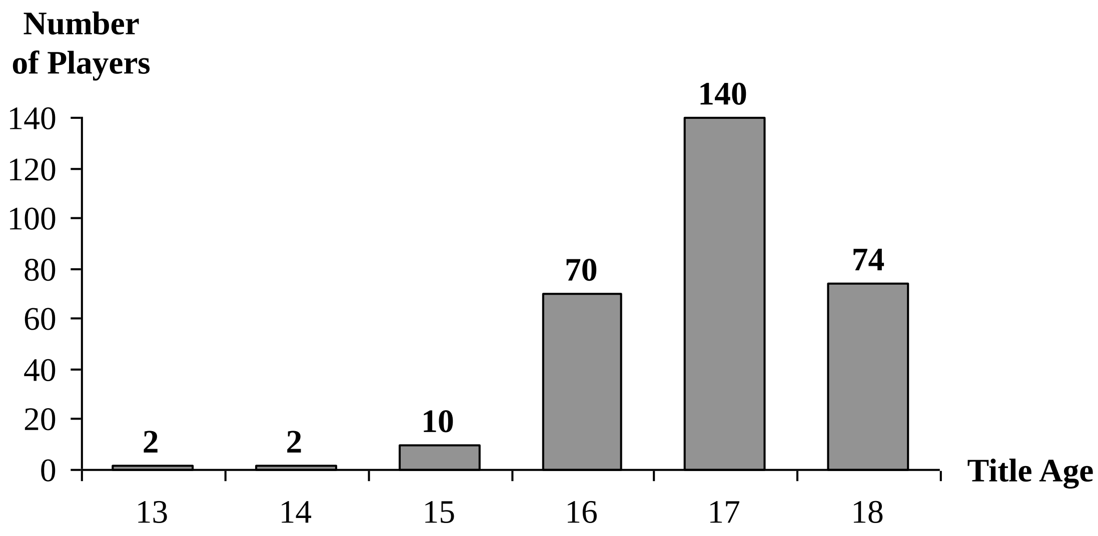
Table 4.4: Summary Statistics.

Variable	Description	Obs.	Mean	Std. Dev.	Min.	Max.
Age (Months)	Player age in months	298	211.188	9.793	169	233
Not Last U19 Year	1 if player was in last U19 year, 0 otherwise	298	0.601	-	0	1
Height (cm)	Player height in cm	279	181.265	6.575	160	196
Goalkeeper (Ref. Cat.)	1 if player position is goalkeeper, 0 otherwise	300	0.093	-	0	1
Defender	1 if player position is defender, 0 otherwise	300	0.313	-	0	1
Midfielder	1 if player position is midfielder, 0 otherwise	300	0.433	-	0	1
Forward	1 if player position is forward, 0 otherwise	300	0.160	-	0	1
Youth Titles	No. of U19-titles won by player	347	1.035	0.198	1	3
Competition	1 if title competition was league, 0 if cup	347	0.663	-	0	1
Pro Team U23-Players	No. of U23-players in club's professional team	2,026	12.480	3.419	4	23
DFB/DFL Effect	Linear time trend starting at 1 in 1998/1999 season	2,230	7.868	3.013	1	12
U19 Success Germany	1 if German U19 national team made semifinal in European Cup, 0 otherwise	2,230	0.520	-	0	1

Note: Summary statistics have been calculated for players in their title season except for 'Pro team U23', 'DFB/DFL Effect' and 'U19 Success Germany' that have been calculated for player-year observations.
Source: Own calculations.

Table 4.4 summarizes the independent variables used and provides the respective summary statistics. Players are on average 17.6 years old and 1.81 meters tall when winning the title.[43] Figure 4.4 shows the age distribution for the players at the time of winning the title. The title age dummy indicates that approximately 40% of players win the title in their last U19 year and hence have to leave the youth teams after winning the

[43] Note that the height data do not date exactly from the day of winning the U19-title but rather date between a player's 18th and 23rd birthday. Hence, the effect of height differences is even underestimated by these data. When including a squared term of height into the regressions shown in section 4.6 the respective coeffcients turned out to be insignificant.



Source: Own calculations.

Figure 4.4: Title Age Distribution.

title.[44] Positions are distributed as usual throughout rosters with midfielders and defenders being the most frequent positions and with goalkeepers and forwards being the less frequent positions. The maximum number of U19-titles a player has won is three (see table 4.1 for details) and 66.3% of the players have won their title in the DFB-U19-Bundesliga. On average, 12.48 players belonging to the U23 age group are part fo the roster of a professional team. FC Schalke 04 is responsible for the maximum of 23 U23-players being part of its 2009/2010 roster when head coach Felix Magath radically changed the team. The linear time trend measuring the DFB/DFL reforms goes from 1 (1998) to 12 (2009) and the success of the U19 national team is documented year-by-year in table 4.2.

With this setup, the focus of analysis is twofold. First, the competing risk analysis is supposed to shed light on the impact of executed and non-executed youth player options along Lazear's (1995) risky worker model. As described these career outcomes are interpreted as competing risks since a player can either join the professional team of his youth team or another professional team when entering professional football. Different

[44] Note that these 40% do not correspond to the approximately 25% of players who were 18 years old in their title season (see figure 4.4). This is due to the fact that the U19 age group includes all players who have not turned 19 on January 1st of the calendar year in which the season starts. Hence, age measured at the beginning of the title season differs from the age group measured by DFB's cut-off date.

player profiles as already indicated in figure 4.3 are expected. Second, the impact of DFB/DFL's institutional changes on youth career outcomes will be analyzed. A linear time trend is expected to positively impact players' debuts although these changes probably impact U19 champions not as much as average U19 players. Moreover, comparing debuts in all three divisions to debuts in only the first two divisions allows separating the supply and demand effects described above to a certain extent. As 3. Liga is explicitly intended at giving U23-players more playing time a considerable impact of the demand side effect of the reforms is expected.

4.6 Method, Estimation, and Empirical Results for Competing Risk Models

As indicated in the literature review, the appropriate technique to study career success of U19 football players is duration analysis (also called 'survival analysis' or 'event history analysis'). The event to be explained by the covariates is becoming a professional. Key concept in duration analysis is the hazard rate which is interpreted as the probability that the event in focus occurs at a given time. In the present study, time is measured in seasons.[45]

This technique has two key advantages with respect to right-censored and time-dependent data compared to logistic regressions (Kiefer 1988). First, hazard models can also use information of right-censored observations. This is particularly relevant for the present dataset. Players win the U19-title with an average age of approximately 17.6 years. Therefore, players winning in the 1998/1999 season on average are approximately 29.6 years of age at the end of the observation period, i.e. on July 1st 2011. At this age a player's career is not necessarily terminated. Hence, every player who did not become a professional prior to July 1st 2011 may still make his debut in professional football and is hence right-censored. Still, information on all of these players can be used when applying duration analysis. Second, another advantage compared to logistic regression is that duration analysis allows integrating time-dependent variables. The different outcomes of the studies by Jiobu (1988) and Groothuis and Hill (2008) reviewed in section 4.3 emphasize the importance of integrating time-dependent variables. The models estimated in this chapter include player age, the number of U23-players in the home club's professional team, the linear

[45] Five players were observed debuting during their U19-title season. These players were treated as if debuting in the first season after the title.

time trend measuring the impact of DFB/DFL's reforms, and the success of the German U19 national team as time-dependent variables.

In career research, generally, proportional hazard models have been applied assuming that the hazard rates for different values of covariates are proportional. Proportional hazard models can further be divided into parametric models such as exponential or Weibull models and semi-parametric models such as the Cox model. Parametric models assume a distribution of the baseline hazard, the hazard rate when all covariates are zero. Semi-parametric models not making this assumption are in contrast more flexible leaving the model's entire explanatory power to the covariates. This is particularly true for data without repeated events (Kalbfleisch and Prentice 2002). Thus, Cox's (1972) semi-parametric proportional hazard model is applied in this chapter to explain career success of the U19 champions as in Frick et al. (2007 and 2008) and in chapter 3. For time t, a vector of covariates x, the baseline hazard $h_0(t)$ and a vector of regression coefficients β, the hazard of becoming a professional has the following general form:

$$h(t \mid x) = h_0(t) \exp(\beta \, x)$$

The regression coefficients $\hat{\beta}$ in this single risk model are estimated by maximizing the partial log-likelihood function:

$$LL_{SRM} = \sum_{j=1}^{D} \left\{ \sum_{k \epsilon D_j} x_k \, \beta - d_j \, ln \left[\sum_{i \epsilon R_j} \exp(\, x_i \, \beta) \right] \right\}$$

where j indicates the ordered failure times t_j, D_j is the set of d_j observations that fail at time t_j, and R_j is the set of observations that are at risk at time t_j.

This single risk methodology is extended to perform the competing risk analyses of the cause-specific hazards for debuts with the home club 'Pro Home Club' and debuts with another club 'Pro Other Club'. Following Cleves et al. (2010), at each time t the cause-specific hazard for risk type m is:

$$h_m(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t, failure \; from \; risk \; type \; m \mid T \geq t)}{\Delta t}$$

The cause-specific hazard function based on this differentiation by risk type is:

$$h_m(t \mid x_m) = h_{0_m}(t) \exp(\beta_m x_m), \qquad (m = 1, 2, \ldots, n)$$

Accordingly, the partial log-likelihood function for the Cox competing risk model is:

$$LL_{CRM} = \sum_{m=1}^{n} \sum_{j=1}^{D} \left\{ \sum_{k \epsilon D_j} x_{mk} \beta_m - d_{mj} \, ln \left[\sum_{i \epsilon R_j} \exp(x_{mi} \beta_m) \right] \right\}$$

In this chapter, a method introduced by Lunn and McNeil (1995) is used to estimate the competing risk models of entries into Bundesliga careers. Here, a U19 champion enters Bundesliga either with his home club or with another club and consequently the two competing risks are independent of each other and mutually exclusive. Thus, time to failure is the minimum of the failure times for either of the two debuts. Lunn and McNeil (1995) suggest a data augmentation to estimate the models adequately (see table C.1 in the appendix for an example of the performed augmentation). In the case of two competing risks the dataset is duplicated to have one set of data for each risk type and an indicator variable is introduced to identify the respective risk type. This indicator variable has been coded one for debuts with another club and zero for debuts with the home club. Observations of debuts at the home club are right-censored if the risk type is 'Pro Other Club' and vice versa as the total number of failures is not affected by the data augmentation.[46]

Based on the augmented dataset, Cox competing risk models are simultaneously estimated by stratifying by risk type, i.e. by the indicator variable. This allows to model different baseline hazards for each risk type. The simultaneous estimation is performed with identical sets of covariates and with the covariates interacted with each risk type. Consequently, hazard rates for each covariate and risk type are estimated.

[46] As Lunn and McNeil (1995) perform the augmentation for single record data per subject and the present dataset contains multiple record data per subject due to the incorporation of time-dependent covariates an adjustment had to be made. To prevent events per subject to occur at the same instant a small constant of 0.001 has been added for the times of risk type 'Pro Other Club'.

Table 4.5: Cox CRM Estimates for Debuts in All Three Leagues.

	(M1) Cox CRM All Leagues		(M2) COX CRM All Leagues	
VARIABLES	**Pro Home Club**	**Pro Other Club**	**Pro Home Club**	**Pro Other Club**
Age (Months)	1.746**	1.242	1.741**	1.272
	(0.439)	(0.205)	(0.438)	(0.211)
Age2 (Months)	0.999**	1.000	0.999**	1.000
	(0.001)	(0.000)	(0.001)	(0.000)
Not Last U19 Year	0.826	4.082***	0.803	4.250***
	(0.375)	(1.923)	(0.367)	(2.013)
Height (cm)	1.101***	1.039*	1.101***	1.040*
	(0.028)	(0.023)	(0.028)	(0.023)
Goalkeeper	Ref. Cat.	Ref. Cat.	Ref. Cat.	Ref. Cat.
	-	-	-	-
Defender	1.518	1.059	1.542	1.115
	(0.714)	(0.483)	(0.727)	(0.513)
Midfielder	1.614	0.831	1.576	0.837
	(0.799)	(0.392)	(0.780)	(0.396)
Forward	1.537	1.381	1.496	1.398
	(0.819)	(0.704)	(0.799)	(0.716)
Youth Titles	1.880	2.614*	1.780	2.987**
	(1.170)	(1.396)	(1.106)	(1.600)
Competition (1=League)	0.685	2.321**	0.676	2.215**
	(0.247)	(0.764)	(0.242)	(0.720)
Pro Team U23-Players			0.986	1.084**
			(0.049)	(0.041)
DFB/DFL Effect	1.151***	1.183***	1.135**	1.130**
	(0.061)	(0.069)	(0.060)	(0.068)
Player-Year Observations	1,486		1,378	
Subjects (Players)	279		270	
Failures	124		124	
Log-Likelihood	-603.9		-598.6	
Chi2	78.9		75.7	
Age Peak (Years)	18.1	31.2	18.1	31.2

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.
Source: Own calculations.

Overall, two sets of competing risks are defined. The first class of models takes debuts in all three divisions with the home club or with another club into account whereas the second class of models restricts debuts to Bundesliga and 2. Bundesliga only. Table 4.5 shows the results of the competing risk models allowing debuts in all three divisions. Model 1 excludes the number of U23-players to better isolate the DFB/DFL effect since the number of U23-players employed in e.g. Bundesliga has risen steadily over the last years (see figure 4.2). On the contrary, model 2 includes this variable. Models based on the more restrictive debut definition for Bundesliga and 2. Bundesliga only are presented in table 4.6. Independent variables in model 3 are equal to model 2. Model 4 replaces the linear time trend with a dummy measuring the success of the German U19 national team.[47]

All four models reveal a robust, but clearly distinguished profile between players who debut with their home club and players who debut with another club. The age-debut profile for players debuting with their home club is inverted U-shaped since the hazard rate of the age variable is larger than one at the 5% significance level while the hazard rate of the squared term of age is smaller than one at the 5% significance level across all models. Regardless of including 3. Liga (M1 and M2) or not (M3 and M4), the hazard to make one's debut with the home club increases until the age of approximately 18 and then decreases from this age on. With an average title age of 17.6 years (see table 4.4) this means that such players debut immediately after winning the title and hence debut just before exiting the U19 age group. Thus, the probation period ends with age 18. Clubs execute their options, if they execute them, directly after a player's U19 success and do not wait until the player gains further experience. U19 champions whose performance was particularly honored at the home club use this gain in reputation directly. The inverted U-shaped age-debut profile is comparable with the U-shaped age-exit profile found by in chapter 3 for Bundesliga players exiting Bundesliga voluntarily. Both U19 champions who debut at their home club and Bundesliga players who exit Bundesliga voluntarily are very successful individuals. Yet, the time window to realize this success is limited.

