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*The effect of psychological factors on individual and team performance
in high-pressure competitive settings*

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Overview

List of Tables	VII
List of Figures.....	IX
List of Abbreviations	XI
List of Symbols	XII
1 Introduction.....	1
2 [Article 1] Predicting Promotion with Human Capital.....	6
3 [Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments.....	42
4 [Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship.....	52
5 Conclusion	90
References.....	93
Appendix.....	102

Table of Contents

List of Tables	VII
Articles	VII
Appendix	VII
List of Figures.....	IX
Articles	IX
Appendix	IX
List of Abbreviations	XI
List of Symbols	XII
1 Introduction.....	1
1.1 Background and motivation	1
1.2 Outline and abstracts.....	4
1.2.1 [Article 1] Predicting Promotion with Human Capital	4
1.2.2 [Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments.....	4
1.2.3 [Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship	5
2 [Article 1] Predicting Promotion with Human Capital.....	6
2.1 Introduction	6
2.2 Theory and hypotheses.....	8
2.2.1 Career success	8
2.2.2 Human capital as predictor of career success	9
2.2.3 Hypotheses	13
2.3 Background: German youth academies	15
2.4 Data and methods.....	17
2.4.1 Measures	17
2.4.2 General human capital: Cognitive ability	19

Table of Contents

2.4.3	Specific human capital: Performance.....	20
2.4.4	Controls.....	22
2.5	Methods.....	23
2.6	Results.....	24
2.6.1	Logit model: BASE.....	25
2.6.2	Logit model: REDUCED.....	27
2.6.3	Discussion on hypotheses.....	30
2.6.4	Predictions.....	32
2.6.5	Ensemble learning: Tree-based methods for classification.....	35
2.7	Conclusion.....	40
3	[Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments.....	42
3.1	Introduction.....	42
3.2	Background.....	43
3.3	Data and methodology.....	44
3.4	Results.....	49
3.5	Conclusion.....	50
4	[Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship.....	52
4.1	Introduction.....	52
4.2	Theoretical background.....	55
4.2.1	First mover advantage.....	55
4.2.2	Entry timing-performance relationship.....	63
4.3	Hypotheses.....	68
4.3.1	Lagging-behind effect.....	68
4.3.2	Decision-making effect.....	69
4.4	Data and method.....	71
4.5	Empirical evidence.....	78
4.5.1	Re-examining the first mover advantage debate in penalty shootouts.....	78

Table of Contents

4.5.2	A new perspective: The decision-making effect.....	83
4.6	Implications.....	84
4.7	Conclusion	87
5	Conclusion	90
	References	93
	Appendix	102

List of Tables

Articles

2	[Article 1] Predicting Promotion with Human Capital.....	6
	Table 1— Expected relationship of variables with PROMOTED	23
	Table 2— Determinants of PROMOTED in the football academy	27
	Table 3— LASSO model coefficients at optimal (lambda.1se) λ value	29
	Table 4— Variance inflation factors for BASE and REDUCED.....	30
	Table 5— Confusion matrix of REDUCED at two threshold values.....	33
3	[Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments.....	42
	Table 1— Variable definition, measurement, and rationale for use.....	47
	Table 2— Determinants of PROMOTED in the football academy	48
4	[Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship.....	52
	Table 1— An overview of empirical studies on first mover advantage: 2013 to 2017.....	62
	Table 2— Overview of literature on lagging-behind pressure effects in sports.....	68
	Table 3A— Shootout data from seasons 2003/04 to 2016/17 (AGGREGATE).....	75
	Table 3B— Shootout data from seasons 2003/04 to 2016/17 (SUBSET 1)	76
	Table 4— Determinants of WIN in penalty shootouts.....	81
	Table 5— Shootout data from 1970 to 2017	83
	Table 6— Breakdown of win and lose frequencies for DECIDED	85

Appendix

[Article 3] Table A1— Comparison of shootout data: 1970 to 2017 and Palacios-Huerta (2014)	105
[Article 3] Table A2— Shootout data from 1970 to 2013	106

List of Tables

[Article 3] Table A3— Comparison of shootout data: 1970 to 2013 and Palacios-Huerta (2014)	107
[Article 3] Table A4— Decision data from 2003 to 2017.....	108

List of Figures

Articles

2	[Article 1] Predicting Promotion with Human Capital.....	6
	Figure 1— Number of individuals dropped and promoted in our PROMOTED sample	18
	Figure 2— Correlations between variables	25
	Figure 2— Mean standard error of the predictions for each λ value.....	29
	Figure 4— ROC curve for the REDUCED model	34
	Figure 5— Unpruned classification tree for PROMOTED.....	36
	Figure 6— <i>Left</i> : Cross-validation deviance for different sizes of a pruned tree. <i>Right</i> : Pruned classification tree for PROMOTED corresponding to the minimum deviance.....	37
	Figure 7— Bagging and random forest results for data on PROMOTED	39
	Figure 8— Dotchart of variable importance as measured by bagging.....	40
3	[Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments.....	42
	Figure 1— Number of individuals dropped and promoted in our PROMOTED sample	45
4	[Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship.....	52
	Figure 1— Relative win frequencies of teams kicking first and teams deciding to act	77
	Figure 2— Relative frequency of first kicking team wins in shootout by season (cumulating backward season by season).....	79
	Figure 3— First kicking team wins in shootout by season (relative frequency).....	80

Appendix

[Article 1] Figure A1— Regression surfaces for unpruned tree built on the PROMOTED data...	102
[Article 1] Figure A2— Regression surfaces for pruned tree built on the PROMOTED data.....	102

List of Tables

[Article 1] Figure A3— Dotchart of variable importance as measured by random forest.....	103
[Article 3] Figure A1— Scoring probabilities per round (SUBSET 1).....	104
[Article 3] Figure A2— Frequency with which a team leads in the score at the end of a round (SUBSET 1).....	104

List of Abbreviations

AIC	Akaike information criteria
APH	Apestequia and Palacios-Huerta (2010)
AUC	Area under the curve
BIC	Bayesian information criterion
DFB	German Football Association
FA	Football Association
FIFA	Fédération Internationale de Football Association
FMA	First mover advantage
GPA	Grade point average
HC	Human capital
KLS	Kocher, Lenz, and Sutter (2012)
LASSO	Least absolute shrinkage and selection operator
MSA	MSA-MotivProfil
OOB	Out-of-bag
R&D	Research and development
ROC	Receiver operator characteristic
UEFA	Union of European Football Associations
VIF	Variance inflation factors
VTS	Vienna Test System SPORT

List of Symbols

\dagger	Statistical significance at the 10% level
*	Statistical significance at the 5% level
**	Statistical significance at the 1% level
***	Statistical significance at the .1% level
$\sqrt{\quad}$	Square root
%	Per cent
α	Nonnegative tuning parameter
t	Threshold value
λ	Regularisation parameter lambda
m	The number of predictors considered at each split in tree models
p	Total number of predictors
p	Probability value

1 Introduction

1.1 Background and motivation

Economic settings featuring individuals competing against one another for incentives define competitive activity on the labour market. In such environments, incentive schemes are often structured as competitive contests and clearly defined rules exist to determine winners and losers (Becker, 1962; Schultz, 1961; Turner, 1960). Contests for employment, for example, frequently involve individuals being selected depending on their comparative performances in formal tasks. Similarly, contests for promotion between individuals in organisations are commonly decided based upon ongoing job performance appraisals (Feri, Innocenti, & Pin, 2013). The results of these contests across the span of an individual's career determines their career success. As Judge, Cable, Boudreau, and Bretz (1995) define, career success is the “positive psychological or work-related outcomes or achievements one has accumulated as a result of one's work experiences” (p. 486).

In an effort to better understand potential predictors of career success, much economic literature has theoretically and empirically investigated individuals' performances in competitive labour market settings (Maurer & Chapman, 2013). Theoretical perspectives provided in early research, such as those on upward mobility, suggested that in labour-contest settings, individuals can advance and get ahead by adding value through enhanced abilities and initiative (Turner, 1960). Consequently, differentials in individuals' human capital, that is, their cognitive skills, knowledge and abilities (Becker, 1962; Schultz, 1961) were identified as the most important factors influencing job performance. Related empirical evidence has shown that greater human

capital can lead to productivity differences, which, in turn, deliver wide-ranging benefits on the labour market including higher earnings, employability and promotion opportunities (Bronars & Oettinger, 2006; Cameron & Heckman, 1993; Finnie & Meng, 2001; Heckman, 2000). More recently, many labour economists have emphasized the importance of controlling for individuals' non-cognitive skills, such as Five Factor Model personality traits, when investigating individuals' performances in career contests. Although for a long time personality was not considered to be relevant (Guion & Gottier, 1965), as Barrick, Mount, and Judge (2001) highlight, "the area is experiencing something of a renaissance" (p. 10). Related research has provided strong evidence that at least some of the contributions made by human capital predictors to labour market success are in fact due to individuals' non-cognitive traits (Cobb-Clark & Schurer, 2012; Heckman, Stixrud, & Urzua, 2006; Helmreich, Sawin, & Carsrud, 1986; Judge, Higgins, Thoresen, & Barrick, 1999; Seibert & Kraimer, 2001). Similarly, given that career contests often impose high levels of stress on individuals, the effects of pressure on individuals' performances in labour-contests have also grown in importance. As Feri et al. (2013) describe, the analyses of individuals' performances in competitive labour market settings have been "recently the object of a wide debate about the psychological effects of competitive pressure" (Feri et al., 2013, p. 249).

To contribute to these strands of career success literature, in this study, we undertake three distinct, yet interlinked research articles. First, through the lens of human capital theory, we investigate how various cognitive ability and occupational skills may deliver advantages to individuals' in career contests. The results of this article address a current lack of accountability for individuals' decision-making behaviour relevant to their human capital development (Maurer & Chapman, 2013). Extending on this analysis, in our second article, we investigate the relationship

between psychological traits and career success, whilst accounting for individuals' human capital factors. This article specifically addresses calls for greater understandings of personality-performance linkages in job contexts in which clear demands are made on behaviour (Judge & Zapata, 2015). Finally, in our third article, we explore psychological pressure effects on individuals' performances in sequential contests. This article tests for the existence of a potential *lagging-behind-effect*, which has been shown to potentially disadvantage late-movers in sequential competitions where individuals are subject to intermediate steps of examination, such as in hiring or promotions (Feri et al., 2013).

For all three articles, professional sports is identified as an ideal labour market laboratory (cf., Kahn, 2000) in which to apply our empirical analyses. Professional sports have been shown to be particularly beneficial to labour market analyses as they feature highly-structured and controlled competitive settings where all individuals have relatively homogenous job profiles and objectives (Schmidt, Torgler, & Jung, 2017). Additionally, throughout their careers, individuals are regularly subject to a range of psychological and physiological tests providing individual-level data not typically available. Comparable naturally occurring business environments rarely create circumstances that allow an objective view of psychological and behavioural elements at work (Savage & Torgler, 2012). The results of our three interlinked articles therefore advance our understandings of the psychological factors that determine performance in high pressure competitive settings, especially at the individual level.

This study proceeds as follows. In section 2, we present our first article on the role of human capital on individuals' promotion likelihood. Section 3 presents our published work on the personality and human capital factors leading to promotion in highly structured work environments. Our article testing the existence of a lagging-

behind-effect in sequential competitions is presented in Section 4. Section 5 concludes the paper.

1.2 Outline and abstracts

1.2.1 [Article 1] Predicting Promotion with Human Capital

Individuals' decisions to invest in human capital have significant influence over their career success. When choosing a career, individuals face a trade-off between accumulating either specific or general human capital, and each offers its own utility on the labour market. Within a highly competitive sporting environment, we investigate how human capital choices may influence the predictability of individuals' career success, as measured by promotions. Our empirical results, based on unique psychological and performance data of elite football players, deliver three key findings. First, we find a generally positive relationship between human capital factors and promotion. Second, we find limited support for the suggestion that individuals' specific human capital is more predictive of promotions than their general human capital. Third, our findings provide strong support for the use of objective, rather than subjective, measures for explaining the effect of individuals' human capital on their promotion likelihood.

1.2.2 [Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments

Much of the research on how human capabilities contribute to labour market success focuses on traditional human capital predictors. However, researchers are becoming increasingly aware of the important role of personality traits in determining individual

labour market outcomes, both positive and negative. Using data from young professional football players in Germany, this study investigates the relationship between individual personality traits and cognitive abilities on career success. Our results suggest that individuals who score low on the tendency to be principled but high on cognitive processing speed are significantly more likely to enjoy career success through job promotion.

1.2.3 [Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship

Much research investigating the effect of entry-order on performance in dynamic tournaments supports the theory that first-movers have an advantage. We re-examine the evidence that, in dynamic tournaments with interim feedback and performance observability, first-movers inflict psychological pressure on later entrants and negatively influence their subsequent actions (lagging-behind effect). Our results, based on extensive penalty shootout data since the 1970s, suggest no significant lagging-behind effect. Furthermore, using unique decisions-making data from 106 professionals, we find a 61.3% advantage for teams deciding the shootout sequence. These results indicate that decision-making rather than any lagging-behind effect may be a deciding factor for success.

2 [Article 1] Predicting Promotion with Human Capital¹

2.1 Introduction

Individuals' decisions to invest in human capital (HC) have significant influence over their career success. Greater HC, that is, their cognitive skills, knowledge and abilities (Becker, 1983; Schultz, 1961), can lead to wide-ranging benefits on the labour market including higher earnings, employability and promotion opportunities (Bronars & Oettinger, 2006; Cameron & Heckman, 1993; Finnie & Meng, 2001; Heckman et al., 2006; Heineck, 2011; Stewart & Ruckdeschel, 1998). However, as Gervais, Livshits, and Meh (2008) highlight, when choosing a career, individuals face a trade-off between accumulating either *general* or *specific* HC, and each offers varying utility. If individuals choose to invest general HC, accumulated through education, they will acquire broadly applicable capital that can be flexibly reallocated across firms or industries. On the other hand, if they choose to invest in specific HC, accumulated on the job, they will acquire capital that is more productive for a foreseeable career path yet less flexibly reallocated (Becker, 1962, 1993; Campbell, Coff, & Kryscynski, 2012).

Research shows that how individuals ultimately decide will depend on their assessment of the costs or value of each option in relation to economic uncertainty. For example, in conditions of high uncertainty, such as when labour markets experience

¹ This chapter is based on an unpublished manuscript under the working title: "The effect of individuals' human capital investment decisions on their career promotions: Evidence from a highly competitive professional football environment". The authors include Mark Kassis, Sascha L. Schmidt (Center for Sports and Management, WHU Otto Beisheim School of Management), and Dominik Schreyer (Center for Sports and Management, WHU Otto Beisheim School of Management).

large income variance (Anderberg & Andersson, 2003) or high job turnover (Wasmer, 2006), individuals will invest greater in general HC and trade-off current costs (e.g. forgone earnings) for future value (e.g. promotions or better employment positions). Conversely, conditions of low uncertainty encourage individuals to invest greater in their specific HC (Buchholtz, Ribbens, & Houle, 2003; Hogan & Walker, 2007). Furthermore, individuals' uncertainty towards their career prospects has been shown to significantly influence their HC trade-off decisions. Merkel, Schmidt, and Torgler (2017) find that the more certain individuals are that their specific HC will ultimately deliver a lucrative career, the less likely they will be to invest in general HC at school.

These findings have important implications for previously established links between HC predictors and career success. Traditional HC measures (e.g. education attainment, or standardized test scores) used predominantly in labour economic analyses rarely account for the specific versus general HC investment decisions faced by individuals throughout their HC development. As Lounsbury, Sundstrom, Loveland, and Gibson (2003) point out, HC measures reflect not only ones cognitive ability, but also their work drive and conscious decision to invest in relevant HC. This missing information bias augments already existing economic evidence that HC measures remain poorly proxied and, subsequently, said to lead to a severe underestimation of the true development effect of HC on labour market outcome differentials (Wößmann, 2003).

In this article, we empirically re-examine the relationship between individuals' HC and their career success, whilst accounting for individuals' HC investment decisions. Using unique psychological and performance measures of individuals from the highly competitive environment of a youth academy of a club in Germany's highest

professional football² league, we for the first time, to our knowledge, account for individuals' specific and general HC at various subjective and objective levels. In doing so, we specifically take into account individuals' HC investment behaviour and provide new insights into our understands of how individuals' HC investment decisions may influence their career success, as measured by promotions. Our findings further extend upon recent related economic literature (e.g., Kassis, Schmidt, Schreyer, & Torgler, 2017; Merkel et al., 2017).

The rest of this article is organized as follows. In section 2, we outline our theoretical foundations and develop hypotheses about the effects of HC measures on career success. Section 3 provides a background on the youth academy as an institution. Section 4 describes the data and various methods used in our analyses. Section 5 reports our findings. Section 6 concludes the paper.

2.2 Theory and hypotheses

2.2.1 Career success

Career success can be defined as the “positive psychological or work-related outcomes or achievements one has accumulated as a result of one's work experiences” (Judge et al., 1995, p. 486). Related organisational research has developed towards the use of two conceptually distinct outcomes as measures of individuals' career success (e.g., Judge & Bretz Jr, 1994; Maurer & Chapman, 2013; Ng, Eby, Sorensen, & Feldman, 2005; Seibert & Kraimer, 2001). The first is *extrinsic* career success and is measured using individual career achievements that are *objectively* observable. These

² Throughout this article, the term 'football' refers to European football, alternatively known as soccer in some areas.

include achievements such as salary and promotions (Ng et al., 2005). The second is *intrinsic* career success and is measured using individuals' *subjective* feelings of accomplishments. These include feelings such as job or career satisfaction (e.g., Greenhaus, Parasuraman, & Wormley, 1990; Judge et al., 1995; Judge et al., 1999). Both extrinsic and intrinsic career success have been considered important to individuals and organisations (Boudreau, Boswell, & Judge, 2001; Gattiker & Larwood, 1988; Maurer & Chapman, 2013), however, in the present study we specifically focus on promotion, an objective measure of individuals' extrinsic career success. This measure provides the most applicable career success factor to individuals in our research setting.

2.2.2 Human capital as predictor of career success

Research on upward mobility provide theoretical perspectives that can help identify the effects of various predictors on extrinsic career success. As highlighted by Ng et al. (2005) "upward mobility is relevant to career success because those who are able to move up the societal or organizational hierarchy are typically regarded as successful and are more likely to view themselves as successful" (p. 369). More specifically, Turner (1960) describes two distinct perspectives that govern the upward mobility of individuals in an organisation – *contest mobility* and *sponsored mobility*.³ The *contest mobility* perspective suggests that individuals compete with each other in an open and fair contest. In this opportunity structure, individuals will advance and get ahead by adding value through enhanced abilities or performance (Maurer & Chapman,

³ These upward mobility perspectives describe fundamentally different career opportunity structures, however they are not necessarily mutually exclusive (Wayne, Liden, Kraimer, & Graf, 1999). Institutions "may have an upward mobility system that reflects one perspective more than the other but not necessarily to the point of exclusion" (Ng et al., 2005, p. 369).

2013). Successful upward mobility is therefore determined by individuals' own skills and initiative and not on the basis of some criterion of supposed merit from superiors (Turner, 1960). Conversely, the *sponsored mobility* perspective suggests that individuals do not compete in an open and fair contest. Successful upward mobility is not determined by any amount of individual skill or initiative, but rather granted or denied by superiors "on the basis of whether they judge the candidate to have those qualities they wish to see in fellow members" (Turner, 1960, p. 856).

The contest mobility perspective best describes the organisation setting used in the present study to investigate individuals' extrinsic career success. First, individual careers in our organisation setting can be viewed as a "tournament in which one has to constantly compete with others by improving oneself if one wants to succeed" (Ng et al., 2005, p. 371). Second, although superiors make decisions about which individuals to advance, transparency of individuals' performances establishes an upward mobility systems that ultimately rewards those that are most skilled and that show the greatest initiative. Accordingly, based on related theoretical and empirical findings (Maurer & Chapman, 2013; Ng et al., 2005; Steffy, 1986; Turner, 1960), we identify individual HC as particularly relevant indicators for predicting extrinsic career success within our setting.

Individual HC is a product of deliberate investment in skills and knowledge (Schultz, 1961) and the notion that differentials in career success on the labour market closely correspond to differentials in individual HC has long been suggested in the literature. Since the seminal works of Schultz (1961) and Becker (1962) helped shape HC theory, empirical literature has supported suggestions that "individuals who invest the most in human capital attributes such as education, training, and experience are expected to show higher level of work performance and subsequently obtain higher

organizational rewards” (Ballout, 2007, p. 743). Greater HC has been attributed to significantly predict a range of labour market outcomes including higher earnings, employability, and promotion opportunities (Cameron & Heckman, 1993; Finnie & Meng, 2001). Tharenou (2001), for example, show HC to be the strongest predictor of individuals advancing from entry level to upper level management. A quantitative review of career success literature by Ng et al. (2005) showed that HC predictors displayed the strongest relationships with salary level and employability. And these findings are generally supported and extended in subsequent empirical analyses (Bronars & Oettinger, 2006; Frederiksen & Kato, 2017; Heckman et al., 2006; Heineck, 2011). Although some authors have questioned the strength of relations between HC and career success outcomes such as wages (Cawley, Heckman, & Vytlačil, 2001; Zax & Rees, 2002), for example, the overwhelming theoretical and empirical evidence supports the view that investment in HC delivers individuals wide-ranging benefits on the labour market.

Accordingly, individuals’ decisions to invest in HC have significant influence over their career success and investigating how individuals make these decisions has become an important part of HC literature. Related works distinguish between two types of HC individuals can invest in when choosing a career (Becker, 1993; Campbell et al., 2012). First, individuals can invest in general HC, which is acquired through schooling and education. Alternatively, individuals can choose to invest in specific HC, acquired on the job. The utility of these two investment options varies (Gervais et al., 2008). General HC, for example, delivers broadly applicable capital that can be flexibly reallocated across firms or industries, while specific HC, on the other hand, delivers capital that is more productive for a foreseeable career path yet less flexibly reallocated. Importantly, as outlined by Campbell et al. (2012), resource constraints render these

HC investment alternatives mutually exclusive, that is, an investment in specific vocational skills (i.e. specific HC), for example, represent foregone educational opportunities.

Thus, when choosing a career path, individuals are faced with a dichotomous trade-off decision whose utility and predictive ability to deliver wide-ranging benefits on the labour market is dependent on the career path they choose (Mellander & Florida, 2006). How individuals ultimately make this trade-off decision has been shown to depend on their assessment of the costs or value of each option according to economic uncertainty (Buchholtz et al., 2003; Hogan & Walker, 2007). Where economic conditions are highly uncertain, such as when labour markets experience large income variance (Anderberg & Andersson, 2003) or high job turnover (Wasmer, 2006), individuals will invest greater in general HC and trade-off current costs (e.g. forgone earnings) for future value (e.g. promotions or better positions). In conditions of low uncertainty, on the other hand, individuals will be encouraged to invest greater in their specific HC. Additionally, individuals' uncertainty towards their career prospects has been shown to significantly influence their HC trade-off decisions. Merkel et al. (2017), for example, find that the more certain individuals are that their specific HC will ultimately deliver a lucrative career, the less likely they will invest in general HC at school.

The decision dynamics involved throughout individuals' HC development have important implications for investigating linkages between HC and career success. They provide further evidence to the suggestion that HC "operates less as a static endowment or stock and more as a dynamic flow" (Mellander & Florida, 2006, p. 3). Accordingly, a lack of accountability for individuals' HC investment decisions may misrepresent the true effect of HC measures on the career success outcomes being investigated (Gibbons

& Waldman, 2004; Sullivan, 2010). As Wößmann (2003) highlights, the majority of HC measures used to investigate labour market outcome differentials, such as education attainment, standardized test scores, or general aptitude tests, for example, are poor proxies for the complex development effect of HC on labour market outcome differentials.

Therefore, in order to appropriately measure for individuals' HC, and account for individual level decision behaviours, we investigate the effects of various specific and general HC constructs on individuals' career success. Specific HC measures include a subjective measure of job performance as provided by manager reports, and two additional objective performance measures. General HC include GPA as a subjective HC measure, and two occupation specific measures of cognitive ability measured via an objective cognitive ability tool. Using these various constructs, we address the current lack of accountability for individual behaviour relevant to individuals' HC development and specifically answer the research question: *How do different specific and general HC measures vary in their predictability of individuals' career success?*

2.2.3 Hypotheses

To answer our research question, we posit three hypotheses. First, we identify contest mobility to best explain the organisation setting we use to investigate individuals' extrinsic career success. In this setting, individuals constantly compete with others in a tournament for promotion and individuals' job performance is open and transparent to all. Upward mobility systems are rewarding of individuals that are most skilled and that show the greatest initiative. Accordingly, in line with related theoretical and empirical literature (Maurer & Chapman, 2013; Ng et al., 2005; Turner,

1960), we identify individual HC as particularly relevant indicators for extrinsic career success in our setting and predict that:

***Hypothesis 1 (H1).** There exists a positive relationship between HC and individuals' extrinsic career success.*

More specifically, given the evidence that individuals' HC investment decisions are influenced by their assessment of their career prospects, we expect to find differences between the effect of specific and general HC on individuals' extrinsic career success. In our setting, clear demands for specific HC determine employment and promotion decisions. Thus, in line with recent empirical evidence (Merkel et al., 2017), we would expect that individuals who are optimistic about their chances of receiving a promotion to exhibit less investment in their general HC and more in specific HC. Accordingly, our second hypothesis predicts that:

***Hypothesis 2 (H2).** Individuals' specific HC measurements will be more predictive of individuals' extrinsic career success than individuals' general HC measurements.*

Finally, we use measures of individuals' specific and general HC at various subjective and objective levels. Subjective measures include managerial ratings of individuals expected future performances, as well as individuals' GPA. Objective measures include transparent job performance data and two occupation specific measures of cognitive ability. Given that promotion decisions are strongly linked to transparent job performance and that our setting sets clear demands for occupation specific expertise, we expect that:

***Hypothesis 3 (H3).** Individuals' objective HC measurements will be more predictive of individuals' extrinsic career success than individuals' subjective HC measurements.*

2.3 Background: German youth academies

We examine individual-level career successes in the youth academy of a football club in Germany's highest professional football division. It is a requirement that all 36 clubs in the first and second tiers of German professional football operate a youth academy and ensure it meets strict regulatory standards set out by the German Football Association (Merkel et al., 2017; Van Hoecke, Schoukens, Simm, Isakowitz, & de Sutter, 2011). The academy is made up of approximately 150 male players, who represent the best talents of youth football in Germany. Players are aged between 11 and 19 and each season⁴ compete across seven teams according to their respective age group levels; under-12 or U12, U13, U14, U15, U16, U17 to U19. The goal for each player is to progress through the academy and ultimately be promoted to a professional contract with the club's U23 or first teams. Promotion decisions are made at the end of each season based on aggregated performance appraisals. As noted by Kassis, Schmidt, Schreyer, et al. (2017) "Approximately 60% of players progress each year within the levels, but only 5% are promoted from the academy to a professional career, which underscores the competitiveness and opportunity costs to individuals" (p. 2).

This academy offers four main advantages for furthering our understandings of individual level career success through the lens of HC theory. First, the setting is a highly-structured and controlled competitive environment where all individuals have

⁴ In Germany, a football season is a non-calendar year, from July to June. For example, a season starting in 2017 would run from July 2017 until June 2018 (i.e. season 17/18).

relatively homogenous job profiles and objectives of promotion (Schmidt et al., 2017). Comparable naturally occurring business environments rarely create circumstances that allow an objective view of psychological and behavioural elements at work (Savage & Torgler, 2012). Second, the academy's job appraisal and promotion systems have much in common with those in business contexts, particularly the up-or-out systems used by professional service firms (Merkel, Schmidt, & Torgler, 2015). Third, throughout their time at the academy, individuals are regularly subject to a range of psychological and physiological tests. This provides a range of individual-level data not typically available in comparable competitive contexts. Finally, in addition to training and development in football, these institutions also provide players with schooling. Players must therefore "efficiently split personal efforts between two potential career paths that could determine their future income" (Merkel et al., 2017, p. 1). Individuals can invest resources in their specific HC (i.e. their football ability), which may yield high returns, however carries low probability of success. Alternatively, individuals may invest in general HC, which promise lower potential short-term returns, but are less risky. HC theory provides a valuable perspective in this context as career choices are strongly influenced by individuals' ambitions, abilities, resources, and limitations (Lent et al., 2002; Parsons, 1909). Accordingly, the setting has been the subject of much related labour market research (Kassis, Schmidt, Schreyer, et al., 2017; Merkel et al., 2017; Schmidt et al., 2017).

2.4 Data and methods

2.4.1 Measures

In order to test our hypotheses, we compiled a dataset consisting of cognitive, performance, and additional control indicators from 97 elite youth academy players.⁵ Subjects are aged between 14 and 19 and participated across five teams (U14 to U19) over four seasons (season-2011/2012 to season-2014/2015).

Our binary dependent variable, PROMOTED, is based on the promotion of players in the academy at the start of the season-2015/2016. Each of the 97 observations received a 0 if they were not in the academy at the start the 2015/2016 season (i.e. dropped) and 1 if they were selected to remain in the academy at the start of the 2015/2016 season (i.e. promoted). Figure 1 shows the split of dropped and promoted players in our sample. The observations consist of 51 (52.6%) dropped and 46 (47.4%) promotions. As outlined by Seibert and Kraimer (2001), promotion is an instrumental reward from the job or occupation and provides an objectively observable outcome measure for individuals' extrinsic career success. In our specific case, it also takes into account the cognitive ability and job performance of individuals as promotion decisions are based upon a range of physiological and psychological evaluations administered by staff at the club's academy or teachers from their school. Given the highly structured nature of the academy setting, evaluations are undertaken on almost the same date each season at either semi-annual or annual intervals depending on the type of evaluation.

⁵ As is described in the *General human capital: Cognitive ability*, *Specific human capital: Performance*, and *Controls* sections, the range of sources used to gather the measures in this study each consisted of many more observations than our final sample. However, due to unavailability of school reports, missing performance information due to injury, or how recent an individual entered the academy, the final sample was ultimately reduced to 97 complete observations across all measures for 97 individuals.

This method is particularly beneficial as it allows for consistent measurement of individuals' abilities and progress throughout their time at the academy.

The independent variables in our analyses consist of the results of academy evaluations and are selected on the basis of theoretical and empirical linkages with individual performance criteria (Tett, Jackson, & Rothstein, 1991). These include three cognitive ability measures, three job performance measures, and three controls. Table 1 shows a summary of variables and their expected relationship with PROMOTED. A discussion of each independent variable and control, including measurement and rationale for inclusion, is also provided.

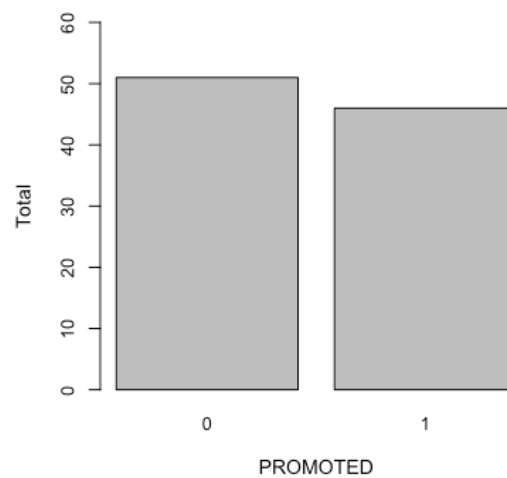


Figure 1— Number of individuals dropped and promoted in our PROMOTED sample

2.4.2 General human capital: Cognitive ability

General HC differentials, that is, differences in individuals' cognitive skills, knowledge and abilities (Becker, 1983; Schultz, 1961), have been shown to result in productivity differences, which may then lead to better promotion prospects (Heineck & Anger, 2010). In order to account for individual HC differences, we operationalise general HC using three distinct measures.

As validated by Miller (1998), high-school grades provide an effective signal of individual general HC and share a significantly positive relationship with labour market productivity. Although they are essentially subjective by nature, "teacher idiosyncrasies, subjectivity, and varying difficulties average out over time" (Merkel et al., 2017, p. 4). Thus, we take players' most recently available *grade point average* (GPA) as one measure of their general HC. Following the method prescribed by Merkel et al. (2017), the measure is derived by computing individual GPAs "with all school subjects weighted equally and then standardize them on the 15-point scale commonly employed in German upper secondary education, which ranges from 0 (very poor/fail) to 15 points (very good)" (p. 5). Our initial sample consisted of the GPAs of 178 individuals recorded across six half years (three years ranging from season-2010/2011 until season-2012/2013).