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[47] Note that results are quite robust to various important changes in specification. First, players below the age of 16 have been excluded. Second, cup winners have been excluded. Third, becoming a professional has been restricted (instead of one) to at least ten cumulated appearances in three consecutive seasons after the first debut (with special treatment of substitute goalkeepers). Fourth, players exited the risk pool already at age 23, the official end of internationally defined youth age groups.

Table 4.6: Cox CRM Estimates for Debuts in Bundesliga and 2. Bundesliga Only.

VARIABLES	(M3) Cox CRM Bundesliga, 2. Bundesliga Pro Home Club	(M3) Cox CRM Bundesliga, 2. Bundesliga Pro Other Club	(M4) COX CRM Bundesliga, 2. Bundesliga Pro Home Club	(M4) COX CRM Bundesliga, 2. Bundesliga Pro Other Club
Age (Months)	1.822**	1.382*	1.839**	1.385*
	(0.484)	(0.271)	(0.490)	(0.272)
Age2 (Months)	0.999**	0.999	0.999**	0.999
	(0.001)	(0.000)	(0.001)	(0.000)
Not Last U19 Year	0.758	2.837**	0.727	2.842**
	(0.361)	(1.503)	(0.344)	(1.506)
Height (cm)	1.092***	1.060**	1.095***	1.061**
	(0.029)	(0.028)	(0.029)	(0.028)
Goalkeeper	Ref. Cat.	Ref. Cat.	Ref. Cat.	Ref. Cat.
	-	-	-	-
Defender	1.703	1.925	1.831	1.943
	(0.852)	(1.128)	(0.919)	(1.137)
Midfielder	1.600	1.479	1.682	1.491
	(0.842)	(0.890)	(0.884)	(0.897)
Forward	1.553	2.233	1.760	2.273
	(0.889)	(1.473)	(1.010)	(1.489)
Youth Titles	1.633	2.966**	1.178	2.911*
	(1.014)	(1.621)	(0.712)	(1.625)
Competition (1=League)	0.692	2.026*	0.826	2.058**
	(0.245)	(0.743)	(0.254)	(0.741)
Pro Team U23-Players	1.018	1.038	1.019	1.040
	(0.052)	(0.049)	(0.051)	(0.048)
DFB/DFL Effect	1.068	1.014		
	(0.058)	(0.067)		
U19 Success Germany			1.608*	1.014
			(0.456)	(0.310)
Player-Year Observations	1,404		1,404	
Subjects (Players)	270		270	
Failures	100		100	
Log-Likelihood	-497.0		-496.4	
Chi2	45.3		46.6	
Age Peak (Years)	18.1	25.2	18.0	25.2

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.
Source: Own calculations.

In other words, in case the player does not debut with his home club right after winning the title he will most likely not make it at all with this club. Then, his career takes on a quite different path. In fact, the relationship between age and career success for players debuting with another but their home club needs to be interpreted linearly when considering significance levels.[48] Here, the probability to succeed increases every year between 24.2% and 27.2% in models 1 and 2 and around 35% in models 3 and 4. This upward-sloping age-debut profile for players who debut at another but their home club is comparable to the downward-sloping age-exit profile that Frick et al. (2007) find in their analysis of players exiting the Bundesliga. When examining the quadratic age function for this risk type despite a not significant the squared term of age, the maximum turning point in models 1 and 2 is at approximately 31.2 years and in models 3 and 4 at approximately 25.2 years. This result is also in line with the descriptive analysis carried out in figure 4.3 where the last debut with a home club is made no later than five years after winning the title compared to ten years for players debuting with another club. With professional careers rarely exceeding the age of 35 (Frick et al. 2007) the age-debut profile in models 1 and 2 is clearly linear. However, debuts may only happen so late because of the introduction of 3. Liga in 2008/2009. Indeed, only six players make their debut after turning 25 and all five of them debut in 3. Liga. Hence, the age-debut profile for players not debuting with their home club of models 3 and 4 seems to be the more realistic one.

As discussed already, there is a striking difference in age-debut profiles between players becoming a professional with their home club and players becoming a professional with another club. This contrast leads to the conclusion that career paths of the two groups are completely different. On the one hand, a club's private information about a player, that induces the club to expect an outstanding performance in the professional setting, strongly supports a quick start of the player's professional career with this club. Since these clubs are established Bundesliga clubs, this means that the players do not only debut directly but do so in high divisions. On the other hand, a club's expectation prohibiting a debut with the home club implies a career start in minor divisions working the way up eventually through late performance shocks or through the respective club's promotion into a professional setting. This means that the player who does not make it at his home club moves to a club whose professional team performs weaker than the one of his home club. In other words, a non-exercised option by the home club is a clear signal to the competition, making private information of the home club publicly

[48] Note that the z-values of 1.31 in model 1 and of 1.45 in model 2 of the age variables are close to significance for debuts with another club while this is not the case for the respective squared terms of age.

available. This signal impacts decisions of labor market participants as these players do not directly start at the top level of professional football (Spence 1973). Some continuously work their way up. Others do not debut at all. This underlines that the call option is clearly with the employer and not with the worker since it may well be assumed that players want to make the debut as fast and as high as possible.

However, the negative signal of the non-executed option seems to be diminished by winning the title early and by winning it in DFB-U19-Bundesliga rather than in DFB-Youth-Cup as three covariates discussed in the following indicate. First, if the player wins the title already prior to his last year in the U19 age group his chances to debut with another club increase by a factor of 3.1 and 3.2 at the 1% significance level for models 1 and 2 respectively and by a factor of 1.8 at the 5% significance level for models 3 and 4 as the respective hazard rates demonstrate. Here, the home club did not execute the option to promote the player after winning the title. Yet, since the player is still eligible to play in the youth team, this decision does not become public directly. The player has the chance to search for another club during the following U19 season and may hence smoothly transition to the professional level. The difference between hazard rates of models 1 and 2 and models 3 and 4 indicates that winning the U19-title early will almost definitively lead to a debut in either Bundesliga, 2. Bundesliga, or 3. Liga but not to the same extent to a debut in Bundesliga and 2. Bundesliga.[49] Second, winning the U19-title early also offers to win another U19-title in the following seasons. In fact, players that were part of several, very successful teams and for some reasons did not debut with their home club have high chances to debut with another club. The hazard to debut in Bundesliga, 2. Bundesliga, or 3. Liga increases with the number of titles won by a factor of 1.3 at the 10% significance level (model 1) and by a factor 2.0 at the 5% significance level (model 2). The hazard to debut in Bundesliga or 2. Bundesliga only similarly increases per title won by a factor of 2.0 at the 5% significance level (model 3) and a factor of 1.9 at the 10% significance level (model 4).

[49] With regard to age groups, i.e. maturity of the observed players, a strand of literature needs to be mentioned that analyzes the impact of cut-off dates for age groups in youth sports (see Deutscher 2010 for a recent analysis in German Bundesliga football). Evidence shows that athletes that were born close to a cut-off date are overrepresented in the sports' professional teams. It is argued that these athletes have particular physical advantages in earlier years of their childhood and youth over their rivals that were born relatively later to the cut-off date. However, including a variable measuring the days between DFB's cut-off date January 1st and the respective birthdate did not produce significant results.

It seems that such players leverage the youth team's reputation rather than their own reputation to become a professional since the youth team was very successful but the player did not manage to debut with the home club, i.e. in Bundesliga rather than in 2. Bundesliga or 3. Liga (see table 4.3). Third, winning the U19-title in DFB-U19-Bundesliga increases the hazard to debut between a factor of 1.0 to 1.3 across models mostly at the 5% significance level. Since the players observed in this chapter are all winners of either the DFB-Youth-Cup or the DFB-U19-Bundesliga one can assume that all of them are extraordinarily talented. Nevertheless, it seems that the league title is more prestigious than the cup title (see Szymanski 2001 for a comparison of league and cup competitions in professional football in the UK). Indeed, the winning DFB-U19-Bundesliga is a stronger public signal than winning the DFB-Youth-Cup. Interestingly, neither winning the title prior to the last U19 year, nor winning multiple titles, nor winning the league instead of the cup impacts the hazard to debut with the home club. This emphasizes that the home club uses some other, more valuable private information to evaluate a player's potential that is not publicly available.

Perhaps surprisingly, the hazard rate of the number of U23-players employed in the home club's professional team is larger than one but is not significant in most models. One may have expected that it gets more difficult for players to become professionals if their home teams have already many young players employed. Yet, results show a tendency that youth players benefit from a young average age of the professional team. One may conclude that clubs with many U23-players on their roster sign even more such players since these clubs follow a strategy focusing on young talent, a strategy that is often followed due to financial restrictions (see e.g. the development of VfB Stuttgart, Borussia Dortmund, or FC Schalke 04 in the past decade). With a different risk type given, results of model 2 need to be interpreted differently. Here, the hazard rate for the Pro Team U23-Players variable is larger than one at the 5% significance level for players debuting with another but their home club. With each U23-player employed in the home club's professional team the hazard to debut with another club increases by 8.4%. Again, the fact that the home club has already employed many U23-players diminishes the negative impact of the signal that the home club did not execute the option to promote the player. The agents in the labor market seem to judge it more difficult for a player to debut with a team with many U23-players in the roster.

However, it is not so. The hazard rate of the U23-player variable in model 3 regressed on debuting with the home club is insignificant. Hence, the home club rather uses private information about the player to make a judgment, independently from possibly having a set number of U23 slots in the roster.

Evidence of the DFB/DFL effect from the estimations is not robust. Models 1 and 2 reveal that each additional year that passes increases the chance to become a professional in Bundesliga, 2. Bundesliga, and 3. Liga between 13% to 18%. These results hold equally for both risk types. Moreover, including the number of U23-players reduces impact and significance of these results as expected since the number of U23-players in, for example, the Bundesliga has increased steadily over time (see figure 4.2). When excluding debuts in 3. Liga, however, the linear time trend is no longer significant (model 3). As table 4.3 and figure 4.3 indicate, the players who debut in Bundesliga and 2. Bundesliga are primarily the players who debut with their home club. Hence, these players seem to be the top group out of the U19 champions since the club executes the option to promote the player based on the private information available. Presumably, such players become professionals regardless of the characteristics of the existing institutional setup. For the complete population of U19 players in Germany, this may well be different. Model 4 includes the success of the German U19 national team instead of the linear time trend. Actually, stronger U19 classes seem to benefit from their experience in the national team and see the hazard increase by approximately 60% at the 10% significance level. Yet, this result is to be interpreted with caution since many youth players debut for the U19 national team after having debuted in Bundesliga or 2. Bundesliga. Unfortunately, very limited data on U19 caps, i.e. games played in the national team, are available but these data show that out of 88 players in the dataset that have been capped in the U19 national team during their career only 12 have been capped prior to debuting in Bundesliga or 2. Bundesliga.

Across all models, height has a positive and significant effect on becoming a professional. However, this effect is larger for debuting with the home club than for debuting with another club. One centimeter in height increases chances to debut with the home club by approximately 9% to 10% at the 1% significance level whereas the same change in height only increases chances to debut with another club by 4% to 6% at the 5% significance level. Physical strength, proxied by height, hence seems to be of particular advantage for establishing oneself in the Bundesliga as most home club debuts occur in Germany's top division. For lower divisions, a young player's physical strength is not as important. The findings around height are especially interesting because in the professional football player's labor market height or weight turn out to always be insignificant when explaining salaries, transfer fees, or career length (Frick 2007, chapter 3). Consequently, physical strength is important for making the transition from youth teams to professional teams but becomes irrelevant afterwards.

Positional dummies are insignificant throughout all four models. Yet, this may only be interpreted with caution, given the selective nature of the dataset. 54 professional teams across Bundesliga, 2. Bundesliga, and 3. Liga search for the respective U19 champions. Because of this large set of possible engagements, it seems obvious that the position of the U19 champion on the pitch is not a distinctive determinant of his career success. This may be different for the overall population of U19 players in Germany.

4.7 Summary and Implications for Further Research

In this chapter career success of U19 football champions has been analyzed covering the period from 1998/1999 to 2009/2010. Duration analysis, more specifically semi-parametric models proposed by Cox (1972), has been applied to explore the determinants of the event of becoming a professional football player. Findings reveal major differences between becoming a professional with the home club and becoming a professional with another club and hence give an important implication of Lazear's (1995) risky worker theory.

Key differences in career development have been found by competing risk models differentiating between players who debut with their home club and players who debut with another club. Home clubs by running the youth academies and youth teams possess private information about a player's performance. Following Lazear (1995), the home club has the option to either promote the player after his time in the youth club, i.e. a certain probation period, or not. Whether or not this option is executed has large impact on the youth player's career since a non-executed option is a signal to the labor market (Spence 1973). In fact, the private information that the player is not judged capable to perform in the home club's professional team becomes publicly available when the player is not promoted. As a consequence, these players debut significantly later and with a less successful club or do not debut at all. Interestingly, the impact of the non-executed option is less negative for players that win the youth title early in their career or win even multiple titles. This information seems to be another signal to the labor market, demonstrating a player's ability to perform well in professional football.

Evidence around the impact of DFB/DFL's recent institutional changes in German football is not robust. Clearly, the impact of the introduction of 3. Liga has a positive effect on youth players' career success. Other institutional changes, however, do not seem to impact this selective sample of U19 players. This may well be different for the complete population of U19 players in Germany.

Hence, it is difficult to make generalized statements at this point, mainly because of the selective nature of the U19 players in the sample and because of the lack of player performance data, prohibiting a more direct operationalization of talent. Clearly, the option value of these risky workers needs to be explored further. Larger datasets eventually coming from DFB/DFL, Foot PASS Germany, or the football clubs themselves are urgently required to further develop this field of research.