Given evidence that individuals' GPA may reflect more about individuals' conscious HC investment decisions than a true value of their HC (Lounsbury et al., 2003; Merkel et al., 2017), we extend our measure of general HC with two additional variables. As a component of players' pre-season training, the club's lead psychologist administers the simulation of standardised cognitive tests using the Vienna Test System SPORT (VTS), a digital neuropsychological test system for measuring sports-related, yet general, cognitive ability parameters (Schuhfried, 2011). The VTS enables us to

account for players' objective general HC through two test output scores. The first is the overall score from the individuals' VTS cognitive ability simulation (SIMS), which is a ratio of correct impulse responses to total impulses. The second is the information processing speed per impulse in the VTS simulation, which is simply the median time per correct response. These objective measures have been used in related literature as measures of general cognitive ability (Kassis, Schmidt, Schreyer, et al., 2017). Our initial sample consisted of the VTS output scores of 218 individuals recorded across 3 seasons (2013/2014 until season-2015/2016).

In summary, our cognitive ability measures of individuals' general HC are school grade point averages – GPA, VTS cognitive ability simulation scores – SIMS, and VTS information processing speed scores – PROS. Through the inclusion of these three measures, we account for the dynamic nature of individuals' HC development and in doing so, help to better predict the influence of cognitive ability differences on our dependent variable. Furthermore, all cognitive indicators were collected at least one year prior to measuring PROMOTED, which mitigates the risk of reverse causality (Heineck & Anger, 2010).

2.4.3 Specific human capital: Performance

In order to account for individual job performance differentials, we operationalise players' specific HC using three distinct measures.

First, throughout their time at the youth academy, players receive performance appraisals from coaches at the end of each half year. As a part of this process, the coach gives an assessment of the players' expected future performance, or footballing potential, which is evaluated on a 10-point Likert scale from 1 (very low) to 10 (very high). This score is then used in player feedback sessions and ultimately makes up part

of promotion decisions (Merkel et al., 2017). As such, we include coaches' assessment of players (EVAL) as a predictor in our models. Our initial sample consisted of the evaluation scores of 295 individuals recorded across three seasons (season-2013/2014 until season-2015/2016).

Two additional measures of job performance were included using data available from official season match reports, which are required to be submitted by the club to the German Football Association. These data contain the total number of times a player was selected in match team rosters, as well as the total number of minutes each selected player played per match. To account for varying number of matches, and minutes per match, that exist between the age group levels, these measures were converted to percentages before being included in our models. Therefore, for each individual in our sample, we include the percentage number of times the individual was selected for a match to total number of matches in a season (SELE) and the percentage number of minutes played to total minutes in a season (MINI). In line with Vaeyens, Philippaerts, and Malina (2005), these variables serve as objective proxies for players' job performance that are irrespective of player position. Our initial sample consisted of the objective performance scores of 191 individuals recorded across three seasons (season-2013/2014 until season-2015/2016).

In summary, our job performance measures of individuals' specific HC are managers expected future performance ratings – EVAL, the percentage number of selections the player earned in a season – SELE, and the percentage number of minutes played in a season – MINI. Through the inclusion of these three measures, we account for the influence of current objective and future subjective performance aspects of individuals' specific HC differentials on PROMOTED. Following methods prescribed by Prendergast (1993) and related studies modelling for HC investment (Buchholtz et

al., 2003; Gervais et al., 2008), we used lagged scores in our model to avoid any influence of PROMOTED stimuli on individuals' performance measures.

2.4.4 Controls

To factor for the potential influences of individual characteristics on promotion likelihood in the football academy, three controls are included. The first is individuals' age (AGE), in years, and is calculated as at 30th of June 2015. The mean age in our sample is 17.2 years. Previous research shows that age influences both the performance and HC investment of individuals (Bedard & Dhuey, 2006; Glamser & Vincent, 2004; Merkel et al., 2017; Musch & Grondin, 2001). Also, as Merkel et al. (2017) state, age represents players' seniority, because it "indicates which team a player belongs to, which in turn determines how many selection cycles he must still survive" (p. 5). The second control variable is individuals' length of service, or tenure, (TENURE). This control is calculated in years and is included in addition to AGE as not all individuals enter the academy at the same age group level. The two variables are, however, positively correlated. The mean TENURE in our sample is 3.7 years. Finally, we control for whether an individual is a foreigner (FOREIGN) to Germany. As measured by Kassis, Schmidt, Schreyer, et al. (2017), FOREIGN is a dichotomous variable, where observations received a 0 if they are non-German, or 1 if they hold German citizenship. Of the 97 observations, 86 (88.7%) are German and 11 (11.3%) are non-German. The variable is included as the effect of origin has been shown to potentially influence individuals' understandings of the evaluations they receive (Landy & Farr, 1980).

Table 1— Expected relationship of variables with PROMOTED

Variable	Operationalises	Type	Expected Relation	Reference(s)
GPA	General HC	Subjective	Negative (-)	(Merkel et al., 2017)
SIMS	General HC	Objective	Positive (+)	(Heineck & Anger, 2010; Kassis, Schmidt, Schreyer, et al., 2017)
PROS	General HC	Objective	Negative (-)	(Kassis, Schmidt, Schreyer, et al., 2017)
EVAL	Specific HC	Subjective	Positive (+)	(Merkel et al., 2017)
MINI	Specific HC	Objective	Positive (+)	(Kassis, Schmidt, Schreyer, et al., 2017; Vaeyens et al., 2005)
SELE	Specific HC	Objective	Negative (-)	(Kassis, Schmidt, Schreyer, et al., 2017; Vaeyens et al., 2005)

2.5 Methods

Using these data, we empirically test the influence of general and specific HC on PROMOTED by employing a range of techniques. First, we calculate pairwise correlations to provide an initial view of the relation between PROMOTED and the independent variables. We then use all available independent variables to estimate two initial logit models; one without controls, and one with all controls. The later model is hereafter referred to as *BASE*. In subsequent steps, we follow procedures prescribed in recent literature (Liaw & Wiener, 2002; McCullough et al., 2011) to try to improve the *BASE* model. First, we use the Least Absolute Shrinkage and Selection Operator (LASSO) procedure to estimate a logit model with reduced features (hereafter referred to as *REDUCED*) and compare its model evaluation criteria with that of the *BASE* model. Drawing on the outputs of these procedures, in a final step, we compare our *REDUCED* model results to those of bagging, and random forests.

All analyses used in this study are coded using R (Version 3.4.2). Despite the range of methods employed being typically applied to large datasets, we nevertheless

adopt these methods on our relatively small number of observations to prescribe a methodological approach for prospective research, where mass data may become available. The methods deliver particular advantages for analysis on large datasets as the techniques solve “challenges related to computation time and memory requirements” (Kosinski, Wang, Lakkaraju, & Leskovec, 2016, p. 494). When working with large datasets, we would also typically split the dataset into training and test subsets (e.g., a 75/25 split), however this step is ignored in these analyses due to the small sample size.

2.6 Results

We use the *corrplot* package (Wei & Wei, 2016) to graphically display a correlation matrix revealing bivariate relations between PROMOTED and measures of cognitive ability, performance, and our controls. The results are illustrated in Figure 2. For further clarity, only significant correlations shown. Insignificant correlations have been blanked (using the argument: `insig = "blank"`). These preliminary results show no significant support for the assumption that there exists a negative relationship between individuals' GPA and their promotion likelihood. We do however find that SIMS is positively correlated with PROMOTED (+.26, $p = .0096$). This result supports the assumed positive relationship between our main objective measure of cognitive ability and PROMOTED, despite no significant negative relationship being identified for PROS. We find mixed support for the assumption that there exists a positive relationship between individuals' specific HC and their promotion likelihood. Only MINI is positively correlated with PROMOTED (+.42, $p = .0000$), which is particularly interesting as managerial evaluations of a players' footballing potential do not, at least initially, seem to impact their promotion likelihood. In addition, the control variable

TENURE is positively correlated with PROMOTED (+.40, $p = .0000$), and AGE negatively with GPA (-.44, $p = .0000$), PROS (-.32, $p = .0013$), MINI (-.41, $p = .0000$), and SELE (-.53, $p = .0000$).

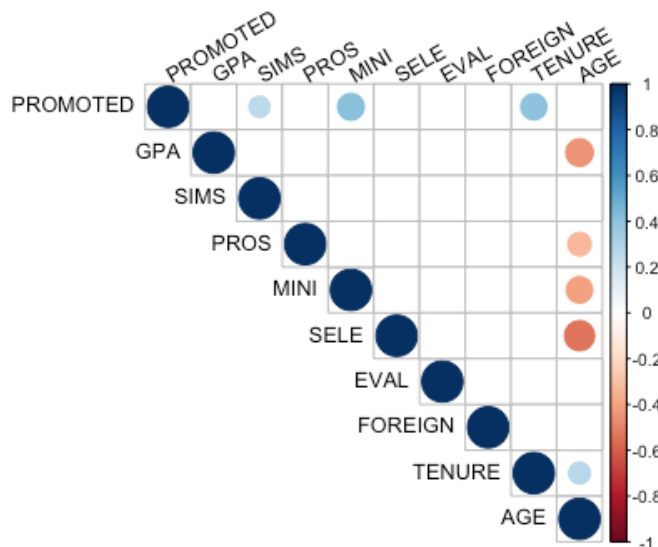


Figure 2— Correlations between variables

2.6.1 Logit model: BASE

In a second step, we estimate two distinct logit models: (1) including features without controls, and (2) including features with controls (BASE). The outputs of these models are presented in Table 2. Intriguingly, we find mixed results for the effect of general HC features on PROMOTED. The negative relationship between individuals' GPA and their promotion likelihood, which is only significant when controls are included, is in line with literature suggesting that individuals will invest less in their general HC if they are positive towards their career progression (Merkel et al., 2017).

We also find a robust and strong positive relationship between SIMS and PROMOTED. The dissimilar results between our general HC proxies give evidence for the dynamic nature of individuals' general HC development, which has been previously established in the literature (Buchholtz et al., 2003; Hogan & Walker, 2007; Lounsbury et al., 2003; Merkel et al., 2017). Relating to specific HC, of all the measures, only our objective measure of players' contribution in season matches, MINI, is significant. We are somewhat surprised to not find a more robust predictive influence of EVAL on PROMOTED. Finally, evaluating our controls, both TENURE and AGE significantly explain promotion likelihood. TENURE shows a strong positive relationship, while AGE is significantly negative. As individuals' can join the youth academy at different age levels, this evidence suggests that TENURE has more predictive power and that entering the academy at older age may in fact lower your chances of being promoted. Also, FOREIGN, which has been suggested to potentially affect the way individuals process their performance ratings, and thus their productivity, appears to have no significant influence in explaining PROMOTED.

Comparing the two initial models, we find clear improvement from model (1) to model (2) through the inclusion of our controls. The 26.226 fall in the Akaike Information Criteria (AIC) indicates strong preference for model (2). We therefore use model (2) for comparison with the evaluation criteria of our REDUCED logit model, which is estimated after employing the LASSO method. Our approach to building our REDUCED model is described in the following section.

Table 2— Determinants of PROMOTED in the football academy

Variables	PROMOTED				
	LOGIT	LOGIT - BASE		LOGIT - REDUCED	
	(1)	(2)	Average marginal effects	(2)	Average marginal effects
<i>General HC</i>					
GPA	-0.0607 0.1407	-0.4249* 0.2148	-0.1007* 0.0503		
SIMS	0.1236** 0.0459	0.2364*** 0.0704	0.0560*** 0.0164	0.2103** 0.0652	0.0507** 0.0155
PROS	0.0058 0.0346	0.0025 0.0440	0.0005 0.0104		
<i>Specific HC</i>					
MINI	0.0314*** 0.0089	0.0278* 0.0120	0.0066* 0.0028	0.0261* 0.0110	0.0063* 0.0026
SELE	0.0145 0.0300	-0.0506 0.0448	-0.0120 0.0105		
EVAL	0.5488† 0.2886	0.0747 0.3772	0.0177 0.0895		
<i>Controls</i>					
FOREIGN		-1.3273 1.1339		-1.4525 1.0148	
TENURE		1.2916*** 0.3263		1.1374*** 0.2735	
AGE		-1.2622** 0.3954		-0.7969** 0.2660	
<i>Evaluation criteria</i>					
<i>N</i>	97	97		97	
McFadden's R ²	0.2273	0.4675		0.4291	
Observations correctly classified	75.26%	85.57%		84.54%	
LR chi-squared	30.508	62.738		57.586	
BIC	135.73	117.22		104.08	
AIC	117.7	91.474		88.627	

Robust SEs in bold and marginal effects in italics. †, *, ** and *** represent statistical significance at the 10%, 5%, 1%, and .1% levels, respectively.

2.6.2 Logit model: REDUCED

In order to estimate our REDUCED model, we implement the LASSO method using the *glmnet* package (Friedman, Hastie, & Tibshirani, 2010). LASSO enables us to alleviate three potential drawbacks in the process of building our BASE model. First,

we required “domain knowledge to identify the correct set of features” (McCullough et al., 2011, p. 5). Second, as shown in Figure 1, we find some (weak) evidence of multicollinearity affecting our variable coefficients. Multicollinearity can lead to severe problems that, for example, “increase estimates of parameter variance; ... produce parameter estimates of the “incorrect sign” and of implausible magnitude; (and) create situations in which small changes in the data produce wide swings in parameter estimate” (O’Brien, 2007, p. 673). Finally, our BASE model contains nine features. We apply LASSO to penalise the use of too many features (particularly given our small sample size) and “correctly identify the smallest possible subset of power relevant features” (McCullough et al., 2011, p. 6). Through this approach, we attempt to end up with a more sparsely constructed model that incorporates “just enough features as are necessary” (McCullough et al., 2011, p. 6), while at least maintaining our model evaluation criteria.

The LASSO coefficients and null-deviance explained by the model were calculated at 100 different values for the regularisation parameter lambda (λ).⁶ Figure 3 shows the mean standard error of the model predictions for each λ value, which is returned after using the coefficients calculated at each λ to execute k-fold cross-validation. We select the λ value that minimises the cross-validated mean standard error, in this case 0.0686 (i.e. “lambda = lambda.1se” in R). Table 3 shows the feature coefficients for the model where the λ value is set to 0.0686. This model suggests the inclusion of predictors whose coefficients are nonzero. We use this information to estimate REDUCED, an additional logit model with only the features specified for

⁶ The penalty function (λ), “encourages the solution to aggressively set β values to zero (and exclude the associated features from the model)” (McCullough et al., 2011, p. 6).

selection by our LASSO model. The results of REDUCED are shown in Table 2. The REDUCED model contains only five features, as opposed to nine in the BASE model, yet the AIC is improved further and overall feature effects remain robust and significant.

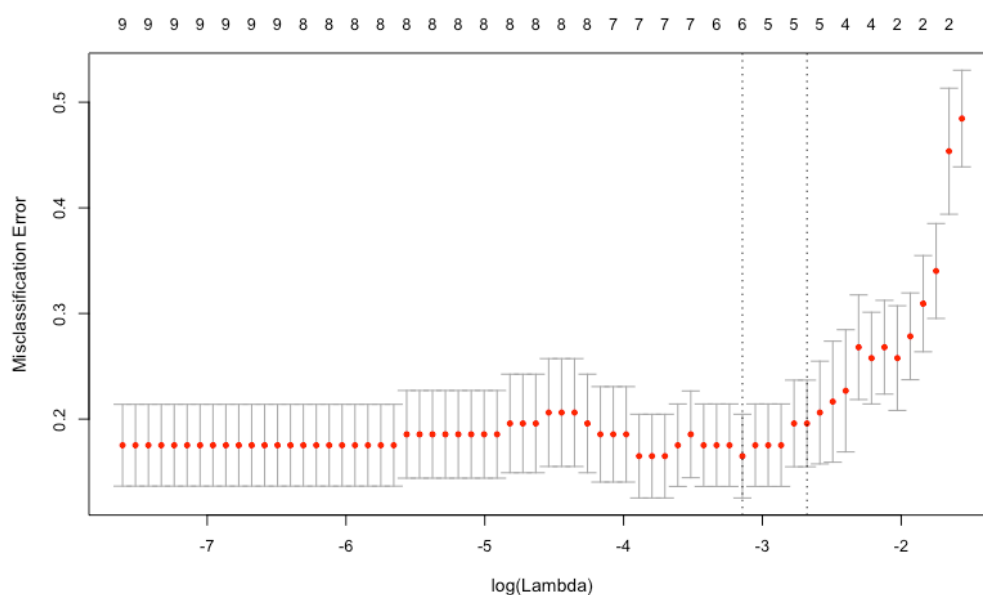


Figure 2— Mean standard error of the predictions for each λ value

Table 3— LASSO model coefficients at optimal (λ_{1se}) λ value

Variables	GPA	SIMS	PROS	MINI	SELE	EVAL	FOREIGN	TENURE	AGE
Coefficients	.0000	0.0486	.0000	.0144	.0000	.0000	-.0866	.4099	-.1805

By calculating variance inflation factors (VIF) of features used in our BASE and REDUCED models (see Table 4), we highlight the reduction in multicollinearity as a result of selecting features after employing the LASSO method. As outlined by O’Brien (2007), the VIF is the “inflation of the variance of the regression coefficient

due to multi-collinearity” (p. 683). VIF values are particularly useful given their clear interpretation. For example, “a VIF of 10 indicates that (all other things being equal) the variance of the *i*th regression coefficient is 10 times greater than it would have been if the *i*th independent variable had been linearly independent of the other independent variable in the analysis” (O’Brien, 2007, p. 684). However, following suggestions by O’Brien (2007), the values are calculated for comparison purposes only. We avoid an exclusive focus on treating for multicollinearity by dropping variables with VIF values above certain threshold levels, such as five or ten (Menard, 2002).

Table 4— Variance inflation factors for BASE and REDUCED

Variables	GPA	SIMS	PROS	MINI	SELE	EVAL	FOREIGN	TENURE	AGE
BASE - VIF	1.499	1.921	1.185	1.301	1.770	1.196	1.088	2.438	4.045
REDUCED - VIF	-	1.715	-	1.206	-	-	1.055	1.926	2.162

2.6.3 Discussion on hypotheses

In line with theory on contest mobility systems (Maurer & Chapman, 2013; Ng et al., 2005; Turner, 1960), the results of our REDUCED model support the view that individuals’ HC factors are positively related to individuals’ career success. Specific to our sample, when controlling for the age, tenure and whether the individual is a foreigner, individuals with higher SIMS and MINI enjoy a greater likelihood to be promoted. In fact, holding all other variables constant, a one standard-deviation increase in SIMS, results in a 15.0% increase in their promotion likelihood. Similarly, holding all other variables constant, a one standard-deviation increase in MINI, results in a 11.2% increase in their promotion likelihood. We therefore generally support our

first hypothesis that there exists a positive relationship between HC and individuals' extrinsic career success.

Concerning our second hypothesis, as we account for the fact that our setting places clear demands on specific HC to determine employment and promotion decisions, we expected to find that specific HC would be more predictive of promotions than general HC factors. However, our results show no superior predictive ability among specific HC factors over general HC factors. For example, we are particularly intrigued by the lack of predictive influence of EVAL on PROMOTED. One potential explanation for this finding is that due to the high-pressure coaches are faced with to deliver results, potential future performances of players do little to influence their decisions on promoting players. Rather, current performances are priority and thus outweigh any potential future performance. This possible explanation is supported by the fact that MINI, the relative contribution of players playing time in a season, is robust and positive in predicting promotion decisions. Taken together, given the robust and positive influence of SIMS on PROMOTED, we cannot support our second hypothesis that specific HC is more predictive of individuals' extrinsic career success than individuals' general HC.

Finally, we find strong support for our third hypothesis that objective measures of individual level HC would be more predictive of extrinsic career success than subjective measures. Both objective measures of specific and general HC, MINI and SIMS respectively, show a robust and strong positive effect on promotion across all models. Subjective measures, EVAL and GPA, on the other hand, show no robust effect. This finding is particularly noteworthy as it also highlights a significant difference between the two measures of general cognitive ability, SIMS and GPA, in predicting extrinsic career success. More specifically, SIMS is an occupation specific

measure of general cognitive ability, while GPA provides a general cognitive ability that is not explicitly tied to the job requirements of individuals. Accordingly, given that SIMS outperforms GPA in explaining promotion decisions, the findings suggest that when investigating the effect of individuals' cognitive ability on their extrinsic career success, general HC measures should account for the specific requirements of the individuals' job and the demands of their workplace.

2.6.4 Predictions

We can further evaluate the quality of the REDUCED model by its accuracy in predicting player promotions in our sample. When working with a large dataset, the evaluation of model accuracy would be made on the subset of data not used in building the model (i.e. approximately 25% of full sample that is subset for testing). This approach would, for example, replicate the process of collecting new data. However, due to our small sample size, we illustrate this evaluation process using just the training data (i.e. data used for building the model).

For all cases in our sample where PROMOTED was equal to 0 (player dropped), the average probability returned from the REDUCED model was 0.232. For all cases where PROMOTED was equal to 1 (player promoted), the average probability returned was 0.743. In order to convert individual model probabilities into class predictions (0 or 1) and subsequently compare the predictions with actual sample outcomes, we first require a threshold value (t). The threshold value is between 0 and 1; where $\Pr(\text{PROMOTED} = 1) < t$, the model would predict promotion, and where $\Pr(\text{PROMOTED} = 1) \geq t$, the model would predict the player being dropped. Selecting a threshold value requires careful consideration of the two types of errors a model can make – predicting 0 when the actual outcome is 1 (i.e. false negatives), or predicting 1

when the actual outcome is 0 (i.e. false positives). The closer a threshold value is to 0, the more often the model will predict 1, and thus, the more likely the false positive error will increase. Conversely, the closer a threshold value is to 1, the more often the model will predict 0, and thus, the more likely false negative error will increase. We can quantify the trade of between these errors using calculations of *sensitivity* and *specificity* (Altman & Bland, 1994). The confusion matrix shown in Table 5 shows a comparison of model predicted outcomes to actual sample outcomes at two threshold levels. The first threshold value is 0.5, which suggests no preference between the false negative or false positive errors. Using this threshold, we have a sensitivity of 0.826, and a specificity of 0.863, which results in a model with 84.54% balanced accuracy (as shown for “Observations correctly classified” in Table 2). The second threshold is 0.4, which incorporates a preference for false positive error over false negative error (i.e. higher specificity). Using this threshold, we increase the sensitivity to 0.957, while reducing specificity to 0.784. The effect of lowering the threshold value to 0.4 results in an overall increase in our model accuracy by 2.06% to 86.60%.

Table 5— Confusion matrix of REDUCED at two threshold values

<i>Threshold = 0.5</i>	Predicted = 0	Predicted = 1
Actual = 0	44 (true negatives)	7 (false positives)
Actual = 1	8 (false negatives)	38 (true negatives)
<i>Threshold = 0.4</i>	Predicted = 0	Predicted = 1
Actual = 0	40 (true negatives)	11 (false positives)
Actual = 1	2 (false negatives)	44 (true negatives)

In order to view the performance of our REDUCED classification model and show how we selected the 0.4 threshold value, we run a Receiver Operator Characteristic (ROC) curve using the *ROCR* package in R (Sing, Sander, Beerenwinkel, & Lengauer, 2005). The results of the ROC are presented in Figure 4. As seen in the plot, we find a steady improvement in the true positive rate as a function of the false positive rate until the 0.4 threshold. The marginal improvement in the true positive rate between 0.4 and 0.3 (or lower), is negatively outweighed by the increase in the false positive rate. As such, the balanced accuracy of the model is maximised at the 0.4 threshold value (approximately). In addition, we find that the model's area under the ROC curve (AUC) is 91.56%. The AUC criterion represents a widely used measure of the quality of the classification algorithm or accuracy of predictive distribution models (Cortes & Mohri, 2004).

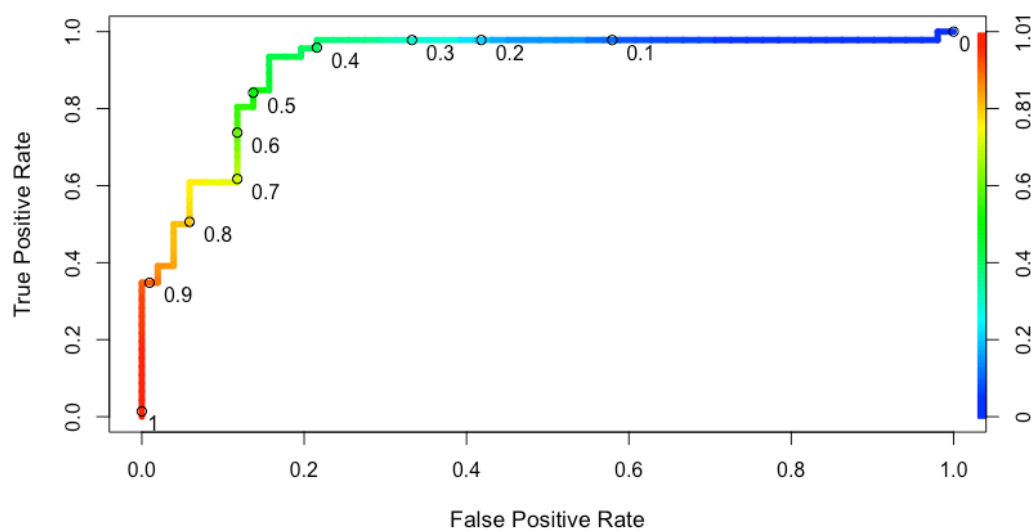


Figure 4— ROC curve for the REDUCED model

2.6.5 Ensemble learning: Tree-based methods for classification

In a final step, we further test the robustness of our REDUCED model by comparing results with those of tree-based methods (Breiman, 1996, 2001; Schapire, Freund, Bartlett, & Lee, 1998). Tree-based methods offer a simplified alternative for interpreting promotion predictions in our data. Following procedures outlined by James, Witten, Hastie, and Tibshirani (2013), recursive binary splitting (i.e. *top-down, greedy* approach) is used to grow our initial tree. Figure 5 shows the result of the initial unpruned classification tree, which consists of nine internal nodes (i.e. splits or regions), and ten terminal nodes.

The *cross-entropy* criterion is specified for making the binary splits and the observations in each split is assigned the most commonly occurring class of all observations in that region. Although this process produces good predictions (accuracy 84.53%), to avoid overfitting the data (and subsequently poor test set performance where test data are available), we *prune* the *tree* to obtain a *subtree*. As James et al. (2013) state, “This is because the resulting tree might be too complex. A smaller tree with fewer splits ... might lead to lower variance and better interpretation at the cost of a little bias” (p. 307). In order to prune the tree, we follow an approach similar to that used in the LASSO model. Specifically, we use *cost complexity pruning* (i.e. weakest link pruning) to obtain a sequence of best subtrees as a function of a nonnegative tuning parameter (α). K-fold cross-validation is used in order to choose the optimal value for α . Cross validation results presented in Figure 6 show deviance values for trees with one to ten terminal nodes. The deviance takes on its minimum for a tree consisting of three terminal nodes (deviance = 109.83). The corresponding pruned tree with three terminal nodes is presented in the right of Figure 6.

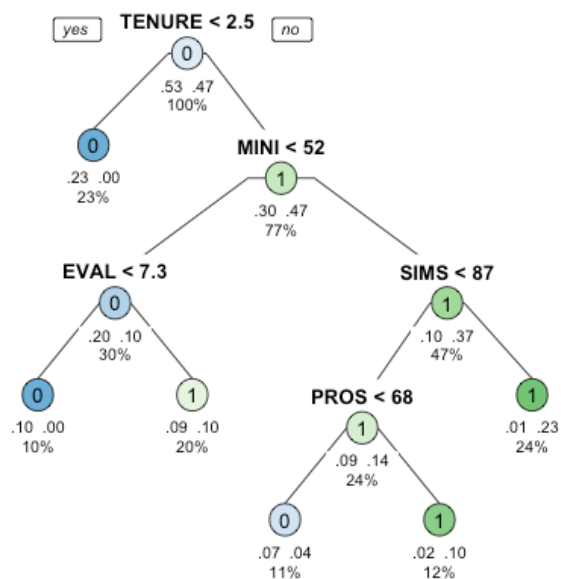


Figure 5— Unpruned classification tree for PROMOTED

As expected, the results of our decision tree method allow for a vastly simplified interpretation of our data. Overall, the pruned tree stratifies the observations in our dataset into three regions. Starting at the top of the tree, as shown in the left branch, PROMOTED is predicted at 0 for individuals with TENURE less than 2.5 years. Where TENURE is greater or equal to 2.5 (i.e. the right branch), an additional split occurs depending on the individuals’ minutes played in the season. Individuals that play less than 52% of the season for their respective teams are assigned a 0 for PROMOTED, whereas those with more than, or equal to, 52% are assigned a 1 for PROMOTED. These three regions can be written as:

$$R_1 = \{X|TENURE < 2.5\}, R_2 = \{X|TENURE > 2.5, MINI < 52\}, \text{ and } R_3 = \{X|TENURE > 2.5, MINI > 52\}.$$

The predicted promotion classifications for these regions are 0, 0, and 1 respectively and the accuracy is 79.38%.

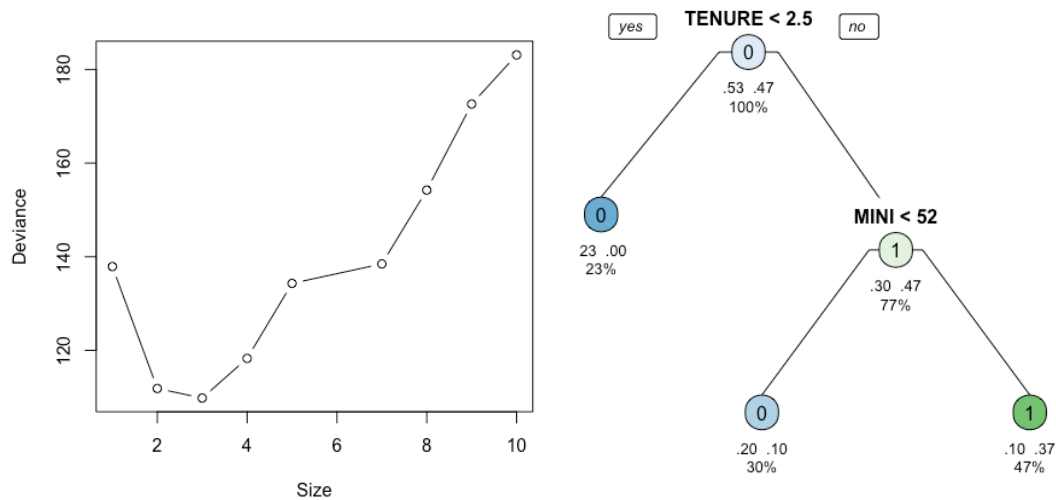


Figure 6— *Left:* Cross-validation deviance for different sizes of a pruned tree. *Right:* Pruned classification tree for PROMOTED corresponding to the minimum deviance.

Given this information, we see that the relationship between our features and PROMOTED is better approximated by our REDUCED model. Nevertheless, the decision tree method provides relatively high accuracy considering the significantly simplified interpretation and visualisation it offers. Furthermore, there exist methods to overcome the generally lower predictive accuracy decision trees provide over other classification approaches (James et al., 2013). Two well-known methods are *bagging* (Breiman, 1996), and *random forests* (Breiman, 2001). These methods offer a simplified alternative to the normally impractical process of taking many training sets from the population as a “way to reduce the variance and hence increase the prediction accuracy of a statistical learning method” (James et al., 2013, p. 316). Bagging

constructs classification trees using bootstrapped training sets (i.e. a percentage of total observations for each bagged tree). For a given test observation, the class predicted by each of the bagged trees is recorded and the overall prediction is the most commonly occurring class among the bagged tree predictions (i.e. *majority vote*). This approach enables straightforward estimation of the test error of a bagged model without the need to perform cross-validation. It is simply estimated using out-of-bag (OOB) observations (the remaining percentage of observations not used to fit a given bagged tree) and the majority vote rule. As James et al. (2013) state, “An OOB prediction can be obtained in this way for each of the n observations, from which the overall ... classification error ... can be computed. The resulting OOB error is a valid estimate of the test error for the bagged model, since the response for each observation is predicted using only the trees that were not fit using that observation” (James et al., 2013, p. 318). Although bagging is a special case of a random forest, random forests can further reduce variance, and classification tree accuracy, over bagged methods by using a splitting algorithm that “is not even allowed to consider a majority of the available predictors” (James et al., 2013, p. 320). This alleviates situations where a very strong predictor in the dataset determines bagged trees in the top split.

Using the randomForest package in R (Liaw & Wiener, 2002), we can perform both bagging and random forest by simply changing the number of predictors that should be considered for each split of the tree. For bagging, we use all predictors (i.e. $m = p$), and for random forest, we simply use the square root of all predictors (i.e. $m = \sqrt{p}$). Due to our current small number of observations, these methods do not provide overall improvements in our ability to investigate the influence of various HC factors on PROMOTED. They do, however, offer unique ways for visualising and interpreting classification problems, which we intend to use in subsequent related research where

mass volumes of data may become available. Accordingly, we nevertheless include examples of the results of bagging and random forests applied to our data. Figure 7 shows the test error for bagging (in red) and random forests (in blue) as a function of the number of bootstrapped training sets used. We see that the overall OOB error diminishes, generally, with the number of trees and that compared to bagging, the OOB error for random forests is generally lower.