5 Human Capital, Personnel Turnover, and Team Performance: Evidence from German Bundesliga Football

5.1 Introduction

Personnel turnover is a common phenomenon in the football player's labor market. In the Bundesliga, Germany's top division in association football, average contract length is only approximately three years (Huebl and Swieter 2002, Feess et al. 2004). Moreover, analyses of spells, i.e. uninterrupted player-year observations in the Bundesliga by Frick et al. (2007) disclose that approximately 46% of all spells last only one season. For players, mobility in association football is facilitated by the transfer market where not only free agents may switch teams but also players with effective contracts are eligible to be traded for cash. Compared to American team sports, this is a unique feature of European football since draft systems and player for player exchanges dominate trade patterns in the US (see Hoehn and Szymanski 1999 for a discussion of the differences between US and European systems in professional team sports).

In association football, managing turnover constitutes a top management task. This task is handled by the team's head coach as well as the club's top management including the team manager, the Chief Financial Officer (CFO), and the Chief Executive Officer (CEO) (Göke and Wirkes 2010).[50] Hence, players, head coach, and top management are a club's key stocks of human capital. On the basis of the seminal works of Becker (1962 and 1993), human capital is defined as the set of skills and abilities that the individual accumulates over time. These skills and abilities are either general or specific. Whereas general human capital can be transferred to another firm in the industry, specific human capital cannot. Thus, if human capital is specific, turnover creates a challenge for the firm as the firm‘s idiosyncratic needs can no longer be served. With regard to team performance, it is one of the stylized facts in sports economics that human capital of players, if measured by the team's aggregated salary, is a key indicator of team performance (see Forrest and Simmons 2002 and Simmons and Forrest 2004 for empirical works covering multiple European and American leagues, Frick 2005 covering the German Bundesliga or Frick 2012b covering multiple leagues in European

[50] To ease understanding, in the following ‘club’ is used for the organization employing the ‘team’, i.e. the roster of players, the head coach, and the top management.

association football). However, this evidence does not differentiate between general and specific human capital. In addition, research including the human capital of head coaches or top managers as independent variables is rare (see e.g. Barros et al. 2009 for head coaches and Dawson and Dobson 2002 for top managers). Moreover, existing evidence for turnover in association football focuses largely on explaining salaries and transfer fees and not on transfers themselves (see e.g. Frick 2007 for a research overview).

As a consequence, this chapter sets out to empirically investigate how a Bundesliga club's turnover influences team performance while controlling for the existing stock of human capital. Here, a combination of three datasets based on 288 team-season observations covering 16 Bundesliga seasons during the period 1995/1996 to 2010/2011 is used. Moreover, insider knowledge about top management setups of the respective Bundesliga clubs gained by Göke and Wirkes (2010) in 2008 by interviewing 16 key executives in Germany's first and second football division is employed for operationalization of the independent variables. As in other analyses of team performance in professional team sports, fixed-effects models are estimates to control for unobserved team heterogeneity.

This chapter is organized as follows. In section 5.2 human capital and turnover theory is discussed in the context of professional team sports and in section 5.3 the available literature on performance of professional sport teams is reviewed. Section 5.4 presents the dataset and explains the variables. Models and results are discussed in section 5.5. Finally, section 5.6 concludes.

5.2 Human Capital and Turnover in the Context of Professional Team Sports

Human capital theory has been developed on the basis of the seminal works of Becker (1962 and 1993), Mincer (1958), and Schultz (1961). Along these pillars, human capital is defined as the set of skills and abilities that the individual accumulates over time. The key investments an individual makes to acquire these skills and abilities are education and training. Education generally happens prior to the entry of an individual into the labor market whereas training does so thereafter. Training can be defined along the following three dimensions: learning by doing, on- vs. off-the-job training, and formal vs. informal training.

In the context of association football, education may be defined as the accumulation of football skills and abilities prior to the start of a professional career. This education for German football players happens mainly in so-called youth academies run by professional clubs. Training is a major part of a football player's occupation and is hence relevant in all of the above defined dimensions. Learning by doing, then, is the accumulation of human capital in daily practice sessions, practice matches, and competitive matches. On-the-job training appears to be the major source of training that a professional football player experiences since training sessions at his club's premises are his day-to-day occupation. Yet, some off-the-job training may occur when being away for a training camp or when joining the national team for a certain period of time. Formal training sessions are conducted by specific coaches whereas informal training may occur when best practices are exchanged among colleagues.

The acquired human capital is assumed to raise a worker's productivity and may consequently lead to higher wages from a worker's perspective and to higher profits from a firm's perspective, or higher utility from a football club's perspective (Sloane 1971). In fact, Feess et al. (2004) argue for example that a productivity shock of a player may result in a transfer to adapt both the club's and the player's rents. Assuming a positive productivity shock, these rents are distributed by a transfer fee to the selling club and by a higher compensation to the player, compared to his existing contract. However, in this context, it is important to distinguish between general and firm specific human capital. Key difference between the two is that general human capital is equally valuable in all clubs while specific human capital is only valuable at the club where it has been acquired. In professional team sports, general human capital of players may be seen as their innate ability to perform on the pitch or any physical abilities such as speed or endurance that can be trained. A player's team specific human capital in this context refers to knowledge of e.g. running paths or other coordination and cooperation mechanisms within the team (see Alchian and Demsetz 1972 for a discussion of team productivity). Clearly, such team specific human capital cannot be transferred to another team.

In practice, training does most likely serve both types of human capital as it is for example hard to imagine training leading to an accumulation of purely specific human capital. With regard to turnover, however, it is to some extent possible to distinguish between the two. If, on the one hand, the employed human capital is rather team specific, turnover creates a challenge for the club as the club‘s idiosyncratic needs can no longer be served. Frick and Prinz (2005) find that, when team specific human capital is important, prolonging a contract is the best option for a player since the current club will compensate for general and team specific human capital while a new club would only compensate for the former. Then, both the club and the player are interested in employment stability. Moreover, this reasoning again underlines that salaries compensate for the player’s general and team specific human capital. Yet, if on the other hand, human capital is rather general, lost skills and abilities due to turnover can easily be reestablished in the transfer market. In this case, turnover helps the firm to facilitate sorting in order to find the most talented employees. In such a job market turnover is expected to be high as market participants frequently adapt to new information.

An important aspect relevant in the context of turnover in professional team sports is the functioning of the player transfer market. This market provides a unique governance mechanism of job-to-job transitions not known from other labor markets. Here, team managers, head coaches, players, and player agents meet to realize player transfers along standardized rules. One such rule is the clear definition of time frames in which transfers are to take place, so-called transfer windows. Generally, one pre-season window exists in the summer and one in-season window in the winter.

Trading in Europe’s player transfer market has been liberalized since 1995 by the so-called Bosman-ruling of the European High Court (Court of Justice of the European Communities 1995). Prior to this ruling, any player’s change of clubs had to be associated with a cash payment, the so-called transfer fee, from the player’s new club to the former club. This was even the case when the player’s contract had already expired. The Bosman-ruling changed this practice allowing clubs to sign players for free when they are free of contractual obligations, i.e. a ‘free agent’. In line with this liberalization, the number of foreign players eligible to be taken to the field in a team’s match was extended by the Union of European Football Associations (UEFA), association’s football governing body in Europe. From the 1996/1997 season onwards, restrictions on the employment of foreigners from UEFA countries were withdrawn and the number of non-UEFA foreigners eligible to play in a match was set to three. The latter regulation was further relaxed to five in the 2001/2002 season. Turnover of head coaches and turnover of top managers in football clubs are not facilitated by such a transfer market.[51] However, supply on these markets for such delicate positions is very limited (Frick and Simmons 2008).

5.3 Previous Evidence in Professional Team Sports

It is one of the stylized facts in sports economics that human capital of players is a key prerequisite of team performance in professional sports. Mostly, team wage bills, i.e. aggregated salary measures, are used as proxies for human capital. Forrest and Simmons (2002) analyze the three top divisions in German, English, and Italian association football as well as the four American Major Leagues football (NFL), ice hockey (NHL), basketball (NBA), and baseball (MLB) to conclude that team wage bills significantly predict team performance. The authors again investigate the respective leagues with better data availability to find clear evidence that better spending on team wage bills relative to competing teams leads to higher team performance measured by teams' winning percentages (Simmons and Forrest 2004). Additionally, they find that the explanatory power of this covariate is more important in the less regulated European football leagues than in the American major leagues. On a similar note, Hall et al. (2002) analyze the link between team wage bills and performance for MLB and English football with a focus on causality. Their Granger causality tests reveal that in England's first football division, causality from higher wage bills to better performance cannot be rejected – opposed to results for the MLB. The authors explain this difference in line with Simmons and Forrest (2004) with fewer transfer restrictions in English football compared to Major League Baseball.

A recent and comprehensive analysis is carried out by Frick (2012b). The author analyzes pay and performance for 13 European leagues during the three seasons 2006/2007, 2008/2009, and 2010/2011 to find clear evidence that money pays out. The explanatory power is in fact extremely high with an r-squared of more than 80% by including in the regressions only league dummies next to the relative team wage bill. Furthermore, the author finds a similar relationship for three German divisions,

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[51] As a consequence, player turnover may happen pre- and midseason only and head coach turnover may happen at any time during the season. To ease understanding all turnover that happens during the season is referred to as in-season regardless of whether it occurred exactly midseason or not.

including also second and third division in addition to Bundesliga. For the German Bundesliga alone, Lehmann and Weigand (1997) find a positive effect of team salaries on performance for a 15 season period between 1981/1982 and 1995/1996. Frick (2005) enlarges the scope of analysis by including head coach salaries next to the ones of players. He finds that the stocks of both player and head coach human capital have a positive and significant effect on team performance. Further research is contributed by Franck et al. (2011) who distinguish between general and specific human capital of players when analyzing match-level data of six Bundesliga seasons from 2001/2002 to 2006/2007. The authors measure general human capital by market value and specific human capital by the number of league games the player has played with the respective team. For their match-level analysis, the latter variable is averaged for each team per player. Results demonstrate that specific human capital positively impacts team performance, however, at a decreasing rate. Moreover, consistent with previous research, market value also positively impacts team performance.

Despite extensive human capital research, evidence of the impact of turnover is rather limited. Frick (2002) investigates the impact of turnover in the NBA for ten seasons between 1990/1991 and 1999/2000. Controlling for team wage bills, he finds that the proportion of stayers, i.e. players that neither move to another team nor drop out of the NBA between seasons, has a positive effect on team performance. Results are almost identical when the proxy for roster stability is the pure number of stayers or the number of stayers weighted by playing time. The author consequently concludes that a player's specific human capital is of value to the team even when this player is only a substitute, or a sparring partner in training sessions.[52] For German Bundesliga football, Golla (2002) finds in his monograph that the number of departing and arriving players, though, has no impact on team performance. Only when weighting turnover by player experience measured in career league appearances or international career caps,[53] results demonstrate a positive link between roster stability and team performance. However, due to the observation period of 32 seasons from 1963/64 to 1994/95, the author cannot control for team market value as for this time period no such data are available. Thus, he cannot separate effects of the stock of human capital from the effects of turnover of

[52] This analysis is comprehensively extended by Frick and Prinz (2005) regarding contract and career length.
[53] International caps are appearances for the national team.

human capital. In addition, the study does not differentiate between timing of transfers, i.e. pre- and in-season transfers, which may have different consequences.

Apart from the above stated analyses of team performance that generally apply Ordinary Least Square (OLS) or fixed-effects methods for estimation, another strand of literature is relevant in the present research context. In this field, research focuses on the link between managerial efficiency and team performance. Here, stochastic frontier analysis (SFA) and data envelopment analysis (DEA) are applied. Dawson and Dobson (2002) analyze the relationship between efficiency of team managers and team performance in English football. They distinguish between general and specific human capital, measured by months of management experience at any club and months of management experience at the current club respectively. SFA results exhibit that only general experience impacts efficiency. For Bundesliga football, the monographs by Dockter (2002) and Fritz (2006) both argue for stability on roster and head coach positions in order to accumulate team specific human capital. Dockter (2002) examines recruiting patterns of Bundesliga teams for six seasons starting in 1991/1992 with DEA. He differentiates departed and signed players by their importance for the team. In fact, the author sets thresholds of appearances per season to identify whether the player has a key role in the roster as a starter, is a substitute or is merely a sparring partner in training sessions. Results show that recruiting patterns with rather stable rosters positively influence efficiency. So does stability on the head coach position. Fritz (2006) applies SFA to a six season dataset from 1997/1998 to 2002/2003 and comes to similar results. In a recent SFA Frick and Simmons (2008) analyze technical efficiency in Bundesliga football for 22 seasons from 1981/1982 to 2002/2003. They make use of player and head coach salary data to find that both team wage bills and head coach salaries positively impact a team's efficiency.

In summary, clear evidence seems to exist for a positive link between the stock of player human capital and team performance. Nevertheless, evidence isolating the separate effect of general and specific human capital of players is rare. Furthermore, only few studies include the human capital of head coaches and top managers. A similar picture is revealed for research focusing on turnover. Hence, the work of the present chapter sets out to contribute to this field in a comprehensive way.

5.4 Data, Key Levels, and Variables Relevant for Analyzing Team Performance

5.4.1 Data

To analyze the effects of human capital and turnover in Germany's top division in association football, three datasets have been compiled. First, various issues of Kicker Sportmagazin, the leading sports newspaper in Germany, have been used to consistently assemble a dataset with player data from 1995/1996 to 2010/2011. The dataset contains 8,481 player-season observations with player characteristics and performance data. Since the respective player-team relationship is also available, the dataset consequently provides information about a player's career on a yearly basis. The observation period starts in 1995 since in this year Kicker Sportmagazin published player market values for the first time in its yearly pre-season special issue.[54] Consequently, the dataset begins one year prior to the 1996/1997 season when the Bosman-ruling became effective, allowing for stable transfer rules during the observation period.