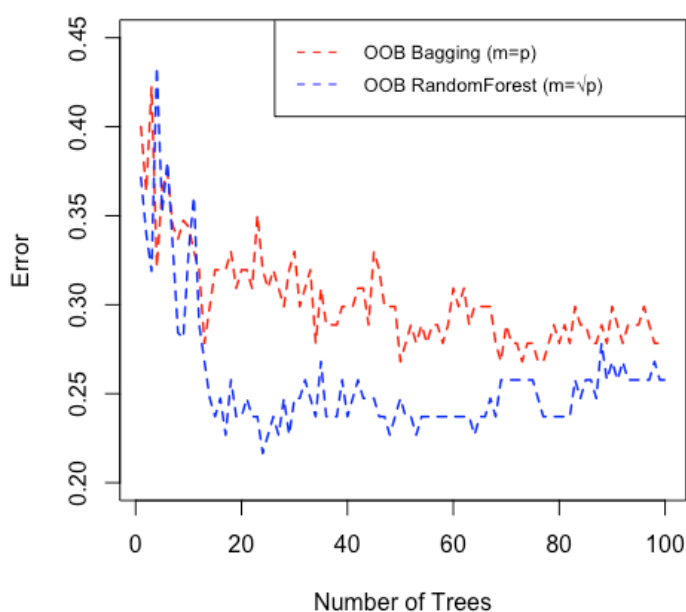


Figure 7— Bagging and random forest results for data on PROMOTED

Figure 8 provides a more interpretable view of the overall importance of each variable to the bagging procedure. As James et al. (2013) explain, “in the context of bagging classification trees, we can add up the total amount that the Gini index ... is decreased by splits over a given predictor” (p. 319), which are then averaged over all bagging trees. The variables with the largest decrease are TENURE (10.49, 12.28),

MINI (4.90, 9.65), and SIMS (5.70, 8.47). These results generally support the findings of our REDUCED model, despite their lower respective accuracy.

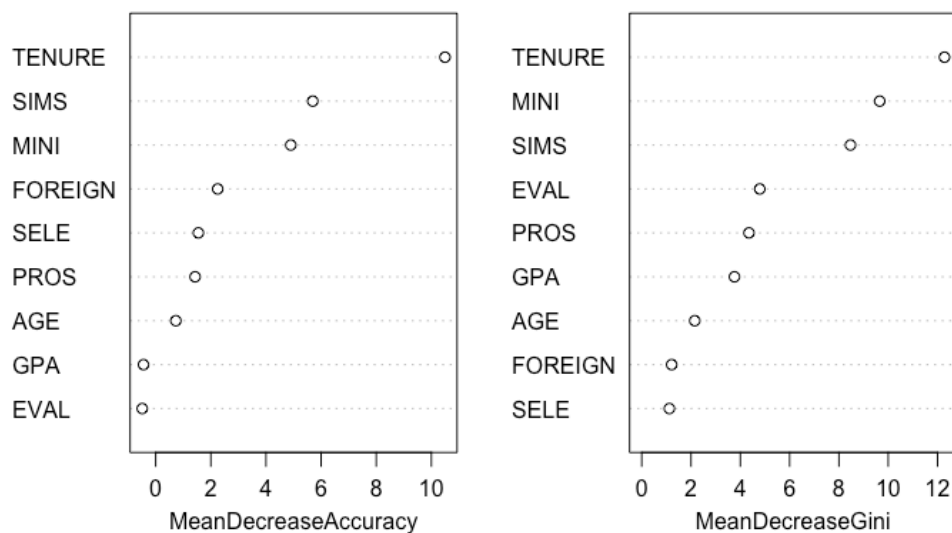


Figure 8— Dotchart of variable importance as measured by bagging

2.7 Conclusion

In this study, we set out to answer the research question: *How do various HC measures vary in their predictability of individuals' career success?* Our empirical results, based on unique human capital data of 97 elite football players aged between 14 and 19, deliver three key findings. First, in line with literature on upward mobility (Maurer & Chapman, 2013; Ng et al., 2005; Turner, 1960), we find a generally positive relationship between individuals' HC factors and their extrinsic career success, as measured by promotion. Second, despite recent evidence that individuals who are optimistic towards their career prospects will invest more in their specific HC and less

in general HC (Merkel et al., 2017), we are unable to find support for the suggestion that individuals' specific HC are more predictive of promotions than their general HC. Third, our findings provide strong support for the use of objective, rather than subjective, HC measures for investigating the effect of individuals' HC on promotion likelihood. More specifically, our occupation specific measure of general cognitive ability outperformed GPA (a general cognitive ability measure that is not explicitly tied to the job requirements within our setting) in explaining promotion decisions. This suggests that when investigating the effect of individuals cognitive ability on their extrinsic career success, researchers should link the cognitive ability factors being measured to the job requirements and appropriately account for the cognitive factors that are most suited to cope with the demands of subjects' workplaces.

It is important to highlight here that this study is undoubtedly limited by its relatively small sample size and its encompassing of only one German youth academy. Furthermore, the sampled data excludes women. For the findings to be generalizable, they must be validated using a larger dataset that, in best case, includes youth from other academies as well as females. Nevertheless, this study takes a useful step towards quantifying the specific relation between various individual human capital factors and promotion, whilst also accounting for the dynamic nature of individuals' HC decision trade-offs involved in their HC development.

3 [Article 2] Who Gets Promoted? Personality Factors Leading to Promotion in Highly Structured Work Environments⁷

3.1 Introduction

In the face of research evidence that certain personality characteristics are rewarded on the labour market while others are punished (see Heineck & Anger, 2010), individual personality traits have become critically important to economists investigating how human capabilities contribute to labour market outcomes. In particular, this evidence supports the premise that some contributions made by traditional human capital predictors⁸ to labour market success (Finnie & Meng, 2001; Heckman, 2000; Schultz, 1961) are in fact due to individual personality traits (Brunello & Schlotter, 2011; Cobb-Clark & Schurer, 2012; Kagel & McGee, 2014). Hence, several recent studies analyse the relation between individual personality traits, cognitive abilities, and labour market outcome differentials (Heckman et al., 2006; Heineck & Anger, 2010; Judge et al., 1999).

In this paper, we extend this evidence by using professional sports as a labour market laboratory (cf., Kahn, 2000) in which to examine whether particular personality traits support or hinder career promotion,⁹ thereby accounting for individual cognitive

⁷ This chapter is based on a published paper under the title: “Who gets promoted? Personality factors leading to promotion in highly structured work environments: evidence from a German professional football club”. The paper is published in *Applied Economics Letters*: Volume 24, 2017 - Issue 17. The authors include Mark Kassis, Sascha L. Schmidt (Center for Sports and Management, WHU Otto Beisheim School of Management), and Benno Torgler (Economics and Finance, QUT Business School).

⁸ The traditional human capital predictors include education, experience, and approximates of individual cognitive abilities via standardized test scores or general aptitude tests (Heineck & Anger, 2010).

⁹ Also referred to as extrinsic career success; that is, outcomes that are instrumental rewards from the job or occupation but also objectively measured by, for example, salary or promotions (see Seibert & Kraimer, 2001).

ability and job performance. We also detail specific situations¹⁰ that might moderate which personality traits predict career promotion. In doing so, we test the hypothesis that the relation between personality traits and career success is not important in job contexts in which clear demands are made on behaviour (Judge & Zapata, 2015).

3.2 Background

To address our research question, we examine career promotions in the youth academy of a professional football club in Germany's highest football division, the Bundesliga. This academy comprises seven teams ranging across seven age group levels¹¹ from which approximately 150 players compete each year for promotion to the next level. Promotion decisions for each individual are made at season end based on aggregated performance appraisals by coaches. Approximately 60% of players progress each year within the levels, but only 5% are promoted from the academy to a professional career, which underscores the competitiveness and opportunity costs to individuals (Schmidt & Weiss, 2010).

Because this environment provides an opportune setting for investigating personality-promotion linkages, it is the subject of much previous labour market research (Merkel et al., 2017). Not only does each "employee" compete for a relatively homogeneous job with the strong shared objective of a professional contract on academy completion (Schmidt et al., 2017), but the job appraisal and promotion systems have much in common with those in business contexts, particularly the up-or-out systems used by professional service firms (Merkel et al., 2015). Because this

¹⁰ By "situation," we mean the degree to which job context constraints are imposed on individuals in the work environment (Judge & Zapata, 2015).

¹¹ Each team consists of approximately 22 players; the levels range from the under-12s (U12) to the under-19s (U19), representing ages 12 to 19.

setting meets the conditions for the “strong situation”¹² described by Judge and Zapata (2015), it allows us to leverage our unique individual personality trait data to assess the moderating effect of personality-labour market outcome linkages in a highly structured and unambiguous work environment (Judge & Kammeyer-Mueller, 2007).

3.3 Data and methodology

Our data are drawn from the MSA-MotivProfil (MSA), a psychological survey measuring individuals’ core motives (Fuchs & Huber, 2002), and the Vienna Test System SPORT (VTS), a digital neuropsychological test system for measuring sports-related cognitive parameters (Schuhfried, 2011). In July 2015, as a component of the players’ pre-2015/16 season training, the club’s lead psychologist administered both the survey and the simulation to 84 participants from the under-15 (U15) to under-19 (U19) age group levels. Four participant responses were excluded because of quality checks, resulting in a final sample of 80 valid respondents. Player demographic and performance statistics were also collected at season’s end in August 2016 via official data sent to the German Football Association (DFB).

Using these data, we assess the influence of psychological traits on the players’ career promotion by estimating probit models with the following specification:

¹² A strong situation is a job context in which individuals are subject to (1) a high impact of decisions on co-workers and results, (2) high consequences of error, (3) high consistency in job tasks, and (4) high constraints (Judge & Zapata, 2015).

$$\Pr(\text{PROMOTED} = 1) = \Phi(\beta_0 + \beta_1 \text{COMP} + \beta_2 \text{FREE} + \beta_3 \text{KNOW} + \beta_4 \text{ORDE} + \beta_5 \text{PHYS} + \beta_6 \text{POWE} + \beta_7 \text{PRIN} + \beta_8 \text{RECO} + \beta_9 \text{RELA} + \beta_{10} \text{RISK} + \beta_{11} \text{SOCl} + \beta_{12} \text{STAT} + \beta_{13} \text{SIMS} + \beta_{14} \text{PROS} + \beta_{15} \text{SELE} + \beta_{16} \text{MINI} + \beta'_{17} \text{CONTROLS}),$$

Here, PROMOTED, a dependent variable that accounts for both cognitive ability and job performance, is based on the objectively observable promotion of a player from one team squad to another team squad at the start of the subsequent season; that is, season 2015/16 to 2016/17. Figure 1 shows the split of dropped and promoted players in our sample. The observations consist of 30 (37.5%) dropped and 50 (62.5%) promotions.

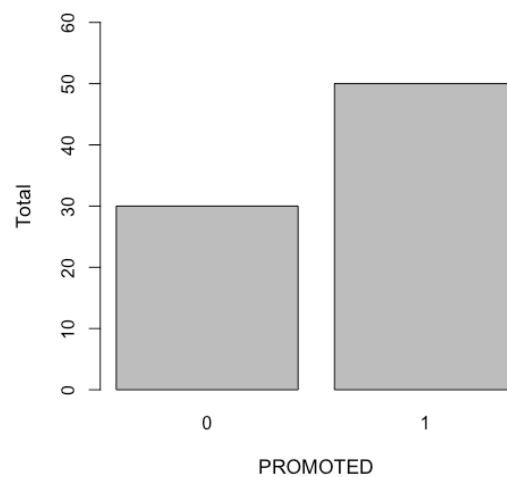


Figure 1— Number of individuals dropped and promoted in our PROMOTED sample

The independent variables, selected on the basis of conceptual linkages with individual performance criteria (cf., Tett et al., 1991), include 12 personality trait variables, two

cognitive ability variables, and two overall performance measures that are indicative of players' season involvement (see Table 1).

We mitigate the risk of reverse causality¹³ by collecting both personality and cognitive indicators approximately one year prior to measuring promotion (PROMOTED). We classify MSA taxonomy in our model according to its best fit with facets of the five-factor model not only because it is the “most ubiquitous and widely accepted trait framework in the history of personality psychology” (Judge & Zapata, 2015, p. 1150) but because relevant labour market outcome evidence suggests its efficiency (Barrick & Mount, 1991; Seibert & Kraimer, 2001). We also include a number of control variables, including individual AGE, TEAM, TENURE (years in the club), and POSITION, and a FOREIGNER dummy for non-Germans (see Table 1 for a complete list and rationale for inclusion).

¹³ That is, environmental feedback effects that may shape individual personality and thus overestimate the contribution of respective traits to economic outcomes (Heineck & Anger, 2010).

Table 1— Variable definition, measurement, and rationale for use

Variable	Definition and measurement			Rationale for including variable
Dependent variable				
PROMOTED	Objectively observable promotion of a player from one team squad to another team squad at the start of the subsequent season: 0 if player is not selected, 1 when player is selected			Career progression is the major objective of players in the professional football industry (Jung, Schmidt, & Torgler, 2012).
Independent variables				
Personality factors				
60 question survey, five questions per trait: 0-100% score based on MSA scales				
<i>Low score: <=25%</i> <i>High score: >=75%</i>				
<u>Conscientiousness</u>				
ORDE (order)	Flexible	vs	Structured	Positive relation between facets of conscientiousness and extrinsic career success (Howard & Bray, 1990).
<u>Neuroticism</u>				
RECO (recognition) RISK (risk/stress)	Self-reliant Sensitive	vs vs	Self-conscious Robust	Negative correlation between career success and individuals characterized by high levels of anxiety and self-consciousness (Ng et al., 2005).
<u>Extraversion</u>				
FREE (freedom) PHYS (physical activity) POWE (power) RELA (relation)	Team oriented Inactive Follower Distant	vs vs vs vs	Independent Active Leader Sociable	More positive relation between facets of extraversion and extrinsic career success, particularly in jobs involving high levels of interaction (Seibert & Kraimer, 2001).
<u>Agreeableness</u>				
COMP (competitiveness) PRIN (principle) STAT (status)	Compensatory Purpose orientated Modest	vs vs vs	Fierce Code orientated Elitist	More negative relation between facets of agreeableness and extrinsic career success (Judge & Kammeyer-Mueller, 2007).
<u>Openness</u>				
KNOW (knowledge)	Pragmatic	vs	Intellectual	Little consistent relation between facets of openness and career success (Judge & Kammeyer-Mueller, 2007).
<u>Other</u>				
SOCI (social desirability)				Little consistent relation between facets of social desirability and job performance (Ones, Viswesvaran, & Reiss, 1996)
Cognitive factors				
SIMS (simulation score)	Score from VTS cognitive ability simulation: ratio of correct impulse responses to total impulses			Cognitive ability differentials result in productivity differences which may then lead to better promotion prospects (Heineck & Anger, 2010).
PROS (processing speed)	Information processing speed per impulse in VTS simulation: median time per correct response			
Performance factor				
SELE (selection)	Games that the player was selected for in a season, including as a substitute, not necessarily as a starting player: total selections/total matches in a season			Number of selections and minutes played serve as objective proxies for performance irrespective of player position (Vaeyens et al., 2005).
MINI (minutes played)	Minutes played in a season: total minutes played in the season/total minutes in season			
Control factors				
AGE in years, players' current academy TEAM, TENURE in years, players' main playing POSITION, and a dummy for FOREIGN (non-German = 1)				

Table 2— Determinants of PROMOTED in the football academy

Dependent variable	PROMOTED							
	(PROBIT – A)				(PROBIT – B)			
	(1)	(2)	(3)	Average Marginal Effects	(4)	(5)	(6)	Average Marginal Effects
Personality factors								
COMP	1.0018 1.0185				1.0018 1.2899			
FREE	-0.2023 1.2523				-0.2023 1.1782			
KNOW	0.2865 1.0771				0.2865 1.1830			
ORDE	-0.6136 1.0306				-0.6136 1.1187			
PHYS	2.0728 2.4736				2.0728 2.2030			
POWE	-0.0591 1.4363				-0.0591 1.2688			
PRIN	-4.4190** 1.4463	-2.9791* 1.1715	-5.1551** 1.9397	-1.1653** 0.3971	-4.4190* 1.9369	-3.6216* 1.5665	-5.2755* 2.6579	-0.9358* 0.4361
RECO	2.8579† 1.5633				2.8570* 1.2694	2.9919* 1.2432	3.0792 2.0323	0.5462 0.3417
RELA	0.4830 1.5420				0.4830 1.5209			
RISK	0.4255 1.0316				0.4255 1.2360			
SOCI	0.8845** 0.3075	0.5452 0.3661	1.3554*** 0.2119	0.3064*** 0.0755	0.8845 1.3237			
STAT	-2.4781 2.5124				-2.4781* 1.1663	-3.0037** 1.1088	-4.8844* 2.1628	-0.8665* 0.3477
Cognitive factors								
SIMS		5.4430* 2.2712	3.5089 2.3794	0.7932 0.6279		6.7579 4.2446	7.7037 6.1317	1.3666 1.0489
PROS		-1.0936 3.6966	-5.1304*** 1.2327	-1.1597*** 0.3244		-3.0862 2.3637	-8.7204* 4.3272	-1.5470* 0.6984
Performance factor								
SELE			-1.8847 1.4495	-0.4260 0.3644			-2.9569 1.9456	-0.5245 0.3265
MINI			4.7905*** 1.0675	1.0829*** 0.2692			6.2395** 2.2901	1.1069*** 0.3363
Control factors								
FOREIGN			-0.7673 0.4890	-0.1849† 0.1099			-1.0611 0.7340	-0.1235 0.1512
TENURE			-0.3769** 0.1194	-0.0852*** 0.0171			-0.3303* 0.1678	-0.0586* 0.0274
AGE			YES				YES	
POSITION			YES				YES	
TEAM	CLUSTER	CLUSTER	CLUSTER		CONTROL	CONTROL	CONTROL	
Evaluation criteria								
N	80	80	80		80	80	80	
McFadden's R ²	0.1336	0.0634	0.3892		0.2916	0.1503	0.5113	
Observations correctly classified	73.75%	63.75%	83.75%		73.75%	70.00%	82.50%	
LR chi-squared	14.14	6.71	41.20		14.14	15.91	54.12	
BIC	-201.889	-229.509	-220.179		-201.889	-234.333	-211.190	

Notes: Robust standard errors in bold and marginal effects in italics. †, *, **, and *** represent statistical significance at the 10%, 5%, 1%, and .1% levels, respectively.

3.4 Results

To measure the importance of individual personality traits and cognitive ability for promotion, we estimate three probit models: (1) a psychological factors model including all factors together,¹⁴ (2) a cognitive factors model including psychological factors significant at a minimum 5% level, and (3) an extended model containing all the personality and cognitive factors from the preceding model together with controls. As a robustness test, we run this process twice, once using standard errors adjusted for clustering over teams (see Table 2 specifications (1) to (3)) and once using team dummies (see (4) to (6))

Intriguingly, of all the personality traits, we find a robust and strong negative effect of principle, PRIN, on promotion across all models. This finding is particularly noteworthy for its suggestion that in strong situations, individuals with higher tendencies to loyalty and morality who value traditions and norms have a lower likelihood of promotion. For example, in specification (6), increasing individual PRIN by one standard deviation while holding other variables constant decreases promotion probability by an average 11.1%. This result is consistent with the overall negative relation between extrinsic career success and agreeableness (Boudreau et al., 2001; Seibert & Kraimer, 2001) and with previous evidence that individuals high on agreeableness “perceive competitive situations as more problematic, more difficult, and less rewarding” (Judge & Zapata, 2015, p. 1155).

The results in specifications (3) and (6) further show that the cognitive ability factor, PROS, has a significant impact on player promotion: individuals who have a higher processing speed – and thus a lower decision time – are more likely to be

¹⁴ Testing each single factor independently yields similar results.

promoted. For example, in specification (3), when other variables are held constant, a one standard deviation in PROS increases the probability of promotion on average by 11.1%. Likewise, SIMS, the individual cognitive ability score of correct simulation impulses, may also increase promotion likelihood through productivity differences. Lastly, as expected, the level of individual season involvement, MINI, has a very strong and significant relation with PROMOTION: the more involved in the job, the more likely an individual is to be promoted.

3.5 Conclusion

Our analytic results, based on unique personality data and the cognitive ability scores of 80 elite football players in age groups U15 to U19, suggest that individuals who score low on the personality facet of principle but high on cognitive processing speed and job involvement are significantly more likely to positively influence their extrinsic career success through job promotion. Observing this outcome in our relatively homogeneous but competitive sports setting supports the view, refuted in some earlier research (Cooper & Withey, 2009; Judge & Zapata, 2015; Withey, Gellatly, & Annett, 2005), that personality traits are important for career progression even in a highly structured and unambiguous job context. Our results are thus in line with the increasing awareness that the returns to personality traits and cognitive abilities may result in productivity differences and better job performance, which translate directly into labour market success differentials (Heineck & Anger, 2010).

Admittedly, the study is limited by its relatively small sample size, which encompasses only one German youth academy and excludes women. Hence, for the findings to be generalizable, they must be validated using a larger data pool that includes youth from other academies, as well as females. This study does, however,

take a useful step toward quantifying the specific relation between personality traits, cognitive ability, and promotion while identifying which skills are important and quantifying their effects.

4 [Article 3] The Decision-Making Effect: Psychological Pressure and the Role of Decision Making on the Timing-Performance Relationship¹⁵

4.1 Introduction

In 2016, Germany squared off against Italy in the quarter-final of the UEFA European Championship, arguably one of the most competitive football competition in the world. With the match still drawn after regulation and extra playing time, it was on to the dreaded penalty shootout, football's method of determining a match winner where teams take turns shooting from the penalty spot until one team outscores the other. As required prior to a shootout, the match referee gathered team captains for a coin toss to determine the shooting sequence. Bastian Schweinsteiger, captain of Germany, won the coin toss and amidst the roar of 38,764 fans, faced a key strategic decision – choose that his team kick first, or leave the pressure of the first kick to their rivals. In feverish consultation with coaching staff and teammates, Germany's captain chose to kick second. Was this decision the right one?

In the face of economic evidence that moving first in competitive tournaments may accrue higher performance than later entry (Kerin, Varadarajan, & Peterson, 1992; Lieberman & Montgomery, 1988; Urban & Star, 1991), first-mover advantage (FMA) theory has attracted much attention in strategic management literature. Researchers

¹⁵ This chapter is based on an unpublished manuscript under the same title. The authors include Mark Kassis, Sascha L. Schmidt (Center for Sports and Management, WHU Otto Beisheim School of Management), Dominik Schreyer (Center for Sports and Management, WHU Otto Beisheim School of Management).

have subsequently developed FMA theory by identifying firm-level resources that allow firms to benefit from being a first-mover and prescribe methods for protecting FMA against later entrants (Suarez & Lanzolla, 2007). Although the debate over optimal time of entry rages on (see Lieberman & Montgomery, 2013; Suarez, Grodal, & Gotsopoulos, 2015), researchers are becoming increasingly aware that psychological pressure may play an important role in explaining the performance of subjects competing in tournament settings (Ariely, Gneezy, Loewenstein, & Mazar, 2009). Yet examining the effects of whether psychological pressure and entry-order may influence tournaments' outcomes presents many challenges. The highly complex nature of naturally occurring economic environments rarely create circumstances that allow an objective view of psychological and behavioural elements at work (Savage & Torgler, 2012).

Accordingly, due to their comparable, yet controlled nature, recent FMA research has turned to dynamic competitive settings found in professional sports (e.g., Feri et al., 2013; González-Díaz & Palacios-Huerta, 2016; Kolev, Pina, & Todeschini, 2015; Walker & Wooders, 2001). Football penalty shootouts in particular offer a unique tournament setting to investigate links between psychological pressure and FMA. Similar to, for example, internal promotions within companies or research and development (R&D) races between organisations, penalty shootouts feature a sequential competitive format where interim feedback about the performance of competitors is provided prior to the end of the competition. First-movers may therefore gain an advantage as early feedback about their performance may put psychological pressure on competitors and thus negatively influence competitors' subsequent actions (Vandebroek, McCann, & Vroom, 2016).

Related literature yields mixed findings regarding the mediating role of psychological pressure in driving FMA. For example, by using data from 129 penalty shootouts between 1970 and 2003, Apesteguia and Palacios-Huerta (2010; hereafter abbreviated as APH) show that first kicking teams win in 60.5% of cases, suggesting psychological pressure significantly influences participants in sequential tournaments. Conversely, Kocher et al. (2012; hereafter abbreviated as KLS) use data from 540 shootouts over the same period to conclude no significant FMA (53.3%) and little support for psychological pressure effects. Palacios-Huerta (2014) once again asserts a significant first-mover advantage (60.6%) using 1001 shootouts between 1970 and 2013.

In order to re-examine the evidence, we extend previous studies by running two analyses: 1) using data from 612 penalty shootouts between July-2003 and August-2017, and 2) using data from 1096 penalty shootouts between 1970 and August-2017. Consistent with KLS and contrary to both APH and Palacios-Huerta (2014), results of both of our analyses show no significant advantage to the first kicking team. First kicking teams won in 50.16% and 50.6% of cases respectively, indicating that sequential tournaments do not seem to be significantly affected by psychological pressure.

Furthermore, for the first time, using objective data from 106 decisions of highly paid professionals in their natural environment, we address an important limitation in FMA literature – how conscious decision-making of participants in sequential tournaments may influence the entry timing-performance relationship (Fosfuri, Lanzolla, & Suarez, 2013; Klingebiel & Joseph, 2015). Intriguingly, of the 106 cases where decision data are available, we find that teams deciding whether to kick first or second, win in 61.3% of cases. This result indicates the existence of a decision

advantage in sequential tournaments, where the decision rather than the entry-order may be the deciding factor for success.

The rest of this paper is organized as follows. In section 2 we outline our theoretical foundations and hypotheses. Section 3 describe the data and why we focus on data from July-2003 to present. Section 4 presents our results and how our dataset relates to the ones used by APH and KLS. Section 5 concludes the paper.

4.2 Theoretical background

4.2.1 First mover advantage

Economic and consumer behaviour perspectives

FMA can be understood as “a firm’s ability to be better off than its competitors as a result of being first to the market” (Suarez & Lanzolla, 2005, p. 122). That is, on average, in cases where at least two firms or business units enter a market sequentially, the first-mover will achieve higher performance (e.g. market share; Min & Wolfenbarger, 2005, profitability; Kalyanaram, Robinson, & Urban, 1995, or survival; Cantner, Dreßler, & Krüger, 2006) than the later entrant(s). Firms or business units are attributed first-mover status by being first to the market with a new product, process or service.

Two main theoretical rationales have been used to explain the existence of FMA. First, from the economic perspective, first-movers derive cost (or producer-based) rewards in the marketplace through which they erect economic *barriers to entry* over later entrants. McAfee, Mialon, and Williams (2004) define an economic barrier to entry as “a cost that must be incurred by a new entrant and that incumbents do not or

have not had to incur” (p. 463). Second, from the consumer behaviour perspective, first-movers derive differentiation (or consumer-based) rewards in the marketplace through which they leverage a range of positive consumer attitudes and habits towards pioneering products and brands (Golder & Tellis, 1993; Suarez & Lanzolla, 2007). As Kerin et al. (1992) state, “a first mover may be able to influence how attributes are valued, define the ideal attribute combination, and ultimately influence consumers’ preferences to its benefit over later entrants.” (p. 35)

Mediators: The ‘Isolating Mechanisms’

Economic and behavioural explanations of FMA attribute various cost and differentiation rewards to the first-mover. Drawing on previous FMA conceptual frameworks (Kerin et al., 1992; Suarez & Lanzolla, 2007), these can be divided into three categories or what Rumelt (1987) classified as *isolating mechanisms*:

Resource Pre-emption. Being first to the market, first-movers have the opportunity to pre-emptively procure plant, equipment or scarce input resources at prices below those typically offered to follower firms in the later evolution of the market (Suarez & Lanzolla, 2007). These head start investments deliver *scale effects* (i.e. cost rewards) that enable first-movers to grow to a larger comparable size (whether in production or marketing or administration), streamline their production processes, and lower marginal costs. The first-mover therefore establishes a competitive cost advantage as later entrants may be forced to only consider small-niche-scale market entry; the increased total marketplace output due to their entry would put downward pressure on market

prices and reduce potential profit margins compared to the first-mover (McGee & Thomas, 1986).

Technology Leadership. Through early entry, pioneer firms may achieve relative information rewards over later-entrants “by way of product experience or familiarity” (Robinson & Fornell, 1985, p. 306), both in production and consumption. When these *experience/learning effects* are used to innovate product and process technologies, they can subsequently enhance product performance, develop superior product features (i.e. differentiation rewards) and further improve process technologies (i.e. cost rewards). Obtaining a technological edge over competitors has been shown to provide sustainable competitive advantages and have become critical impact factors in all organizational systems and structures (Mittal & Swami, 2004).

Buyer Choice. Wyer Jr (2016) states, “When consumers receive information about a product or service, they usually construe its implications with reference to their previously acquired knowledge” (p. 102). This suggests that the pioneer brand may become a reference point for the consumer; when the reference is positive, “making competitive inroads would become difficult for later entrants” (Kerin et al., 1992, p. 35). Advantageous manifestations of consumer responses towards the first-mover (e.g. “less-resistance”, “higher-preference”; Heiens, Pleshko, & Al-Zufairi, 2015, or “greater awareness”; Kerin et al., 1992), drive FMA through factors such as *switching costs* – “time and effort costs of acquiring new skills or know-how in order to use a new product or service effectively” (Burnham, Frels, & Mahajan, 2003, p. 111), or *network effects* –

positive communication “*endowed* on the first mover by the marketplace” (Kerin et al., 1992, p. 42).

Isolating mechanisms protect first-movers’ “entrepreneurial rent”¹⁶ from the imitative competition of later entrants and are foundational mediators explaining the entry timing-performance relationship (Suarez & Lanzolla, 2007). The activation and sustainability of these mechanisms may vary throughout different stages of a first-mover’s marketplace lifecycle. For example, during a first-movers monopolistic position (i.e. prior to followers entering the marketplace), they provide competitive advantage through higher profits and lengthen “the lead time between a firm’s head start and the response by followers” (Mittal & Swami, 2004, p. 18). During a competitive marketplace (i.e. after followers enter the marketplace), they drive FMA through experience effects and dominant market share (Suarez et al., 2015).

Despite the importance of isolating mechanisms to FMA theory, equally appealing counterarguments to a first-mover entry timing strategy exist. Many scholars identify disadvantages to the first-mover such as higher comparable start-up costs due to the onus on early-movers to establish necessary market infrastructure, imitation risk as followers may quickly copy and ‘free-ride’ off early-movers, or higher risk of error allowing followers to opportunistically learn and capitalise upon (Bohlmann, Golder, & Mitra, 2002; Lévesque, Minniti, & Shepherd, 2013; Markides & Geroski, 2004; Schnaars, 1994). Additionally, research has also outlined firm level characteristics more suited to later entry such as for firms with lesser comparable resources (Shamsie,

¹⁶ Entrepreneurial rent is defined as “value created when economic actors combine resources in new and different ways and when the value of these resource combinations is not known, *ex ante*” (Alvarez, 2007, p. 431)

Phelps, & Kuperman, 2004), or firms investing in “real options” (Kogut & Kulatilaka, 2004) when “information gaps or uncertainty about the new market” (Stevens & Dykes, 2013, p. 389) exist. These examples are among a few in growing literature investigating contingencies that may lead to follower advantages (Fosfuri et al., 2013).

In summary, based on current FMA theory, first-movers’ enable factors of resource pre-emption, technology leadership, and buyer choice. These “isolating mechanisms” drive FMA through cost and/or differentiation rewards, which explain the relationship between entry timing and performance. Although counter arguments exist, as Kerin et al. (1992) state, “one might assert that first-mover advantage is an empirical question” (p. 35). Accordingly, we now provide an overview of empirical literature testing for the presence of FMA and/or its conditions.