In order to be able to analyze player turnover, a second dataset has been compiled from www.transfermarkt.de, a German website specialized on documenting player transfers. It covers all transfers involving the German Bundesliga from the pre-season transfer window of the 1995/1996 season to the in-season transfer window of the 2010/2011 season. However, not all of these 5,722 transfers are relevant transfers in the present research context. In fact, players are sometimes traded more than once in one transfer window (see in table D.1 in the appendix for an example). This is particularly relevant for players on loans, i.e. temporary transfers ending in a return to the former club. Here, it is often the case that the club that loaned the player sells or re-loans the player directly after his return. These transfers do not impact the team's stock of human capital and are thus excluded from the turnover analysis. Information from the player-season observations of the first dataset was added to the remaining transfer data, resulting in complete data for 5,489 transfers.

[54] In general, the market values mentioned are published to serve Kicker Sportmagazin's virtual fantasy game in which users act as team managers. Thus, the fantasy game's monetary values may not exactly correspond to real-world values – an important fact when interpreting results. However, using these data as proxies for market value is adequate as analyses of Torgler and Schmidt (2007) that compare Kicker Sportmagazin data with market values from www.transfermarkt.de demonstrate. Both sources have been used in several previous studies (e.g. Fritz 2006, Torgler and Schmidt 2007, Franck and Nüesch 2011, Bryson et al. 2012, or Frick 2012b).

Nevertheless, these two datasets are only of preparative purpose since the basis of the present analysis is a team dataset. A panel of 288 team-season observations for the period stated above has been collected from Kicker Sportmagazin with team performance data as well as data on head coach and top management experience and turnover. Player data from the above described datasets have been integrated into this third dataset. It is important to note that, opposed to American team sports, leagues in association football are open. This means that within the division hierarchy of a national football association, a team may be relegated or promoted. In Germany's top division up to three teams are relegated each season and replaced by the same number of promoted teams from second division. Hence, the observed panel is unbalanced and in total 31 teams are observed.[55]

5.4.2 Key Levels

In this chapter, we distinguish three "key levels" in a professional sport club to capture its stock of human capital: the roster of players, the head coach, and top management. Whereas the first two levels are straight-forward, the definition of top management needs to be further elaborated since organizational structures of Bundesliga clubs are often quite complex (see Lehmann and Weigand 2002 and Franck 2010 for a discussion of corporate governance). This is mainly due to two reasons. On the one hand, Bundesliga clubs have been founded as member's associations, i.e. without a legal structure adequate to small and medium sized businesses. On the other hand, association football in Germany has become an important business impacting Germany's gross domestic product by about 5 Billion Euro (DFL Deutsche Fußball Liga GmbH 2010c). In such an industry, organizational structures offering limited liability to decision makers are clearly needed. Hence, several legal entities such as limited and public companies exist in a club's organization. To all intents and purposes, these companies run the business. However, with the aim to preserve club tradition and to prevent investors from gaining power over Bundesliga clubs the German football clubs have set out the so-called '50+1 rule' (Die Liga – Fussballverband e.V. (Ligaverband) 2001).[56] This rule stipulates that the member's association as legal entity has to hold more than

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[55] In a balanced panel, i.e. a closed league environment, only 18 teams would have been observed.

[56] Note that Germany's first and second division of professional football is operated by DFL Deutsche Fußball Liga Gmbh (DFL), a limited liability corporation owned by Die Liga – Fussballverband e.V. (Ligaverband), the union of German professional football clubs.

50% of club's shares. Otherwise, the club's team is not eligible to compete in the Bundesliga. This requirement in combination with the business need to limit liability leads to a potpourri of legal entities with numerous executive and supervisory boards within a club's organization. Moreover, despite legal constraints, representatives in supervisory boards sometimes also have virtual executive power since they are key investors for the club. Although it is important to note that variation in governance does not explain team performance (Frick 2012b), it is difficult to identify the relevant top managers in a Bundesliga club without insider knowledge given the sometimes complex governance.

In their study of current management practices in professional team sports in Germany, Göke and Wirkes (2010) identify three key executives in a club's organizational structure: the executive managing the club's team of coaches and players, the executive running the club's finances, and the executive heading the executive team. The authors base their reasoning on results from expert interviews with top managers from 16 clubs in Germany's first and second football division conducted in 2008. Leveraging these interviews plus eight more interviews conducted by the author in 2011, provided the opportunity to identify the relevant individuals for the three respective positions among the 288 team-season observations of the unbalanced panel at hand. The identification was supported by various issues of Kicker Sportmagazin's pre-season special issue. To ease understanding, the three executives will be called team manager, CFO, and CEO in the following discussion.[57]

[57] Note that while roster size may vary considerably only one head coach and three top managers entered the analysis.

Table 5.1: Variable Description.

Variable	Description	Type
Lnrank	Final league rank, i.e. after 34 games	Dependent
Lnrank1stleg	League rank for 1st leg, i.e. after first 17 games	Dependent
Lnrank2ndleg	League rank for 2nd leg, i.e. after second 17 games	Dependent
Winpercent	Final winning percentage, i.e. after 34 games	Dependent
Player Rel MV	Sum of team roster market value[+]	GENHC
Player Rel BL-App Team	Team roster league appearances per player[++]	SPECHC
Departures Pre	No. of departing players during pre-season	PRETURN
Departures In	No. of departing players in-season	INTURN
Signings Pre	No. of signed players during pre-season	PRETURN
Signings In	No. of signed players in-season	INTURN
Departures Pre Fee	Sum of club’s pre-season transfer fee income [Mn EUR]	PRETURN
Departures In Fee	Sum of club’s in-sea. transfer fee income [Mn EUR]	INTURN
Signings Pre Fee	Sum of club’s pre-sea. transfer fees invested [Mn EUR]	PRETURN
Signings In Fee	Sum of club’s in-season transfer fees invested [Mn EUR]	INTURN
Departures Pre MV	Sum of pre-season departures’ market value [Mn EUR]	PRETURN
Departures In MV	Sum of in-season departures’ market value [Mn EUR]	INTURN
Signings Pre MV	Sum of pre-season signings’ market value [Mn EUR]	PRETURN
Signings In MV	Sum of in-season signings’ market value [Mn EUR]	INTURN
Coach Rel BL-Games Career	Career coaching experience in league games[+]	GENHC
Coach Rel BL-Games Team	Team specific coaching experience in league games[+]	SPECHC
Coach Turn Pre	Head coach turnover prior to the season	PRETURN
Coach Turn In	Head coach turnover during the season	INTURN
Mgt Prev BL Career	Previous playing and/or coaching experience of mgt team	GENHC
Mgt Rel BL-Exp Team	Aggregate tenure of management team[+]	SPECHC
Mgt Turn Pre	One if team manager, CFO, or CEO has been replaced	PRETURN
Roster	Size of team roster	CONT
Fairplay	Fair play value based on weighted cards	CONT

Note: [+]denotes centered variables. [++] denotes centered and at 170 games capped variables. The column ‘Type’ refers to the vectors defined in the general equation in section 5.5.

Source: Own illustration.

Table 5.2: Summary Statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Lnrank	288	0.000	1.475	-2.890	2.890
Lnrank1stleg	288	0.000	1.475	-2.890	2.890
Lnrank2ndleg	288	0.000	1.475	-2.890	2.890
Winpercent	288	0.457	0.123	0.176	0.765
Player Rel MV	288	1.000	0.436	0.350	2.520
Player Rel BL-App Team	288	1.000	0.623	0.000	2.660
Departures Pre	288	7.639	2.922	0.000	21.000
Departures In	288	2.240	1.641	0.000	7.000
Signings Pre	288	8.340	2.765	2.000	18.000
Signings In	288	1.948	1.632	0.000	10.000
Departures Pre Fee	288	3.770	5.827	0.000	35.000
Departures In Fee	288	0.757	2.926	0.000	37.300
Signings Pre Fee	288	5.985	9.096	0.000	76.200
Signings In Fee	288	1.181	2.653	0.000	19.250
Departures Pre MV	288	6.851	5.556	0.000	33.600
Departures In MV	288	2.471	2.723	0.000	16.100
Signings Pre MV	288	9.420	6.679	0.256	51.700
Signings In MV	288	1.898	2.368	0.000	12.015
Coach Rel BL-Games Career	288	1.000	1.022	0.000	5.300
Coach Rel BL-Games Team	288	1.000	1.429	0.000	8.860
Coach Turn Pre	288	0.177	-	0.000	1.000
Coach Turn In	288	0.472	0.708	0.000	3.000
Mgt Prev BL Career	288	185.559	202.785	0.000	691.000
Mgt Rel BL-Exp Team	288	1.000	0.913	0.000	4.320
Mgt Turn Pre	288	0.392	-	0.000	1.000
Roster	288	29.451	3.210	22.000	40.000
Fairplay	288	81.483	15.367	42.000	128.000

Source: Own calculations.

5.4.3 Variables

The following section presents the variables used in the regressions presented in section 5.5. To provide further guidance, table 5.1 gives a short description of the dependent and independent variables and table 5.2 summarizes the relevant descriptive statistics.

5.4.3.1 Team Performance. In association football teams compete in a league system. Final goal is to achieve the best league standing possible, i.e. to minimize the league rank at the end of the season. Following Szymanski and Smith (1997) league rank is transformed by the expression -ln(rank/(n+1-rank)), where n denotes the number of teams in the league system. By this transformation it is possible to account for league rank differences more effectively compared to employing just the pure rank number since higher absolute values are linked to ranks at the bottom and at the top of the league (see figure B.2 in the appendix).[58] This comes close to reality since top teams may qualify for international competitions and teams finishing last face relegation. Apart from final standings, league rank is also measured for the first 17 games of the season, the first leg, and for the second 17 games of the season, the second leg, in order to present robust results.

An alternative specification is team winning percentage. Yet, in two seasons identical winning percentages may correspond to different league ranks since league standing are relative to the performance of competing teams. Nevertheless, results are almost identical and will be reported for some regressions as a comparison.

5.4.3.2 General Human Capital. The best approximation for general human capital is its value in the labor market. This market value is per definition relevant for all market participants and includes expectations in the human resource's future performance. Hence, indicated for players market value is used to measure general human capital. For head coaches and top managers, such market values unfortunately do not exist. For head coaches, the best alternative is experience measured by the number of Bundesliga games coached prior to the season's start.[59] For top managers, experience in league

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[58] For example, the season's champion with rank equal to 1 receives a transformed league rank of +2.89 and the team finishing last with rank equal to 18 receives a transformed league rank of -2.89.

[59] Note that in this chapter the labor market is defined only for Bundesliga, Germany's top division in association football. Thus, experience gained in lower divisions or abroad is not taken into account. Moreover, variables are measured at the beginning of the season after the preparatory period of the

games as a player and head coach combined is used.[60] Note that the CEO, CFO, and team manager values are added to form the top management variable.

Since competition in a league tournament is for league positions, relative measures are more adequate than absolute ones. This is particularly true for market values since the Euro value of players has increased steadily over the years as a consequence of a positional rat race (Akerlof 1976). Thus, variables have been centered per season except for previous top management experience of Bundesliga games since 126 out of the 288 management-team-season observations are for managers that do not possess such previous Bundesliga experience. Overall, the three variables intended to measure general human capital of players, head coaches, and management teams are the relative market value of the players on the team's roster, the relative number of Bundesliga games coached by the head coach, and the number of Bundesliga games played and/or coached of the top management team respectively.

5.4.3.3 Team Specific Human Capital. Measuring team specific human capital is a challenge even in a very transparent labor market like the one of association football (see Kahn 2000 for a view on data availability in team sports). No measures that incorporate future expectations regarding an individual's performance exist. Therefore, team specific experience, i.e. experience accumulated during the current relationship with the team, is used.[61] For players and head coaches, team specific experience is operationalized by the total number of Bundesliga games played or coached respectively. Table 5.3 provides an example of a player's Bundesliga career including the general and team specific experience accumulated over time. The sum of a team's specific experience of players is divided by roster size following Franck et al. (2011) since only a limited number of players can perform on the pitch during a game.

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clubs. At this time, the pre-season transfer window will last approximately another four weeks but the majority of summer transfers has taken place.

60 This measure is clearly more relevant for the team manager than for the CFO or the CEO. Hence, as an alternative, years of experience in managing a Bundesliga club has been used. However, results were insignificant.

61 Note that these player-team relationships are defined for Bundesliga participation only and may thus be interrupted by relegation. After relegation, specific human capital is reset to zero. This seems reasonable even when the team is promoted directly in the next season since high turnover of head coaches and players is common after relegation. This is mainly due to the fact that head coaches and players only have valid contracts for Bundesliga, i.e. may leave the team without a transfer fee after relegation which is again due to the fact that salaries are generally cut after relegations since clubs' budgets considerably decrease following that event.

Moreover, a player's team specific Bundesliga appearances have been capped at 170, i.e. at a value equivalent to five full seasons, to prevent biased estimates driven by outliers. For example, counting the team specific experience of Borussia Dortmund's veteran Michael Zorc alone would have already ranked the team higher than six other teams in Zorc's last season of his 19 year career that he spend only at Borussia Dortmund.

Table 5.3: Career and Team Specific League Appearances.

Name	Season	Team	Career League Appearances	Team Specific League Appearances	Player-Team Relationship
Torsten Frings	1996/1997	SV Werder Bremen	0	0	A
Torsten Frings	1997/1998	SV Werder Bremen	15	15	A
Torsten Frings	1998/1999	SV Werder Bremen	43	43	A
Torsten Frings	1999/2000	SV Werder Bremen	66	66	A
Torsten Frings	2000/2001	SV Werder Bremen	99	99	A
Torsten Frings	2001/2002	SV Werder Bremen	129	129	A
Torsten Frings	2002/2003	Borussia Dortmund	162	0	B
Torsten Frings	2003/2004	Borussia Dortmund	193	31	B
Torsten Frings	2004/2005	Bayern Munich	209	0	C
Torsten Frings	2005/2006	SV Werder Bremen	238	0	D
Torsten Frings	2006/2007	SV Werder Bremen	266	28	D
Torsten Frings	2007/2008	SV Werder Bremen	299	61	D
Torsten Frings	2008/2009	SV Werder Bremen	310	72	D
Torsten Frings	2009/2010	SV Werder Bremen	340	102	D
Torsten Frings	2010/2011	SV Werder Bremen	370	132	D

Source: Own calculations.

Contrary to players and head coaches, Bundesliga games cannot be leveraged for team specific experience of top managers. In fact, all top manager experience from previous careers as players or head coaches has to be declared general when the individual becomes top manager because it is not directly related to his new task. Hence, years of experience at the specific club, i.e. tenure, has to be used. As with general top management human capital, tenure is aggregated over the management team. In total, the team roster's sum of team specific Bundesliga appearances, the team specific

Bundesliga games coached by the head coach, and the management team's aggregated tenure are used to proxy the team specific human capital of the three different levels.[62]

Team specific human capital may be considerably correlated with its general human capital equivalent. This may be particularly true when the same variable, e.g. Bundesliga games, is used to measure both general and specific human capital. Then, only turnover makes the difference between the two since whenever an individual changes clubs, his team specific experience is set to zero but his career experience prevails. The correlation matrix of the three measures of team specific human capital and the three measures of general human capital is presented in table 5.4. Despite using different measures, career and team specific human capital of players are highly correlated at 0.702. Yet, the respective pairs for head coaches and management teams show low correlations. For head coaches the low correlation is clearly caused by high head coach turnover. The low correlation of the variable pair for team managers, however, is driven by the use of two different proxies: previous career experience as a player or head coach for general human capital and tenure for team specific human capital.

Table 5.4: Correlation Matrix for General and Team Specific Human Capital Variables.

	1	**2**	**3**	**4**	**5**	**6**
1 Rel Player Market Value	1.000					
2 Rel Player BL-App Team	0.702	1.000				
3 Rel Coach BL-Games Career	0.296	0.169	1.000			
4 Rel Coach BL-Games Team	0.219	0.320	0.312	1.000		
5 Rel Mgt Prev BL Career Exp	0.502	0.415	0.181	0.096	1.000	
6 Rel Mgt BL-Exp Team	0.730	0.620	0.134	0.232	0.382	1.000

Source: Own calculations.

5.4.3.4 Turnover. Personnel turnover in Bundesliga clubs can occur at different points in time. In fact, pre-season turnover is standard practice in Bundesliga football. Teams practice in a preparatory period of approximately six weeks in which they perform in friendly matches to increase their playing strength prior to a season's start. Evidence

62 Like general human capital variables, these variables are measured at the beginning of the season.

exists, however, that in-season turnover may stand rather for an action on short notice (see e.g. Frick et al. 2010 who find that the probability to be dismissed as a head coach increases significantly when the team has lost the three previous games). Hence, not separating pre- and in-season turnover is likely to lead to biased results.

For players, league rules define two transfer windows in which transfers can take place. In the pre-season window approximately 80% of departures and signings happen whereas only approximately 20% of transfers occur in the in-season window. With the large number of player departures and signings occurring in each transfer window, it seems useful to further differentiate these transfers by their importance. Inspired by Golla (2002) and apart from using the pure number of transfers, player turnover is in one set of models weighted by the sum of transfer fees and in another set of models weighted by the sum in market value.

For head coaches and top managers no such set time windows for changing employers exist. Out of the 288 team-season observations, 107 started into the new season with a new head coach whereas 173 team-season observations changed their head coach at least once during the season. 59 of them changed their head coach more than once employing an interim head coach for at least one match. During the 16 seasons observed, only 135 different individuals, including interim head coaches, were employed as head coaches; a fact that demonstrates the limited supply in this particular labor market.

Turnover in top management occurs less frequently, yet still substantially. Between seasons, 113 teams changed their top management constellation of CEO, CFO, and team manager at least on one position. In total, 157 executives were replaced. However, top management turnover during a season is uncommon and since fewer than 1% of positions have been adapted in-season, this variable will not be used in the models presented in section 4.5. Overall, 243 top managers have been employed as CEO, CFO, or team manager. Out of these individuals, only nine have worked for more than one club. Hence, career moves from one club to another are rare, a fact that is also backed up by results from correlating career experience and tenure at the club. Table 5.5 shows that CEOs and CFOs are more loyal executives than team managers. Correlations between their years of career experience and years of team experience (tenure) are at 0.983, 0.989, and 0.844, respectively.

Table 5.5: Correlation Matrix for Top-Management Human Capital Variables.

	1	2	3	4	5	6
1 Mgr BL-Exp Career	1.000					
2 Mgr BL-Exp Team	0.844	1.000				
3 CFO BL-Exp Career	0.326	0.449	1.000			
4 CFO BL-Exp Team	0.326	0.440	0.989	1.000		
5 CEO BL-Exp Career	0.258	0.342	0.244	0.246	1.000	
6 CEO BL-Exp Team	0.277	0.358	0.260	0.262	0.983	1.000

Source: Own calculations.

5.4.3.5 Controls. Roster size is used as a control variable. Moreover, a team's fair play ranking is used to control for the availability of player human capital on match days. In fact, after accumulating five yellow cards during a season or after being dismissed from the pitch due to a second yellow card during a match, a player cannot appear in the next game. After a straight dismissal (red card) the number of games a player is booked for, i.e. cannot appear in a match, is discussed at a sports court. Results vary generally between three to five games.[63]

5.5 Models and Empirical Results

The unbalanced panel used here contains repeated observations of teams for varying seasons, i.e. for different points in time. As a consequence, model errors are likely to be correlated and it is important to control for unobserved team heterogeneity. This is underlined across almost all models by highly significant Breusch-Pagan Lagrange-Multiplier tests (Breusch and Pagan 1980; see tables 5.7 to 5.10). It is necessary to decide whether this team effect is a random or a fixed effect.[64] Opposed to US sports, where such analyses may be even possible with balanced panels, association football is characterized by an open league system. Depending on their performance, teams are

[63] The fair play ranking is a score that weights yellow cards at 1, dismissals after a second yellow card at 3 and straight dismissals (red cards) at 5.

[64] Another option for estimation is the Pooled Ordinary Least Squares method. Yet, a fixed-effects estimation yields more efficient results given the relatively small sample size. Nevertheless, Pooled OLS results did not considerably differ from the fixed-effects results presented below.

relegated and promoted along the association's division hierarchy. In their team survival analysis for European football Frick and Wallbrecht (2012), in fact, find evidence that the number of relegations negatively impacts team survival, i.e. spurs repeated relegations. This is in line with the existence of so-called yoyo-teams, teams that have been relegated and promoted between divisions multiple times.[65] Clearly, relegation is not completely random and thus fixed-effects models are estimated in the remainder of this chapter. This decision is supported by results from Hausman (1978) tests, strongly rejecting the hypothesis that random-effects estimation provides consistent estimates at the 1% significance level for almost all models (see tables 5.7 to 5.10). As Wooldridge (2010) clarifies, a fixed-effects estimation, however, does not mean that in the related model team effects are treated as non-random but that the model allows for arbitrary dependence between the unobserved heterogeneity and the observed explanatory variables.

Table 5.6: Conceptual Model Overview.

Model	Dependent Variable	General Human Capital	Specific Human Capital	Pre-season Turnover	In-season Turnover	Type of Player Turnover	Controls
1A	Final League Rank	Yes	Yes	Yes	-	No.	Yes
1B	Final League Rank	Yes	Yes	Yes	Yes	No.	Yes
2A	Final League Rank	Yes	-	Yes	-	No.	Yes
2B	Final League Rank	Yes	-	Yes	Yes	No.	Yes
3A	Final Win Percent	Yes	-	Yes	-	No.	Yes
3B	Final Win Percent	Yes	-	Yes	Yes	No.	Yes
4A	Final League Rank	Yes	-	Yes	-	Fees	Yes
4B	Final League Rank	Yes	-	Yes	Yes	Fees	Yes
5A	Final League Rank	Yes	-	Yes	-	Value	Yes
5B	Final League Rank	Yes	-	Yes	Yes	Value	Yes
6A	1st leg League Rank	Yes	-	Yes	-	No.	Yes
6C	2nd leg League Rank	Yes	-	-	Yes	No.	Yes

Source: Own illustration.

65 A similar argument can be made for head coach fixed-effects instead of team fixed-effects.

The estimated equation has the following general form.

$$lnrank = \alpha + \beta\ GENHC + \gamma\ SPECHC + \delta\ PRETURN + \varphi\ INTURN + \omega\ CONT + \varepsilon$$

Where:

- α is a constant
- $GENHC$ is a vector of variables measuring general human capital of players, head coaches, and top managers
- $SPECHC$ is a vector of variables measuring team specific human capital of players, head coaches, and top managers
- $PRETURN$ is a vector of variables measuring pre-season turnover of players, head coaches, and top managers
- $INTURN$ is a vector of variables measuring in-season turnover of players, head coaches, and top managers
- $CONT$ is a vector of additional control variables
- $\beta, \gamma, \delta, \varphi$, and ω are vectors of parameters to be estimated
- ε is a random error term

Table 5.6 provides a conceptual overview of the twelve models estimated for ease of orientation. With regard to turnover variables, a model number's suffix A stands for models including pre-season turnover only, the suffix B indicates that the model includes both pre- and in-season turnover, and the suffix C labels models that include in-season turnover only. Tables 5.7, 5.8, 5.9, and 5.10 summarize results from models 1A and 1B, models 2A to 3B, models 4A to 5B as well as models 6A and 6C, respectively.

Table 5.7: Fixed-Effects Estimates (1).

VARIABLES	(1) M1A Lnrank	(2) M1B Lnrank
Player Rel MV	0.937***	0.980***
	(0.265)	(0.217)
Player Rel BL-App Team	-0.247	-0.219
	(0.172)	(0.163)
Departures Pre	-0.066**	-0.044*
	(0.024)	(0.023)
Signings Pre	0.075***	0.056**
	(0.021)	(0.022)
Departures In		0.051
		(0.047)
Signings In		-0.098**
		(0.041)
Coach Rel BL-Games Career	0.091	0.077
	(0.077)	(0.073)
Coach Rel BL-Games Team	0.011	0.032
	(0.051)	(0.044)
Coach Turn Pre	-0.108	-0.167
	(0.148)	(0.135)
Coach Turn In		-0.514***
		(0.092)
Mgt Prev BL Career	0.001*	0.001**
	(0.000)	(0.000)
Mgt Rel BL-Exp Team	0.047	0.151
	(0.196)	(0.189)
Mgt Turn Pre	0.071	0.095
	(0.171)	(0.150)
Roster	-0.107***	-0.091***
	(0.025)	(0.025)
Fairplay	-0.016***	-0.012***
	(0.004)	(0.004)
Constant	3.303***	2.619***
	(0.890)	(0.836)
Observations	288	288
Adjusted R-Squared	0.565	0.635
Chi2 BP LM Test (Random-Effects)	16.021***	13.506***
Chi2 Hausman Test	56.261***	53.601***
Number of Teams	31	31

Note: Robust standard errors in parentheses (White 1980). Breusch-Pagan Lagrange-Multiplier Test based on equivalent random-effects specification (Breusch and Pagan 1980).
*** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 5.8: Fixed-Effects Estimates (2).

VARIABLES	(3) M2A Lnrank	(4) M2B Lnrank	(5) M3A Winpercent	(6) M3B Winpercent
Player Rel MV	0.846***	1.014***	0.072***	0.086***
	(0.232)	(0.221)	(0.018)	(0.018)
Departures Pre	-0.064***	-0.039*	-0.004**	-0.002
	(0.021)	(0.021)	(0.002)	(0.002)
Signings Pre	0.083***	0.063***	0.006***	0.004**
	(0.020)	(0.020)	(0.002)	(0.002)
Departures In		0.048		0.005
		(0.044)		(0.004)
Signings In		-0.092**		-0.006*
		(0.040)		(0.003)
Coach Rel BL-Games Career	0.095	0.086	0.006	0.005
	(0.075)	(0.069)	(0.005)	(0.005)
Coach Turn Pre	-0.109	-0.174	-0.008	-0.014
	(0.138)	(0.135)	(0.011)	(0.010)
Coach Turn In		-0.515***		-0.042***
		(0.092)		(0.007)
Mgt Prev BL Career	0.001	0.001**	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Mgt Turn Pre	0.080	0.082	0.004	0.004
	(0.162)	(0.142)	(0.012)	(0.010)
Roster	-0.104***	-0.087***	-0.007***	-0.006***
	(0.025)	(0.025)	(0.002)	(0.002)
Fairplay	-0.017***	-0.012***	-0.001***	-0.001***
	(0.004)	(0.004)	(0.000)	(0.000)
Constant	3.122***	2.412***	0.666***	0.617***
	(0.893)	(0.858)	(0.064)	(0.069)
Observations	288	288	288	288
Adjusted R-Squared	0.567	0.636	0.570	0.634
Chi2 BP LM Test (Random-Effects)	27.053***	24.943***	11.635**	16.061***
Chi2 Hausman Test	67.318***	66.276***	48.498***	39.056***
Number of Teams	31	31	31	31

Note: Robust standard errors in parentheses (White 1980). Breusch-Pagan Lagrange-Multiplier Test based on equivalent random-effects specification (Breusch and Pagan 1980).
*** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 5.9: Fixed-Effects Estimates (3).

VARIABLES	(7) **M4A** **Lnrank**	(8) **M4B** **Lnrank**	(9) **M5A** **Lnrank**	(10) **M5B** **Lnrank**
Player Rel MV	0.791***	1.063***	0.617**	0.828***
	(0.266)	(0.250)	(0.236)	(0.243)
Departures Pre Fee	-0.020	-0.004		
	(0.013)	(0.010)		
Departures In Fee		-0.036		
		(0.021)		
Signings Pre Fee	0.008	0.008		
	(0.010)	(0.010)		
Signings In Fee		-0.008		
		(0.025)		
Departures Pre MV			-0.055***	-0.035***
			(0.012)	(0.012)
Signings Pre MV			0.033***	0.022**
			(0.008)	(0.009)
Departures In MV				0.015
				(0.024)
Signings In MV				-0.018
				(0.031)
Coach Rel BL-Games Career	0.096	0.082	0.096	0.091
	(0.081)	(0.071)	(0.077)	(0.070)
Coach Turn Pre	-0.040	-0.081	-0.078	-0.151
	(0.145)	(0.118)	(0.143)	(0.133)
Coach Turn In		-0.550***		-0.518***
		(0.084)		(0.084)
Mgt Prev BL Career	0.001*	0.001**	0.001	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Mgt Turn Pre	0.042	0.021	0.052	0.034
	(0.157)	(0.139)	(0.147)	(0.131)
Roster	-0.086***	-0.088***	-0.083***	-0.080***
	(0.026)	(0.023)	(0.027)	(0.026)
Fairplay	-0.017***	-0.012***	-0.018***	-0.013***
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	2.879***	2.592***	3.148***	2.677***
	(0.874)	(0.808)	(0.888)	(0.910)
Observations	288	288	288	288
Adjusted R-Squared	0.548	0.618	0.568	0.623
Chi2 BP LM Test (Random-Effects)	23.708***	26.672***	31.525***	28.376***
Chi2 Hausman Test	48.781***	44.322***	67.318***	66.276***
Number of Teams	31	31	31	31

Note: Robust standard errors in parentheses (White 1980). Breusch-Pagan Lagrange-Multiplier Test based on equivalent random-effects specification (Breusch and Pagan 1980).
*** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table 5.10: Fixed-Effects Estimates (4).