Empirical overview

Two previous reviews of extant empirical entry timing literature show that although being first to market is a necessary condition for firms to exploit isolating mechanisms that drive FMA, “the factors involved in achieving and sustaining first-mover advantage are considerably more complex than a simple order of entry effect.” (Kerin et al., 1992, pp. 33-34) Kerin et al.’s (1992) review details the findings of 13 empirical studies undertaken between 1977 and 1991. Seven of the sampled studies show positive relation between the first-mover and market share, four show a negative relationship or more significant explanators of market share (e.g. market positioning and advertising expenditure), and two show mixed results depending on industry or firm type (see Table 1 of Kerin et al., 1992). The authors conclude that although the majority of studies support the existence of FMA, “they do not provide unequivocal evidence supportive of first-mover advantage arising from entry order alone [...]

findings must be considered in a broader conceptual context.” (Kerin et al., 1992, p. 38) Tsuchihashi & Hamada’s (2014) systematic literature review details the findings of 261 statistical tests in 31 empirical articles between 1992 and 2012. Again, the majority (64.4%) of tests were statistically supportive of the relationship between first-mover entry timing and performance. Nevertheless, the authors similarly conclude that to “accurately understand the mechanism of FMA, we must elaborate the methods and theoretical models of our investigations.” (Tsuchihashi & Hamada, 2014, p. 10)

Following previous review methodology (David & Han, 2004; Newbert, 2007; Tsuchihashi & Hamada, 2014), we evaluated a further four empirical articles published between 2013 and February-2017 (see Table 1). A total of six steps were taken to result in our sample:

1. Searched only peer reviewed journal articles via the EBSCO database.¹⁷
2. Ensured articles’ substantive relevance with at least one of the following primary keywords in their title or abstract; “first mover advantage,” “early mover advantage,” “pioneering advantage,” “entry timing,” and “entry order.”
3. Filtered irrelevant articles by requiring at least one of the following additional keywords in their title or abstract; EXIT, SURVIVAL, PERFORMANCE, PROFIT, MARKET SHARE, MARKETING, RESOURCE, LEAD TIME, RESOURCE BASED VIEW, EARLY MOVER, FOLLOWER, LATE*, SUSTAINAB*, ENVIRONMENT*, BRAND, ASSET*, BARRIER*, ENTRANT*, INDUSTR*, SECOND, DISADVANTAGE*, or LAGGARD*

¹⁷ Previous reviews use ABI/Inform and EconLit databases, although they do not contain all possible studies published in the field. We use EBSCO Discovery Service due to appropriateness and availability.

4. Ensured empirical content with at least one of the following seven ‘methodological’ keywords in their title or abstract: DATA, EMPIRICAL, TEST, STATISTICAL, FINDING*, RESULT*, or EVIDENCE.
5. Filtered substantively irrelevant articles by only selecting articles that appear in journals in which multiple articles appear.
6. All remaining abstracts were analysed for their substantive context (i.e., discussion of the core tenets of the theory) and empirical content (i.e., mention of statistical analysis).

Similarly, more recent research suggests additional empirical support for a positive relationship between early entry timing and performance, as measured through the variables market share, profitability, and survival. However, similar to empirical evidence discussed in both Kerin et al. (1992) and Tsuchihashi and Hamada (2014), we further find that although first-movers enable isolating mechanisms that provide competitive advantages over later entrants, the overall magnitude and sustainability of these advantages are contingent upon types of consumer demand, technological characteristics of industries (Capone, Malerba, & Orsenigo, 2013), and even home/host country cultural or political environments (Stevens & Dykes, 2013).

In summary, based on empirical findings, the majority of articles over the past two decades support the existence of FMA and a positive relationship between first-mover and performance. However, as shown in all reviews, the magnitude of FMA enabled by isolating mechanisms are subject to a breadth of moderators. These significantly influence the entry timing-performance relationship and make the relationship far more complex and multifaceted than simple timing per-se. Therefore, to provide a better overview of the mechanism of FMA, in the following section, we

outline many of the moderators found in FMA literature to date and also give light to current methodological shortcomings.

Table 1— An overview of empirical studies on first mover advantage: 2013 to 2017

Study	Method	Variables	Principle Finding(s)/Conclusions
Capone et al. (2013)	Multi-run simulation model	Investigate the effects of <i>switching costs</i> , <i>demand regimes</i> , and <i>technology regimes</i> on firm <i>survival</i>	Extent to which isolation mechanisms generate FMA vary. Switching costs generate FMA when consumer demand is homogenous, but have a weak effect when consumer demand is fragmented. Technological characteristics of industries and sectors are key determinants of FMA only when consumer demand is fragmented.
Stevens and Dykes (2013)	Ordinary least squares regression	Investigate the effects of aspects such as <i>national culture</i> , <i>political freedom</i> , <i>GDP growth</i> , and <i>cultural distance</i> , on firm <i>entry timing</i>	Firm decisions to opt for first-mover strategies moderated by home country cultural attributes. Home and host country political environments also influence strategic entry timing decisions.
Garcia-Sanchez, Mesquita, and Vassolo (2014)	Multi-run simulation model	Investigate the effects of industry life cycles and economic shocks on firm <i>survival</i> , and <i>market share</i> .	Turbulent macroeconomic environments moderate isolating mechanisms that yield FMA. Financial flexibility of a firm at a time of economic shock is a critical factor to either maintaining an early-entrants' competitive advantage or providing later entrants a window of opportunity to establish a strengthened position against first-mover rivals.
Klingebiel and Joseph (2015)	Hybrid research design	Investigate the effects of <i>revenue</i> and <i>portfolio preference</i> on the link between <i>timing</i> and <i>performance</i> .	Firms' decision to move early in the mobile handset industry dependent on risk preference towards revenue opportunities and selectiveness of innovation portfolios. Timing-strategy alignment related to performance.

4.2.2 Entry timing-performance relationship

Firm and industrial dynamics

Two overarching classifications of moderators influencing the magnitude and sustainability of FMA have been discussed in entry timing literature.

The first classification is on the micro level and refers to characteristics endogenous to pioneer firms, i.e. their resources and competencies. Kerin et al. (1992), for example, outline that positional advantage is contingent upon firms' investment intensity in advertising or R&D. Franco, Sarkar, Agarwal, and Echambadi (2009) find that firms with greater technological capabilities were more likely to enable FMA, a finding also supported by Lieberman (2005). And Giarratana and Torrisi (2010) show more positive survival likelihood for first-movers with international linkages. Such articles support the resource-based view that better-endowed firms have a greater ability over less-endowed firms to commercialise their products or services and extend the magnitude of FMA in an early industry (Agarwal & Sarkar, 2002; Fosfuri et al., 2013). Firm level characteristics have also been shown to influence the sustainability of FMA once followers enter the market. Srinivasan, Lilien, and Rangaswamy (2004), for example, propose that the sustainability of any FMA gained is contingent upon the type of firm product. de Figueiredo Jr and Spiller (2000) outline its dependence on the ease of replicability of a firm's service. And Usero and Fernández (2009) on the resources and competencies of follower firms, where followers with appropriate capabilities or assets can neutralize FMA and capitalize on the so called *follower advantage* (Tsuchihashi & Hamada, 2014).

The second FMA moderator classification is on the macro level and refers to dynamics exogenous to pioneer firms i.e. the role of environmental attributes. Suarez

and Lanzolla (2007), for example, proposed that two important environmental factors – the pace of technology evolution and the pace of market evolution – “act as enablers or disablers of early mover advantages.” (Fosfuri et al., 2013, p. 302). The authors show that irrespective of firms’ resources and competencies, the faster the pace of technological and market evolution of an industry, the less likely first-movers are to sustain any FMA. They go on to explain that different firm level characteristics become more or less important in situations where market evolution outpaces technological evolution and vice versa.

Accounting for micro and macro level dynamics when testing FMA and/or its conditions represent major challenges for scholars investigating optimal entry timing. Several authors attribute the lack of focus and failure to control for micro and macro level dynamics as potential explanators for contradictory findings in empirical literature (see Suarez & Lanzolla, 2007; Tsuchihashi & Hamada, 2014). Concurrently, methodological shortcomings such as the conflicting measurement of FMA proxies, no categorically defined periods of advantage in analyses that account for the dynamic nature of FMA, oversight on simultaneous advantages for both first-mover and follower, a host of definitional problems, or sample selection biases (see Fosfuri et al., 2013; Lieberman & Montgomery, 2013) all contribute to the lack of consensus regarding optimal time for entry.

Professional sports perspective

Alleviating many of the challenges that exist with economic FMA dynamics, we adopt the approach of previous work in management and psychological literature by empirically analysing the mechanisms of FMA within the professional sports setting (see Feri et al., 2013; González-Díaz & Palacios-Huerta, 2016; Kolev et al., 2015;

Vandebroek et al., 2016). More specifically, we focus on football penalty shootouts, a class of binary Markov games particularly useful for studying mixed strategies (Chiappori, Levitt, & Groseclose, 2002; Walker, Wooders, & Amir, 2011). The basic rules for a penalty shootout have previously been explained as follows:

“First, each team selects five players (out of the players on the pitch in the 120th minute). Second, teams kick in alternating order. Third, the shootout is terminated as soon as the number of penalties converted by one team cannot be matched by the other team even if the other team would convert all their remaining penalties. If, after both teams have taken five kicks, both have scored the same number of goals, teams continue kicking in the same alternating order until one team has scored one goal more than the other from the same number of kicks (i.e., in a sequential one-on-one competition). Each penalty kick during the shootout must be taken by a different player, and all eligible players must have taken a kick before any player can take a second kick” (Kocher, Lenz, and Sutter 2012, 1587).

This mixed strategy format offers five distinct benefits for advancing FMA theory in economic situations involving sequential competition. First, penalty shootouts are unique naturally occurring situations where all subjects (highly paid professionals) perform a fundamental yet simple one-dimensional task (kicking a ball) under high-pressure (major competitive tournaments e.g., FIFA World Cup, European Cup, or UEFA Champions League). These natural tournament settings often characterize competitive situations in labour economics and the economics of organizations such as competitions for promotion in internal labour markets or R&D races between companies (APH). Second, job performance can be unambiguously measured with a binary outcome (goal versus no goal or win versus loss) avoiding any conflict in measurement of the outcome proxy (Lieberman & Montgomery, 2013). Third, the decision-making processes of highly paid professionals are transparently observable providing a rare opportunity to test cognitive decision-making factors currently lacking in entry-timing literature (Chatterjee & Sugita, 1990; Fosfuri et al., 2013; Gal-Or, 1985,

1987; Ghosh & Buchanan, 1988; Kaplan & Tripsas, 2008). Fourth, shootouts employ a standardized process common to all major competitive tournaments (e.g., same position of kick and location of shooter, defined duration period, and no subsequent play). Fifth, within a shootout, periods of advantage are categorically defined and the dynamic nature of FMA is accounted for as interim outcomes are transparently available. Taking together, these five benefits allow a more controlled opportunity to investigate the existence of FMA in sequential competitive settings. As KLS state, measuring comparable FMA mechanisms in the field “is a demanding task, because naturally occurring situations, for instance, in companies, are typically too complex to allow for causal inferences.” (p. 1585)

Psychological pressure as mediator

Alternative to the FMA mediators explained via economic and consumer behaviour perspectives, the main theoretical rationale used to explain the existence of FMA from the professional sports perspective is psychological pressure (Vandebroek et al., 2016). Social psychologists have suggested that although often positive, increased levels of motivation and effort in athletes – for instance due to the significance of a competitive game, the presence of an audience, or threats to ego – can in non-optimal levels lead to detrimental effects in athlete performance (Ariely et al., 2009). Athletes under increased levels of psychological pressure may experience detrimental consequences to their cognitive and behavioural performance such as anxiety, a shift in mental processes from automatic to controlled, narrowed span of attention, or fixation with rewards rather than processes (Ariely et al., 2009; Dohmen, 2008). Consequently, these psychological pressure effects have been shown to deliver

competitive advantages to certain teams or athletes over others (González-Díaz, Gossner, & Rogers, 2012; Pope & Schweitzer, 2011).

However, in the specific case of football penalty shootouts, despite the existence of different forms of pressure, there should be no reason why one team is systematically more affected than the other. As APH state, “the explicit randomization mechanism used to determine which team goes first in the sequence, in a situation where both teams have exactly the *same* opportunities to perform a task, suggests that we should expect the first and second teams to have exactly the *same* probability of winning the tournament.” (p. 2549) Therefore, all things being equal, both first and second kicking teams should have an a priori 50% winning probability. Nevertheless, theorists investigating the links between psychological pressure and FMA have argued the existence of a potential *lagging-behind effect*. Where individuals are required to perform a task sequentially, “later participants may feel greater pressure to perform if they are aware that opponents have already successfully completed the task.” (Vandebroek et al., 2016, p. 5) Therefore, in a penalty shootout, upon successfully scoring their first kick, the first-mover may impose additional stress on the second-mover by way of lagging-behind in interim performance and thus negatively influence their subsequent actions. If proven, a lagging-behind effect would have important implications as it may require a re-evaluation of the presumed a priori 50% winning probability.

Table 2— Overview of literature on lagging-behind pressure effects in sports

Study	Dataset / Field	Finding(s)
Magnus and Klaassen (1999)	Almost 90,000 points in professional tennis (Wimbledon).	First-mover more likely to win first set and first game, although
Kocher et al. (2008)	95 football penalty shootouts (DFB Pokal).	First-mover won in non-significant 48.4% of cases.
Apestequia and Palacios-Huerta (2010)	129 football penalty shootouts (14 national and club professional)	First-mover won in significant 60.5% of cases.
Kolev, Pina, and Todeschini (2010)	145 ice hockey penalty shootouts (National Ice Hockey League).	First-mover won in non-significant 49% of cases.
Berger and Pope (2011)	45,000 professional basketball games.	Performance may improve if the trailing performer is only slightly
Feri, Innocenti, and Pin (2011)	84 basketball free-throws competitions (junior professional)	First-mover won in 28% of 18 cases in which a tie prevailed after
Kocher et al. (2012)	540 football penalty shootouts (14 national and club professional)	First-mover won in non-significant 53.3% of cases.
Genakos and Pagliero (2012)	Professional weight lifting competitions.	Trailing participants adopt riskier strategies in an attempt to regain
Palacios-Huerta (2014)	1001 football penalty shootouts (14 national and club professional)	First-mover won in significant 60.6% of cases.
Genakos, Pagliero, and Garbi (2015)	International diving tournaments.	Interim ranks affect performance achievement in diving
Goldman and Rao (2016)	Hundreds of thousands of free throws (National Basketball)	Players perform worse when trailing in the score.
González-Díaz and Palacios-Huerta (2016)	197 matches with a total of 1317 chess games.	First-mover won in significant 57.4% of cases.

4.3 Hypotheses

4.3.1 Lagging-behind effect

Related literature yields mixed findings regarding the link between a lagging-behind effect and performance (see Table 2). In basketball for example, Berger and Pope (2011) suggest that performance may improve in situations where teams are only slightly trailing in the score. Feri et al. (2013) find no significant support for a lagging behind effect. And Goldman and Rao (2016) demonstrate poorer performances in players trailing in the score. In football penalty shootouts, two notable peer reviewed empirical studies, APH and KLS, have dominated the literature. In the former study, APH collected data from 129 shootouts between 1970 and 2003 finding that teams

shooting first have a 60.5% chance of winning and a significant FMA caused by the lagging-behind effect to the opponent. In the latter study however, which re-examined and extended on APH's work using a sample of 540 shootouts over the same time period, KLS find the winning probability at 53.3% and the existence of no significant FMA. Palacios-Huerta (2014) once again asserts a lagging-behind effect using 1001 shootouts between 1970 and 2013, showing a significant FMA (60.6%). A theoretical model by Vandebroek et al. (2016) also gives support to links between psychological pressure and FMA, however show the results to be moderated by factors such as the nature of the pressure and the magnitude of the pressure.

Given the findings of most recent literature investigating links between psychological pressure and FMA, there appears to be growing support for the existence of a relationship between psychological pressure and FMA. Accordingly, we hypothesise that:

***Hypothesis 1 (H1):** Teams kicking first in a penalty shootout will have a significant advantage over teams kicking second due to a lagging-behind effect.*

4.3.2 Decision-making effect

Despite conflicting findings regarding the existence of a lagging-behind effect in APH and KLS, both studies share a key methodological distinction – their analyses investigate potential FMA using penalty shootout data strictly between 1970 to June 2003.¹⁸ The rationale for the exclusion of shootout data post-July 2003 is based on the

¹⁸ APH also use data from an additional 140 shootouts between 2003-2008, however these were excluded from the primary analysis.

fact that up until that point, determining the order of kicks in a penalty shootout was decided by a referee coin toss. The winner of the coin toss *had* to shoot first. As of July-2003, however, the Fédération Internationale de Football Association (FIFA), football's world governing body, changed the rule to allow the winner of the coin toss the *choice* to kick first or second. Hence, the authors argue that only the pre-July 2003 format of penalty shootouts “fulfilled the criterion of a randomized natural experiment” (Kocher et al., 2012, p. 1586) and these data do not give rise to endogeneity problems that may bias the estimation of a potential FMA (Apesteguia & Palacios-Huerta, 2010).