VARIABLES	(11) M6A Lnrank1stleg	(12) M6C Lnrank2ndleg
Player Rel MV	0.274	1.251***
	(0.266)	(0.319)
Departures Pre	-0.048**	
	(0.022)	
Departures In		0.088*
		(0.049)
Signings Pre	0.053*	
	(0.029)	
Signings In		-0.066
		(0.044)
Coach Rel BL-Games Career	0.216***	-0.113
	(0.050)	(0.081)
Coach Turn Pre	0.001	
	(0.202)	
Coach Turn In		-0.430***
		(0.101)
Mgt Prev BL Career	0.000	0.001**
	(0.001)	(0.000)
Mgt Turn Pre	0.238	
	(0.141)	
Roster	-0.089***	-0.068**
	(0.018)	(0.032)
Fairplay	-0.009**	-0.015***
	(0.004)	(0.005)
Constant	2.677***	1.974**
	(0.699)	(0.929)
Observations	288	288
Adjusted R-Squared	0.467	0.436
Chi2 BP LM Test (Random-Effects)	9.456**	1.906
Chi2 Hausman Test	25.933**	15.259*
Number of Teams	31	31

Note: Robust standard errors in parentheses (White 1980). Breusch-Pagan Lagrange-Multiplier Test based on equivalent random-effects specification (Breusch and Pagan 1980).
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: Own calculations.

In line with previous evidence on player human capital, relative player market value has a significant and positive impact on team performance throughout models 1A to 5B. According to M3A and M3B, for example, the increase of a roster's market value by one standard deviation increases the winning percentage at the 1% significance level by 0.072 and 0.086 percentage points respectively (approximately 2.9 percentage points are equivalent to one win). Results of team specific human capital variables for players are insignificant as demonstrated in models 1A and 1B.[66] However, insights into the effects of team specific human capital may be gained from analyzing turnover. Coefficients of turnover variables with respect to the absolute number of players indicate different significance levels in the four relevant models M1A to M3B. Pre-season departures have a negative and pre-season signings have a positive impact on team performance. Hence, losing a player's general and specific human capital prior to the season's start limits chances to succeed whereas gaining a player's general human capital has the opposite effect. The positive effect of pre-season signings, however, is restricted by two factors as indicated by the control variables. First, the human capital signed needs to be available. In fact, unavailability of player human capital, proxied by the team's fair play score, has a negative impact on team performance and is highly significant across all models.[67] At the 1% significance level, for example, models 3A and B reveal that one additional point in the fair play ranking, i.e. an equivalent of one yellow card, decreases winning percentage by 0.001 percentage points. Second, roster size has a negative impact across all models mostly at the 1% level. One additional player decreases winning percentage by 0.007 or 0.006 percentage points demonstrated by M3A and M3B respectively. Thus, large rosters negatively impact success.[68] As statistics show (see figure 5.1 and table 5.2), the roster sizes observed start at 22 players, on average contain 29 or 30 players, and are 40 players at the maximum. Hence, already the minimum roster contains twice the number of players needed on the pitch. With three possible substitutes per match, a roster size of 40 eventually leads to 26 "unhappy" players. Whereas a certain competition among players in a roster may be helpful, such a large number of excess supply implies small chances for each of the 26 dispensable players to be nominated for a match. This represents a situation that may easily lead to a

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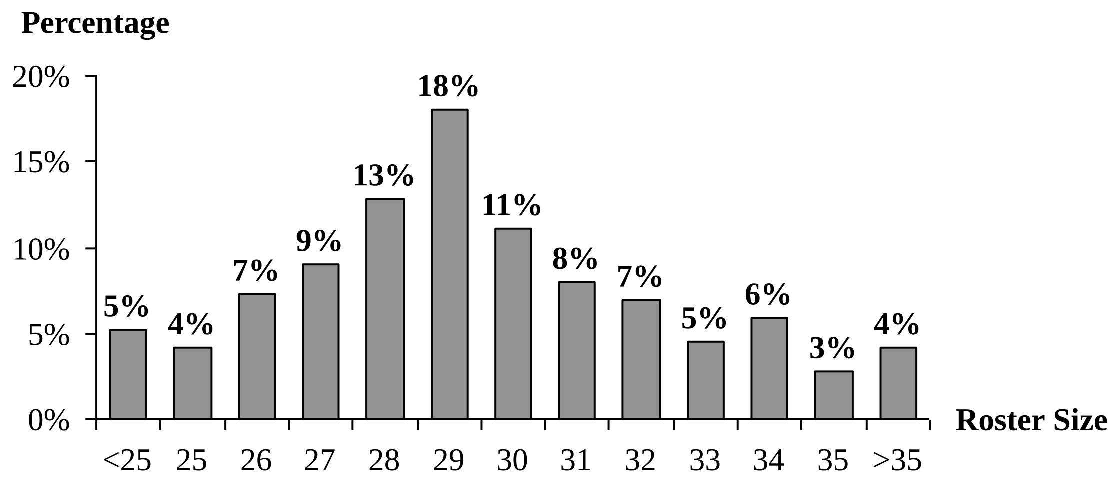
[66] Technically, however, it is important to note that the correlation between the proxies for general and team specific human capital for players is high (0.703). Furthermore, measuring team specific human capital simply by tenure or Bundesliga games may not proxy the peculiarities of such tacit knowledge. Therefore the analyses along M2A to M6C exclude these direct measurements of team specific human capital.

[67] Note that the models have been estimated for the nine largest market teams and the nine smallest market teams separately to control for a potential endogeneity problem as it is possible that teams may play unfair because of low performance rather than teams perform poorly because of booked players missing games. However, results remained largely unchanged when doing so supporting the specification discussed above.

[68] Roster size does not negatively impact team performance at a diminishing rate. Including a squared term of roster size into the respective models did not turn out to be significant and left the other results unchanged.



Source: Own calculations.

Figure 5.1: Roster Size Distribution.

decrease in performance in training sessions and consequently on match days. Moreover, despite the positive effect of pre-season signings, the negative impact of both pre-season departures and roster size suggest that, other things equal, teams with high roster stability outperform teams with high player turnover.

Interestingly, results for in-season player turnover contradict those for pre-season player turnover described above. Here, departures have no significant effect as a separation at this time may be the consequence of worse than expected performance. In-season signings impact team performance even negatively with a coefficient of 0.006 at the 10% significance level as shown by M3B. Consequently, one may conclude that transfers arranged in the in-season window, most likely by a poorly performing team, do not work as well as their pre-season counterparts. Integrating new players into a team in a six week pre-season period when players have high expectations for the upcoming games is presumably easier than adding or even replacing players in a poorly performing team during a two week period in winter.[69] With these opposite signs of coefficients for pre- and in-season turnover, it becomes clear why Golla (2002) did not

[69] Clearly, one may argue that there is an endogeneity problem when integrating in-season turnover since in-season turnover may be the result and not the cause of worse than expected performance. However, results remain robust when integrating the midseason transformed league rank (Lnrank1stleg) to control for in-season performance with this covariate then being highly significant. Moreover, to further separate such effects models 6A and 6C have been estimated (see below).

find significant evidence for player turnover measured in absolute numbers without differentiating by time of the season.

Models 4A to 5B compare the impact of player transfers on team performance by weighting departures and signings with either their transfer fees or their market value. None of the coefficients for the variables weighting player transfers by transfer fees are significant. This implies that this proxy does not capture the human capital associated with a player transfer. In fact, clubs invest in signings according to their market value, i.e. according to a player's general human capital. A player's compensation package generally consists of a base salary, bonuses, and a signing fee. For in-contract players, eventual transfer fees have to be added to this package. Hence, weighting transfers by transfer fees only captures some part of the value of a player. Indeed, Feess et al. (2004) find that Bundesliga transfer fees are not only explained by historic player performance and experience but also by the length of a player's current contract. Thus, it is more reasonable to weight player transfers by market value rather than by transfer fees when analyzing team performance. In fact, results for pre-season transfers weighted by market value are in line with results from the models including non-weighted measures. For departures, this implies that losing the team specific human capital of a player hurts team performance even when players of equal market value are signed as a replacement.

However, this is not the case for in-season transfers weighted by market value since the respective coefficients are not significant in M5B. Presumably, deviations from payments proportional to market value may occur in-season e.g. due to budget constraints or decision makers' time constraints to act in an uncomfortable situation. As described by Frick and Wallbrecht (2012), relegation goes along with large revenue cuts and hence, investing above market value to finally sign a player expected to help preventing relegation may be rational. A similar argumentation may well apply when teams seem unexpectedly to miss the qualification for an international cup competition, an important source of club revenues. In-season signings are then realized although such signings are associated with an even poorer performance.

Evidence on the human capital of head coaches found here contrasts evidence found by Frick (2005) since here the general human capital of head coaches does not provide significant results. However, this may be caused by the different proxies used. Frick

(2005) uses head coach salaries whereas in this chapter the number of Bundesliga games coached during a head coaches career is employed. As discussed in section 5.4.3.2, Bundesliga games coached are not as appropriate as head coach salaries to operationalize a head coach's human capital since the former does not include future expectations in head coach performance.[70] Team specific human capital of head coaches is not significant as indicated by models 1A and 1B.

As with player turnover, it is also crucial to differentiate between pre- and in-season turnover when analyzing head coach turnover. Across all models, coefficients for pre-season turnover of head coaches are not significant. Therefore, the preparatory phase of six weeks before the season seems to be adequate to adapt to a new head coach despite the previous loss of the former head coach's team specific human capital. On the contrary, in-season head coach turnover is negative and significant at the 1% level for all respective models (B-type models). Additionally, the adjusted R-Squared increases from 57.0% in models without in-season turnover (A-type models) to 62% in models with pre- and in-season turnover driven by in-season player transfers and head coach dismissals. This again underlines the different context for turnover in the pre-season, when it seems to be a club's standard business, and during the season, when especially the underperforming clubs aim at avoiding having their team finish worse than expected.

The results of top management human capital coefficients are mostly positive and significant. For example, one additional game of Bundesliga experience as a player or a head coach increases winning percentage by fewer than 0.001 percentage points at the 5% and 10% significance level in models M3A and M3B respectively. This positive relationship holds for models including pre- and in-season turnover (B-type models) rather than for models excluding in-season turnover (A-type models). In difficult times, when the existing player and/or head coach talent does not meet expectations and eventually player or head coach turnover occurs during the season, a top manager's skills and abilities seem to make the difference. He may leverage previous experience as a player or head coach to identify adequate signings or new head coaches able to solve

[70] Unfortunately, data on coach salaries exist only for the time period 1981-2002 when the German weekly 'Welt am Sonntag' published estimated head coach salaries at the beginning of each season. For the present observation period, though, these data are not adequate as the number of observations is too small and as salaries as proxies do not allow separating general and specific human capital.

the problems. Besides, the experienced top manager may successfully intervene as interim head coach – a phenomenon particularly known from with several yoyo-teams. Note that general human capital for top managers is measured by previous experience as a player and/or as a head coach. Clearly, this is more relevant for team managers than for CEOs or CFOs. Only 6.0% of all CEOs and only 7.6% of all CFOs also worked as team managers during their top management careers. Additionally, only five CEOs and only one CFO possessed previous experience as a player or a head coach. As a consequence, when separating top management general human capital by function, only variables measuring team manager general human capital turned out to be particularly significant.[71] This may imply that skills and abilities of CEOs and CFOs are meaningless for team performance. Yet, certainly, years of experience is the simplest applicable measure for human capital. Moreover, team specific human capital of top managers is not significant as results from models 1A and 1B indicate. In addition to the evidence reported, this is also true when distinguishing between team managers, CFOs, and CEOs. Furthermore, variables measuring top management turnover do not provide any significant results. Hence, clubs can sufficiently adapt to pre-season management turnover within the management team. Note that in-season turnover is rare on this level and has consequently not been integrated into the models.

Models 6A and C are estimated to further analyze causality between in-season turnover and league ranks and may in addition serve as a robustness check. Model 6A runs a regression using the transformed league rank after the first 17 games of the season, the first leg, instead of the transformed final league rank. Consistent with this time period only pre-season turnover is included. In analogy, model 6C estimates the regression on the transformed league rank for the second 17 games of the season, the second leg and includes only in-season turnover. Coefficients of our measures of player turnover are in line with previous models, underlying that player transfers in the pre-season are more likely to be successful than during the season. For the first half of the season, perhaps surprisingly, player market value is not significant, but head coach experience has a positive effect at the 1% level. Opposite evidence is found for the second leg when player market value is positive and significant at the 1% level and head coach

[71] With only one observation of a CFO with previous experience as a player or head coach, the CFO variable for this type of general human capital has been excluded in the described models.

experience has no impact. One may argue that head coach experience matters in the beginning as the majority of transfers is handled in the pre-season and the head coach has to form the new team. At this time, his impact on on-the-job training is important. However, when the team is well attuned, i.e. when the second half of the season has started, the individual quality of the players matters most.[72]

5.6 Summary and Implications for Further Research

Using a hitherto unavailable unbalanced panel of 288 team-season observations from the German Bundesliga and applying fixed-effects regressions this chapter has investigated the impact of general and specific human capital and turnover on team performance. By the comprehensive use of publicly available data and insider knowledge from the Bundesliga, it was possible to analyze the human capital of players, head coaches, and top managers. Additionally, detailed information on turnover timing allowed distinguishing between pre- and in-season turnover.

In line with previous research, we find that general human capital of players is a key success factor of teams. Insights on the impact of team specific human capital come mainly from analyzing player turnover. Losing the general and team specific human capital of players prior to a season hinders team performance whereas such signings increase chances to succeed. This still holds when weighting player turnover by its market value suggesting that even when replacing the general human capital of a player, i.e. his market value, the loss of his team specific human capital hurts team performance. Given a highly significant negative impact of roster size, this implies ceteris paribus that teams with high roster stability outperform teams with high player turnover. Moreover, the importance of turnover timing has been identified. In fact, managers tend to sign new players in the in-season transfer window when their team faces relegation although such signings have a negative effect on team performance. Interestingly, the general human capital of top managers accumulated in previous careers as players or head coaches is particularly important when in-season turnover of players and head coaches occurs.

[72] Note that results of model 6C are not impacted by including the midseason transformed league rank (Lnrank1stleg) as another covariate with this covariate then being insignificant.

Furthermore, it has been discussed that variables need to measure not only historic but also expected performance of individuals. In addition, alternative measures of specific human capital e.g. for a roster as a whole instead of players alone would clearly be insightful. In the light of the comprehensive use of publicly available data in the presented research, it seems that – particularly for top management variables – only insider econometric studies may solve these puzzles effectively (see e.g. Van Reenen and Bloom 2007 or Ichniowski and Shaw 2009 for insider econometric studies focusing on management).

Apart from insider econometrics, causality of in-season turnover and team performance needs to be further examined. Whereas in the field of head coach dismissals analyses in this sense already exist (see Frick et al. 2010), player careers have not been detailed in this way. Hence, this would add to the long list of steps applicable to further develop player career research indicated by Frick et al. (2007 and 2008).

6 Summary and Outlook

This research has focused on personnel turnover and the dynamics of team performance in the German Bundesliga. This focus has been addressed in four separate analyses that sought to explain the transfer success of professional players, the career success of professional player, the career success of youth players, and team performance with respect to job matching and turnover. Primarily, attention has been paid to the matching between players and teams and its consequences for the football player's labor market, more precisely in the football player's transfer market. The covariates used throughout the analyses can be grouped as follows.

- Employee data
    - Player characteristics, experience, and performance
    - Head coach experience and turnover
    - Top management (team manager) experience and turnover
- Employer data
    - Selling club characteristics
    - Buying club characteristics
- Conditions of the job change
    - Transfer fees (proxied by free agent status)
    - Remaining contract length (proxied by free agent status and loans)
    - Transfer timing
- Institutional changes
    - DFB/DFL reforms in German youth football

Results show that player characteristics, experience, and performance known from previous salary and transfer fee research in association football are also relevant covariates in the present context. This is particularly true for relative player market value that explains the success of player transfers, player careers, and team performance across all models to a large extent. This impact has systematically been demonstrated at the individual level for the first time and comes as no surprise because it is completely in line with previous research in sports and personnel economics (see e.g. Lazear and Rosen's 1981 contribution to tournament theory or Szymanski and Smith 1997 for an analysis in association football).

However, these analyses also point out that it is difficult to reduce matching in professional team sports to the player-team match since coach-team and manager-team matches are relevant, too. Indeed, head coach turnover is a main driving force of player careers as the research in chapter 3 has shown and the human capital of head coaches and team managers is important for team performance as the analysis in chapter 5 has demonstrated. Hence, it is necessary to broaden the perspective to matches between players, head coaches, team managers, and teams. Such a scope offers several possibilities to analyze interactions and thus is a clear suggestion for further research.

In line with the previous literature, selling club characteristics are used by market participants as proxies of player experience and performance. Buying club characteristics reveal, however, new insights into the importance of an employer's job matching capabilities. Bundesliga's most successful teams are also the ones that generate significantly more value out of their recently recruited players than their competitors (see chapter 2). Moreover, the analysis of chapter 5 indicates that, all other things equal, roster stability positively impacts team performance, conserving und building specific human capital. Hence, successful teams do not only identify better matches, they also have to search for matching players less frequently. Teams with lower turnover have fewer open positions and thus can narrow their search efforts, helping them to identify better matches.

In line with the general approach of personnel economics, three areas of market inefficiencies have been identified, mainly around the conditions of job change and institutional changes. First, results from chapter 2 indicate that transfer fees instead of market values seem to be used as signals for pricing. In fact, holding other factors constant, signings of free agents turn out to lead to less sporting and financial success than signings of in-contract players. Hence, previously paid transfer fees seem to be used for future pricing whereas market value and accordingly signing fees paid to free agents do not seem to be relevant. This result may also indicate player opportunism with players reducing effort levels after having received an up-front signing fee. Moreover, sunk-cost effects can be observed as team managers and head coaches provide expensive players with significantly more playing time than others. The impact of the free agent status has also been demonstrated in the career analysis presented in chapter 3. However, it is important to note that the relationship between market values, signing fees, and transfer fees in a competitive market could not be empirically examined due to a lack of data on signing fees. Using published signing fees to enrich transfer and contract data seems to be a promising task for future research.

Second, inefficiencies have been found with respect to turnover timing. In-season transfers do not seem to work as well as pre-season transfers which may be caused by lower supply and demand in the in-season transfer market. Moreover, when faced with worse than expected performance, decision makers may not act as rational maximizing agents in this very time period. This outcome becomes even more relevant since the analysis in chapter 3 has demonstrated that the number of such in-season signings has significantly increased over the last 16 seasons.

Third, the models estimated in chapter 2 reveal that transfers including players from the own youth team result in significantly less financial success than standard signings from other Bundesliga clubs. This may imply that the transfer market overvalues players that move from the youth team to the professional team of their home club. Indeed, the value of youth players in Germany may potentially be hyped because of the recent reforms at the youth level leading to a rather strong German national team. However, no robust evidence of a positive impact of these reforms has been found in the analysis carried out in chapter 4. Yet, this may be caused by the selective nature of the dataset used since descriptive evidence highlights the positive effect of talent promotion reforms undertaken in Germany before and after the FIFA World Cup 2006.

Summarizing these results and interpretations provides interesting insights for further research. Coming back to Lazear's (1993) view on personnel economics research and focusing on job matching and turnover, it seems most promising to study in more detail the lifecycle of matches. So far, for example, the analysis of transfer success has only included delta market value between the pre-season transfer window of the transfer and the next pre-season transfer window. Using data of several pre- and in-season transfer windows, the time periods observed could either be reduced by investigating half-seasons or be enlarged by analyzing multiple seasons on the basis of contract length or observed tenure. Such analyses would also shed more light on the timing of turnover.

In order to cover a whole lifecycle of matches, career research may also analyze spells more accurately. Spells have so far been defined as uninterrupted stays in Bundesliga independent of the Bundesliga team that the player was with. This definition ignores job-to-job transitions within Bundesliga, so-called movers (see section 3.1). However, such moves may yield interesting insights into up- and downward career mobility since information on important drivers of player utility such as salaries and expected team performance are known in this setting. Similarly, transfer data on exits from Bundesliga has not been analyzed yet to the full extent. Here, it is possible to cover careers in a broader context when taking on a European perspective. Including observations in other European leagues such as the first divisions from England, France, Italy, and Spain is possible since for these leagues also key information is publicly available (lacking player market values can be proxied by e.g. weighted international caps). Overall, these analyses may well help to answer how transition paths of employees are determined and what such paths indicate in terms career success.

Appendix A – Job Matching and Transfer Success

Table A.1: Seemingly Unrelated Regression (SUR) Estimates.

	(3) SUR			
	Minutes Played		Delta Market Value	
VARIABLES	**Coefficient**	**Robust SE**	**Coefficient**	**Robust SE**
Relative Market Value	320.721***	(30.492)	-0.417***	(0.059)
Transfer Experience	93.494	(72.111)	0.049	(0.081)
Transfer Experience2	-15.322	(18.029)	-0.010	(0.018)
Age	131.743*	(73.155)	-0.043	(0.080)
Age2	-1.837	(1.448)	0.000	(0.002)
Goalkeeper	-356.277***	(88.213)	-0.241***	(0.070)
Defender	103.733*	(56.951)	-0.143**	(0.065)
Midfielder	Ref. Cat.	-	Ref. Cat.	-
Forward	-147.107**	(57.530)	-0.127*	(0.075)
Free Agent	-155.631***	(54.296)	-0.172***	(0.059)
Standard Signing	Ref. Cat.	-	Ref. Cat.	-
On Loan	218.743**	(102.950)	0.179	(0.135)
Return Loan	-403.190***	(141.597)	0.112	(0.210)
From Bundesliga	Ref. Cat.	-	Ref. Cat.	-
From 2. Bundesliga	30.653	(85.553)	0.043	(0.086)
From 3. Liga and Below	-524.114***	(123.144)	-0.073	(0.107)
From Top Foreign League	-55.743	(108.341)	0.071	(0.143)
From Other Foreign League	-52.068	(80.074)	0.007	(0.092)
From Unemployment	-378.957	(353.284)	-0.359	(0.412)
From Own Youth Team	-503.318***	(102.392)	-0.235**	(0.109)
From Other Youth Team	-169.744	(208.532)	0.023	(0.170)
Coach Turnover Pre-Season	160.760**	(65.770)	0.058	(0.080)
Constant	-1144.072	(924.324)	1.167	(1.005)
Observations	1,423		1,423	
R-squared	0.392		0.215	
Chi2 BP Test of Independence	349.922***			

Note: Bootstrapped standard errors in parentheses based on 400 repetitions (Efron 1979). Breusch-Pagan test result calculated without bootstrapping (Breusch and Pagan 1979). Dummies for teams, seasons, and the respective FIFA confederation of the player's home country included but not reported. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

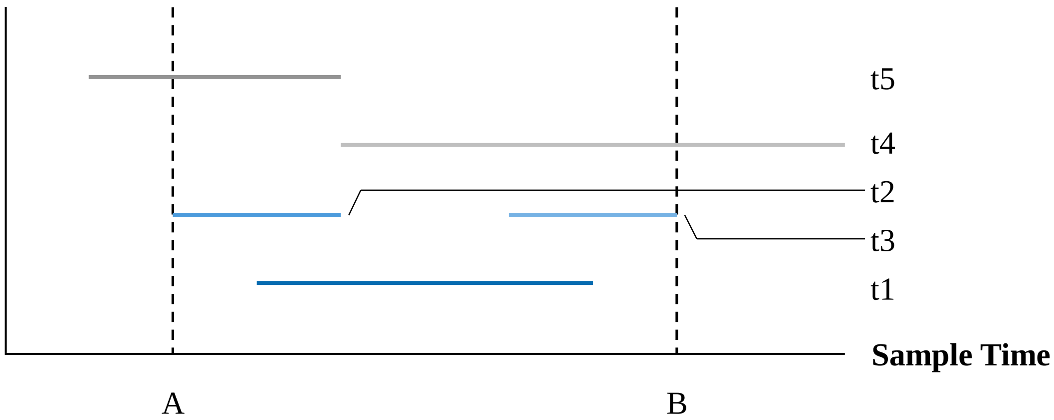
Table A.2: Uncorrected and Corrected OLS Estimates.

VARIABLES	(4) OLS Uncorrected Minutes Played	(5) OLS Corrected Minutes Played	(6) OLS Uncorrected Delta Market Value	(7) OLS Corrected Delta Market Value
Relative Market Value	460.874***	437.920***	-0.394***	-0.394***
	(28.373)	(26.105)	(0.034)	(0.034)
Transfer Experience	181.418***	168.275***	0.072	0.072
	(48.314)	(46.653)	(0.064)	(0.063)
Transfer Experience2	-29.061**	-29.065**	-0.015	-0.015
	(13.596)	(13.069)	(0.018)	(0.017)
Age	222.898***	231.420***	0.031	0.031
	(50.407)	(48.560)	(0.072)	(0.071)
Age2	-3.580***	-3.615***	-0.001	-0.001
	(0.987)	(0.934)	(0.001)	(0.001)
Goalkeeper	-229.438***	-229.690***	-0.254***	-0.254***
	(74.903)	(67.913)	(0.097)	(0.095)
Defender	119.789***	116.933***	-0.141**	-0.141**
	(46.024)	(43.646)	(0.062)	(0.061)
Midfielder	Ref. Cat.	Ref. Cat.	Ref. Cat.	Ref. Cat.
	-	-	-	-
Forward	-160.488***	-157.345***	-0.107	-0.107*
	(42.867)	(45.517)	(0.065)	(0.064)
Coach Turnover (Pre-Season)	88.166*	88.326*	0.051	0.051
	(52.603)	(51.687)	(0.075)	(0.074)
Mills Lambda		-137.223***		0.001
		(37.511)		(0.048)
Constant	-2695.070***	-2606.547***	0.137	0.226
	(639.089)	(630.771)	(0.922)	(0.919)
Observations	2,014	8,083	1,472	7,541
Censored Observations	-	6,069	-	6,069
Uncensored Observations	-	2,014	-	1,472
R-Squared	0.342	-	0.205	-
Chi2 BP LM Test	1.775	-	0.314	-

Note: Robust standard errors in parentheses for (4) and standard errors in parentheses for (5), (6), and (7) (White 1980). Dummies for teams, seasons, and the respective FIFA confederation of the player's home country included but not reported. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

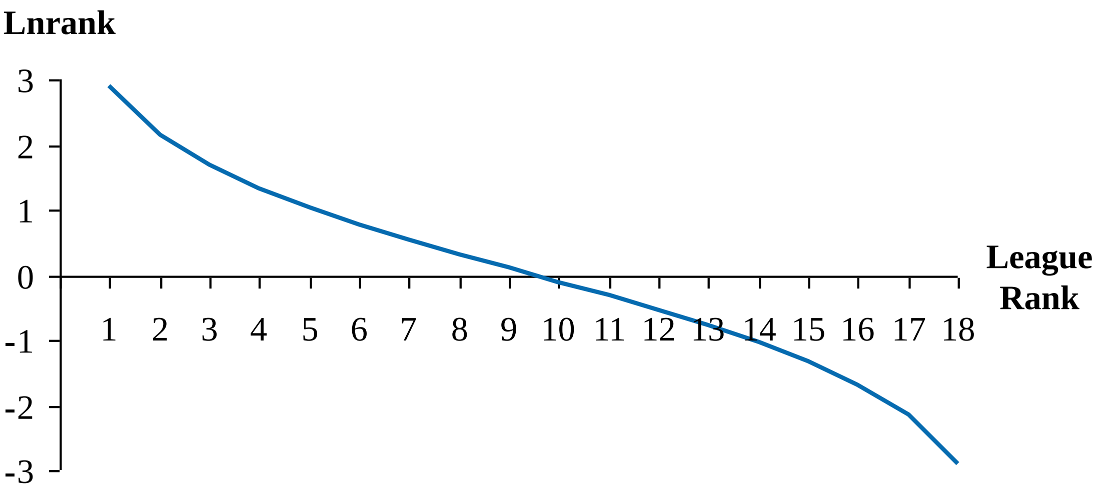
Appendix B – Labor Market Dynamics and Career Success



Note: A: Start of observation period (season 1995/1996).
B: End of observation period (season 2010/2011).
t1: Complete spell or career.
t2, t3: Intermediate exit with subsequent re-entry.
t4: Right-censored spell or career.
t5: Left-truncated spell or career.

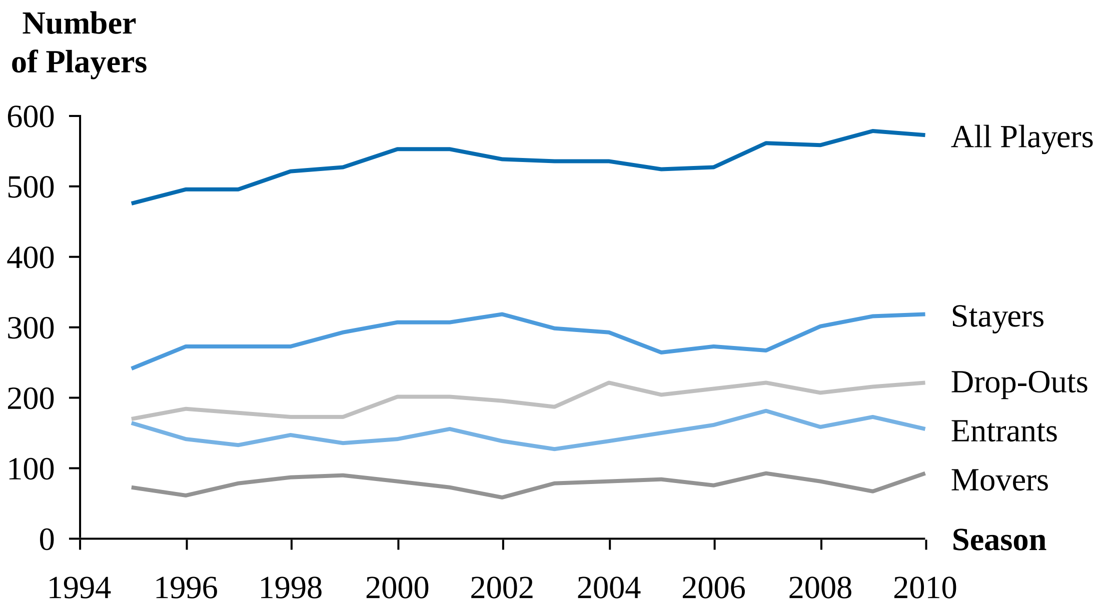
Source: Own illustration.

Figure B.2: Truncation and Censoring in the Bundesliga Sample, 1995-2010.



Source: Own calculations.

Figure B.1: Distribution of the Transformed League Rank.



Source: Own calculations.

Figure B.3: Labor Market Dynamics in the Bundesliga, 1995-2010.

Table B.1: Spells, Careers, and Player Re-Entry in the Bundesliga.

Player	Team	Season	Career ID	Career Length	Spell ID	Spell Length
Markus Babbel	FC Bayern Munich	1995	118	5	144	5
Markus Babbel	FC Bayern Munich	1996	118	6	144	6
Markus Babbel	FC Bayern Munich	1997	118	7	144	7
Markus Babbel	FC Bayern Munich	1998	118	8	144	8
Markus Babbel	FC Bayern Munich	1999	118	9	144	9
Markus Babbel	VfB Stuttgart	2004	118	10	145	1
Markus Babbel	VfB Stuttgart	2005	118	11	145	2
Markus Babbel	VfB Stuttgart	2006	118	12	145	3

Note: Markus Babbel started his career in the 1990/1991 season with FC Bayern Munich and entered the observation period in 1995/1996 still playing for the same team after having been loaned in between to Hamburger SV. In 2000/2001 he transferred to FC Liverpool and returned to Bundesliga in 2004/2005 from FC Liverpool after having been loaned to Blackburn Rovers in between. After three seasons with VfB Stuttgart, Babbel ended his player career in the summer of 2007 to become a head coach.

Source: Own illustration.

Table B.2: Cox CRM Estimates for Careers Split by Involuntary and Voluntary Exit.

	(3) Cox CRM for Careers			
	(A) Involuntary Exit		(B) Voluntary Exit	
VARIABLES	**_t**	**SE**	**_t**	**SE**
Relative Market Value	0.631***	(0.041)	1.573***	(0.121)
Minutes Played (90)	0.923***	(0.003)	0.972***	(0.009)
Age	1.117***	(0.012)	1.061	(0.042)
Age2 (Starting at 26 Years)	0.998	(0.001)	0.987	(0.008)
Goalkeeper	Ref. Cat.	-	Ref. Cat.	-
Defender	1.952***	(0.197)	1.852	(0.893)
Midfielder	1.881***	(0.187)	1.423	(0.683)
Forward	2.075***	(0.224)	1.150	(0.574)
Germany	Ref. Cat.	-	Ref. Cat.	-
UEFA (excl. Germany)	1.314***	(0.084)	5.626***	(1.511)
CONCACAF	1.437*	(0.292)	8.827***	(4.613)
CONMEBOL	1.296**	(0.160)	3.410***	(1.174)
AFC	0.845	(0.161)	2.405	(1.813)
CAF	0.886	(0.104)	5.121***	(1.827)
Team Lnrank	0.937*	(0.034)	1.020	(0.112)
Team Relegated	2.597***	(0.250)	0.975	(0.392)
Team Roster Size	1.024**	(0.010)	1.030	(0.033)
Coach Turnover Pre-Season	1.021	(0.076)	1.364	(0.266)
Coach Turnover In-Season	1.103	(0.072)	1.970***	(0.410)
Coach Turnover End-Of-Season	1.011	(0.068)	1.142	(0.225)
Free Agent (End-Of-Season)	1.569***	(0.086)	1.669***	(0.318)
Linear Time Trend	1.052***	(0.008)	1.079***	(0.025)
Player-Season Observations	6,405			
Team Dummies (Fixed-Effects)	Yes			
Subjects (Careers)	2,153			
Failures (League Exits)	1,743			
Log-Likelihood	-9,785			
Chi2	2,412***			

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table B.3: Cox CRM Estimates for Careers Split by End-Of-Season and In-Season Exit.

	(4) Cox CRM for Careers			
	(A) End-Of-Season Exit		**(B) In-Season Exit**	
VARIABLES	**_t**	**SE**	**_t**	**SE**
Relative Market Value	0.775***	(0.045)	1.601***	(0.164)
Minutes Played (90)	0.931***	(0.003)	0.825***	(0.012)
Age	1.103***	(0.012)	1.170***	(0.035)
Age2 (Starting at 26 Years)	0.999	(0.002)	0.994	(0.004)
Goalkeeper	Ref. Cat.	-	Ref. Cat.	-
Defender	1.838***	(0.188)	4.290***	(1.653)
Midfielder	1.683***	(0.170)	5.175***	(1.951)
Forward	1.834***	(0.202)	4.983***	(1.941)
Germany	Ref. Cat.	-	Ref. Cat.	-
UEFA (excl. Germany)	1.395***	(0.092)	1.414**	(0.242)
CONCACAF	1.718***	(0.356)	2.104*	(0.922)
CONMEBOL	1.306**	(0.162)	1.535	(0.422)
AFC	0.843	(0.169)	1.057	(0.501)
CAF	0.982	(0.115)	0.856	(0.259)
Team Lnrank	0.934*	(0.035)	0.928	(0.086)
Team Relegated	2.828***	(0.283)	1.006	(0.264)
Team Roster Size	1.019*	(0.010)	1.035	(0.026)
Coach Turnover Pre-Season	1.042	(0.079)	1.364*	(0.246)
Coach Turnover In-Season	1.151**	(0.077)	1.258	(0.212)
Coach Turnover End-Of-Season	1.037	(0.071)	1.088	(0.190)
Free Agent (End-Of-Season)	1.657***	(0.093)	1.541***	(0.224)
Linear Time Trend	1.052***	(0.008)	1.065***	(0.022)
Player-Season Observations	6,405			
Team Dummies (Fixed-Effects)	Yes			
Subjects (Careers)	2,153			
Failures (League Exits)	1,743			
Log-Likelihood	-9,842			
Chi2	2,299***			

Note: Hazard rates reported. Standard errors in parentheses. Efron's (1977) method for ties applied. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Table B.4: Example of Dataset Augmentation Following Lunn and McNeil (1995).

Player	**Team**	**Season**	**Spell ID**	**Risk Type (Exit Target)**	**Failure (Exit Target)**	**Risk Type (Exit Timing)**	**Failure (Exit Timing)**
Markus Babbel	FC Bayern Munich	1995	144	0	0	0	0
Markus Babbel	FC Bayern Munich	1996	144	0	0	0	0
Markus Babbel	FC Bayern Munich	1997	144	0	0	0	0
Markus Babbel	FC Bayern Munich	1998	144	0	0	0	0
Markus Babbel	FC Bayern Munich	1999	144	0	0	0	1
Markus Babbel	FC Bayern Munich	1995	144	1	0	1	0
Markus Babbel	FC Bayern Munich	1996	144	1	0	1	0
Markus Babbel	FC Bayern Munich	1997	144	1	0	1	0
Markus Babbel	FC Bayern Munich	1998	144	1	0	1	0
Markus Babbel	FC Bayern Munich	1999	144	1	1	1	0

Note: As described in table B.1, Markus Babbel started his career in the 1990/1991 season with FC Bayern Munich and entered the observation period in 1995/1996 still playing for the same team after having been loaned in between to Hamburger SV. In the pre-season transfer window of the 2000/2001 season he transferred to FC Liverpool. This represents a voluntary exit from Bundesliga as FC Liverpool played in the first division of English association football at the time and an end-of-season exit as the pre-season transfer window of the 2000/2001 season opens at the end of the 1999/2000 season. Consequently, no exit is observed until the 1999/2000 season and in these seasons the player-season observations are right-censored. Concerning the two competing risks focusing on exit target, in 1999/2000 a voluntary exit is observed, i.e. a failure for the exit target risk type coded one (voluntary exit). For the exit target risk type coded zero no failure is observed and the respective player-season observation is right-censored. Similarly, at this point in time the player-season observation is right-censored for the exit timing risk type coded one (in-season exit) and fails for the exit timing risk type coded zero (end-of-season exit).

Source: Own illustration.

Appendix C – Career Success of Risky Workers

Table C.1: Example of Data Augmentation Following Lunn and McNeil (1995).

Player ID	Player	Season	Home Club	Debut Club	Risk Type	Failure (Debut)
124	Piotr Trochowski	2001	FC Bayern Munich	FC Bayern Munich	0	0
124	Piotr Trochowski	2002	FC Bayern Munich	FC Bayern Munich	0	1
125	Philipp Lahm	2001	FC Bayern Munich	VfB Stuttgart	0	0
125	Philipp Lahm	2002	FC Bayern Munich	VfB Stuttgart	0	0
125	Philipp Lahm	2003	FC Bayern Munich	VfB Stuttgart	0	0
124	Piotr Trochowski	2001	FC Bayern Munich	FC Bayern Munich	1	0
124	Piotr Trochowski	2002	FC Bayern Munich	FC Bayern Munich	1	0
125	Philipp Lahm	2001	FC Bayern Munich	VfB Stuttgart	1	0
125	Philipp Lahm	2002	FC Bayern Munich	VfB Stuttgart	1	0
125	Philipp Lahm	2003	FC Bayern Munich	VfB Stuttgart	1	1

Note: Both Piotr Trochowski and Philipp Lahm won DFB-U19-Bundesliga with FC Bayern Munich in the 2000/2001 season. Piotr Trochowski debuted with FC Bayern Munich in the 2002/2003 season and hence entered Bundesliga football with his home club. Philipp Lahm debuted one season later than Piotr Trochowski with VfB Stuttgart, a club unequal to his home club.

Source: Own illustration.

Appendix D – Human Capital, Personnel Turnover, and Team Performance

Table D.1: Example of Treatment of Transfers.

Name	Season	Date of Transfer	Transfer Window	From	To	Treatment
Carlos Alberto	2007/ 2008	01.07.2007	Pre-Season	Corinthians Paulista	SV Werder Bremen	Signing
Carlos Alberto	2007/ 2008	01.01.2008	In-Season	SV Werder Bremen	Pao de Acucar Esporte	Departure
Carlos Alberto	2008/ 2009	01.04.2008	Pre-Season	Pao de Acucar Esporte	SV Werder Bremen	Excluded
Carlos Alberto	2008/ 2009	01.05.2008	Pre-Season	SV Werder Bremen	Botafogo	Excluded
Carlos Alberto	2008/ 2009	01.12.2008	In-Season	Botafogo	SV Werder Bremen	Excluded
Carlos Alberto	2008/ 2009	01.01.2009	In-Season	SV Werder Bremen	Vasco da Gama	Excluded
Carlos Alberto	2010/ 2011	01.06.2010	Pre-Season	Vasco da Gama	SV Werder Bremen	Excluded
Carlos Alberto	2010/ 2011	01.07.2010	Pre-Season	SV Werder Bremen	Vasco da Gama	Excluded

Source: Own illustration.

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