In contrast to APH and KLS however, we argue that the new format of penalty shootouts offers a suitable natural competitive environment in which to investigate the links between psychological pressure and FMA. The basis of our argument is that only the new format data include a component at the core of FMA theory, a strategic decision on whether to act or react (Chatterjee & Sugita, 1990; Fosfuri et al., 2013; Gal-Or, 1985, 1987; Ghosh & Buchanan, 1988; Kaplan & Tripsas, 2008). As Suarez and Lanzolla (2007) state, “given a certain market structure, and assuming rationally competing agents, industrial organization literature outlines conditions under which a firm deliberately decides whether to be a first mover or a later entrant” (p. 380). These decisions are typically made by firms when co-aligning their resources and competencies to their environment (Fosfuri et al., 2013). The mechanisms of FMA in economics are therefore not explicitly random but rather dependent upon carefully weighted decision dynamics of any number of actors (employees, managers or firms) against their rivals. Similarly, after winning a coin toss, winning captains make choices about whether to act first or second depending on what is appropriate to their resources, competencies and assessment of the competitive environment. Thus, we posit that the new format of penalty shootouts truly characterizes the natural competitive

environment under which to investigate potential FMA. Accordingly, we hypothesise that:

***Hypothesis 2 (H2):** There exists a positive relationship between teams deciding to act (whether first or second) in a penalty shootout and teams winning the penalty shootout (H2).*

4.4 Data and method

In order to test our hypotheses, we compiled a dataset consisting of penalty shootout data from national and international tournaments for clubs, and international tournaments for national teams. Table 3A lists the 24 tournaments considered for analysis. We include data from all [1]-[14] tournaments considered in APH and KLS¹⁹ and extend this list with ten additions [15]-[24]. Tournament [15] is included as it plays an important precursor role to the FIFA World Cup. Tournaments [16]-[23] are included as they are all the most important competitions to their respective participants' age group or competitive level. Additionally, they provide two unique characteristics currently unaccounted for in previous penalty shootout analysis – data from females in pressure situations and data from youth, where the tournaments are especially decisive for their career prospects. Finally, although tournament [24] does not yet match the same level of prestige as the UEFA Champions League, the most prestigious of all the club tournaments, we include it due to its wider international participation and growing significance outside of Europe. Media coverage and public attention for tournaments [15]-[24] undoubtedly vary, however their inclusion is in line with KLS's argument

¹⁹ APH and KLS refer to 11 competitions in their studies, however this is due to them grouping competitions according to their region (e.g., FA-Cup, League Cup, and Charity Shield are grouped as English Cups). We list all competitions as separate for further clarity.

that where psychological pressure is particularly strong in penalty shootout situations, “it should be strongest in these tournaments, because they attract the most public attention [...] and they are of the utmost importance for the standing and career prospect of every kicker on the pitch.” (Kocher et al., 2012, p. 1587) The large majority of the shootout data were provided by Gracenote Sports, Netherlands (Nielson Company) and other sources were used to provide supplementary data.²⁰

Column [A] of Table 3A shows the number of shootouts undertaken across the 24 tournaments since July-2003. A total of 645 penalty shootouts have taken place throughout all the competitions including knockout and qualification stages. Column [B] reports the number of shootouts for which we know the team that took the first kick (dataset hereafter abbreviated as “AGGREGATE”). To our best efforts, we followed a systematic collection methodology and attempted to avoid subsamples of tournament shootouts. Our dataset has resulted in a full sample for 20 out of the total 24 tournaments, representing 94.9% of all shootout data. For tournaments [12] and [17], we were unable to verify team kicking order for one match respectively. And for tournament [14], we could only determine team kicking order for 84 out of 112 shootouts (75.0%).²¹ Nevertheless, despite the fraction of shootouts for the Copa del Rey representing the lowest in the dataset, the total number of shootouts where kicking order is known (84) is well above the sample mean (25.5). In Column [B] of Table 3B,

²⁰ Emails to soccer associations, Emails to soccer clubs, FIFA Films, newspaper clips, UEFA Video Archives, El Mundo Deportivo, ABC, AS, and La Vanguardia (online archives), <http://fifa.com>, <http://www.fussballdaten.de>, <http://www.kicker.de>, <http://scorespro.com>, <http://www.welfussball.de>, <http://en.wikipedia.org>, <http://www.worldfootball.net>.

²¹ Determining kicking order for the Spanish competition, Copa del Rey, proved most difficult. In order to obtain additional data, we accessed a range of online databases, called a host of sports performance data providers including Opta Sports and ScoresPro.com, searched Spanish newspaper libraries, accessed online video databases, contacted the Royal Spanish Football Federation and also 57 Spanish football clubs where data was missing. Only three clubs responded to our request, two providing data, and one not having the information on file.

we also provide details on the number of shootouts for which we know the outcome of each individual kick in the shootout (hereafter referred to as “SUBSET 1”). SUBSET 1 is used to provide further robustness checks as more covariate data is available.

Although penalty shootouts for some of the tournaments selected in our sample date back to the 1970s,²² the dataset explicitly includes data from the season starting July-2003 (i.e. season 2003/04) to present. We argue three main reasons for this decision. First, data from 1970 until June-2003 have already been extensively examined (see Apesteguia & Palacios-Huerta, 2010; Kocher et al., 2012; Kocher et al., 2008). Second, in July-2003, penalty shootout rules were changed to allow the winner of the pre-shootout coin toss the *choice* to kick first or second. This change affects the strictly randomized nature of old format data where the winner of the coin toss *had* to kick first. Accordingly, for purposes of testing, we, initially, treat these different formats as exclusive events. Third, only the new shootout format allows for the rare opportunity to objectively collect decision data from highly paid professionals making discrete choices in their natural environment and under pressure.

For the first time, to our knowledge, we have collected the largest sample of decisions (106) from penalty shootouts for which we know the decision of the team that won the pre-shootout coin toss (hereafter referred to as “SUBSET 2”). There are no public records of players’ choices in a pre-shootout coin toss due to there being no regulations requiring referees to record such information. To obtain these data, we received access to FIFA’s film archives and spent several hours sifting through video footage identifying segments where it is possible to view the pre-shootout coin toss and

²² 1970 is the year FIFA officially decided to adopt penalty shootouts, however the first penalty shootout appeared “on September 2, 1962, in the final match of the tournament between Barcelona and Zaragoza.” (Palacios-Huerta, 2014, p. 69)

where the referee subsequently talks to the winner of the toss. We also requested and were granted temporary access to video material from the Union of European Football Associations (UEFA), where we repeated this collection process. APH is the only other study we are aware of to use similar decision data. In their case however, decisions from only “about twenty videos” were collected (see Apesteguia & Palacios-Huerta, 2010, p. 2554) and were not included in their primary analysis.²³

Using SUBSET 2, we assess the influence of kicking first, and teams’ decision to kick first or second, on teams’ winning probabilities. Following methods used by APH and KLS, we 1) calculate relative winning frequencies, 2) calculate two-sided binomial tests, and 3) estimate probit models. WIN, the binary dependent variable is based on the objectively observable result of the penalty shootout, 1 if the team won the shootout, 0 if the team lost the shootout. The independent variables include whether the team was first in the sequence (FIRSTKICK) and whether the team was the pre-shootout coin toss winner, thus giving them the decision to kick first or second (DECIDED). Based on additional attributes that may influence the entry timing-performance relationship, we also include several control variables, including the tournament name (TOURNAMENT), tournament stage (STAGE), whether the team is playing at home (HOME), whether the match was staged on neutral ground (NEUTRAL), match attendance numbers (ATTENDANCE), and player position (POSITION).

²³ APH show decision data to support the view that, in almost all cases, professionals decide to kick first in a penalty shootout.

Table 3A— Shootout data from seasons 2003/04 to 2016/17 (AGGREGATE)

Tournament	[A]	[AGGREGATE]		
	Shootouts <i>N</i>	Shootouts <i>n</i>	[C] First-kicking team wins (rel. freq.)	[D] P-value (two- sided binomial test)
[1] FIFA World Cup	10	10	0.8000	0.1094
[2] European Championship	9	9	0.4444	1.0000
[3] Copa America	11	11	0.5455	1.0000
[4] Africa Cup of Nations	13	13	0.3077	0.2668
[5] Gold Cup	7	7	0.5714	1.0000
[6] Asian Cup	10	10	0.6000	0.7539
[7] UEFA Champions League	30	30	0.6333	0.2005
[8] UEFA Europa League	68	68	0.4853	0.9036
[9] DFB Pokal	104	104	0.5000	1.0000
[10] Premiere Liga Pokal	5	5	0.6000	1.0000
[11] FA Cup	43	43	0.4186	0.3604
[12] League Cup	130	129	0.4961	1.0000
[13] Community Shield	4	4	0.5000	1.0000
[14] Copa del Rey	112	84	0.5238	0.7436
[15] FIFA Confederations Cup	4	4	0.2500	0.6250
[16] FIFA U-20 World Cup	20	20	0.4000	0.5034
[17] FIFA U-17 World Cup	10	9	0.6667	0.5078
[18] FIFA Women's World Cup	4	4	0.7500	0.6250
[19] FIFA U-20 Women's World Cup	6	6	0.3333	0.6875
[20] FIFA U-17 Women's World Cup	6	6	0.3333	0.6875
[21] UEFA U21 Championship	7	7	0.5714	1.0000
[22] UEFA U19 Championship	6	6	0.6667	0.6875
[23] UEFA U17 Championship	17	14	0.3571	0.4240
[24] FIFA Club World Cup	9	9	0.5556	1.0000
<i>All</i>	<i>645</i>	<i>612</i>	<i>0.5016</i>	<i>0.9678</i>

Table 3B— Shootout data from seasons 2003/04 to 2016/17 (SUBSET 1)

Tournament	[A]	[SUBSET 1]		
	Shootouts <i>N</i>	Shootouts <i>n</i>	[C] First-kicking team wins (rel. freq.)	[D] P-value (two- sided binomial test)
[1] FIFA World Cup	10	10	0.8000	0.1094
[2] European Championship	9	9	0.4444	1.0000
[3] Copa America	11	11	0.5455	1.0000
[4] Africa Cup of Nations	13	11	0.2727	0.2266
[5] Gold Cup	7	7	0.5714	1.0000
[6] Asian Cup	10	10	0.6000	0.7539
[7] UEFA Champions League	30	30	0.6333	0.2005
[8] UEFA Europa League	68	62	0.5000	1.0000
[9] DFB Pokal	104	35	0.5143	1.0000
[10] Premiere Liga Pokal	5	5	0.6000	1.0000
[11] FA Cup	43	15	0.3333	0.3018
[12] League Cup	130	33	0.5455	0.7283
[13] Community Shield	4	4	0.5000	1.0000
[14] Copa del Rey	112	3	0.6667	1.0000
[15] FIFA Confederations Cup	4	3	0.0000	0.2500
[16] FIFA U-20 World Cup	20	16	0.4375	0.8036
[17] FIFA U-17 World Cup	10	6	0.5000	1.0000
[18] FIFA Women's World Cup	4	4	0.7500	0.6250
[19] FIFA U-20 Women's World Cup	6	4	0.5000	1.0000
[20] FIFA U-17 Women's World Cup	6	4	0.2500	0.6250
[21] UEFA U21 Championship	7	0	-	-
[22] UEFA U19 Championship	6	0	-	-
[23] UEFA U17 Championship	17	0	-	-
[24] FIFA Club World Cup	9	7	0.7143	0.4531
<i>All</i>	<i>645</i>	<i>289</i>	<i>0.5190</i>	<i>0.5564</i>

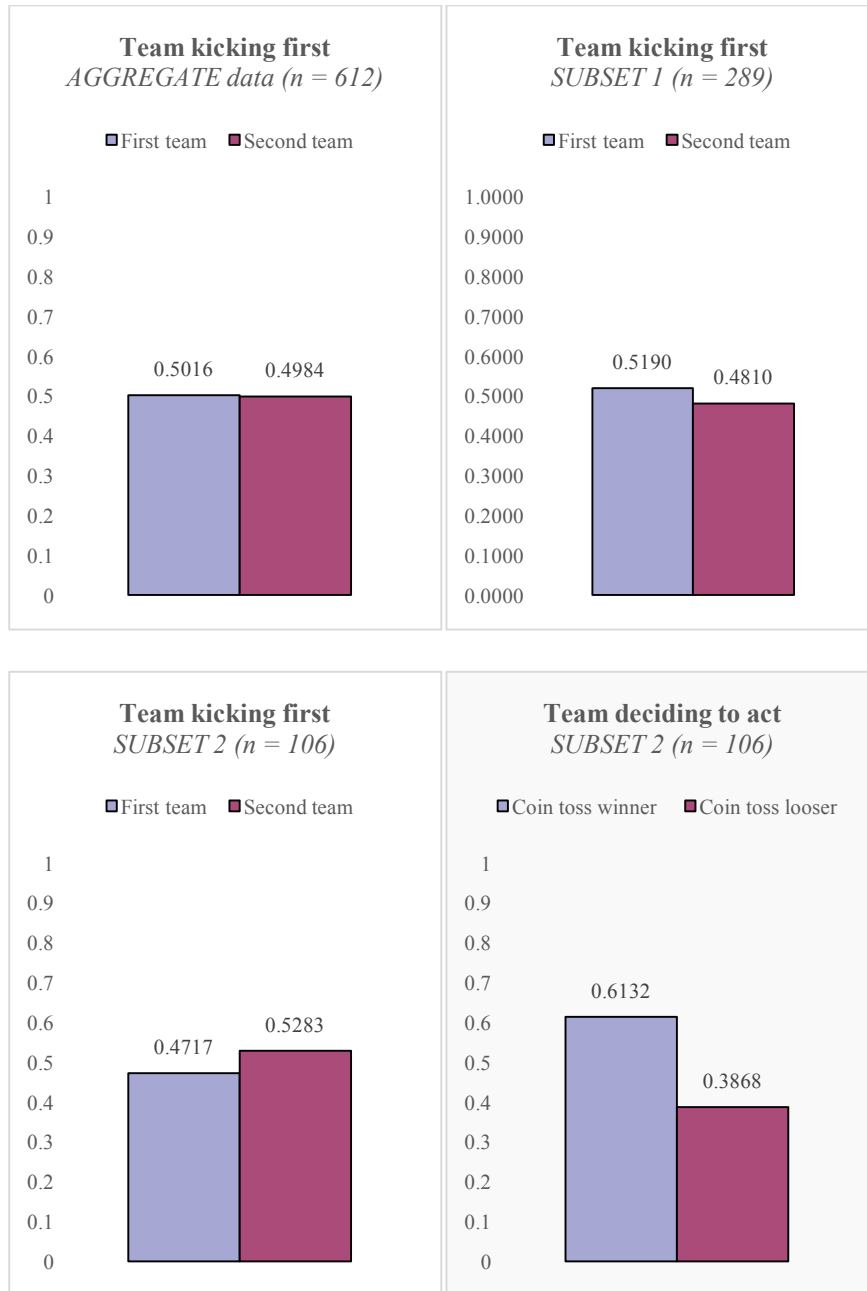


Figure 1— Relative win frequencies of teams kicking first and teams deciding to act

4.5 Empirical evidence

4.5.1 Re-examining the first mover advantage debate in penalty shootouts

To measure whether moving first in a shootout delivers an advantage we first calculated the relative win frequencies of teams kicking first across all 24 tournaments. Column [C] of Table 3A and Table 3B show the relative frequencies in the AGGREGATE data and SUBSET 1 respectively (see also Figure 1). Consistent with previous analyses (González-Díaz & Palacios-Huerta, 2016; Kocher et al., 2012), the range of values vary considerably, reaching a low of 25.0% for the FIFA Confederations Cup and 80.0% for the FIFA World Cup. Different to results in the KLS dataset between 1970 and 2003 (see their Table 1 on p. 1587), the relative frequency in the most important tournament for national teams, the FIFA World Cup, is well above the 43.8% they report. For the major club competition, the UEFA Champions League, our results are consistently high at 63.3%, just short of their reported 64.3%.

Given that some tournaments have a relatively low number of observations, we go on to calculate two-sided binomial tests to check whether the observed frequencies of teams kicking first in the shootout are significantly different from a priori equal (50%) winning probability. As shown in column [D] of Table 3A and Table 3B, across all tournaments, none of the p -values recorded is significant at the 5% or 10% levels. The closest to significance is the FIFA World Cup with $p = 0.1094$. For tournaments comprised of over 50 observations, p -values are 0.9036 for the UEFA Europa League, 1.0000 for the DFB Pokal, 1.0000 for the League Cup, and 0.7436 for the Copa del Rey. Taking the sum of all data (see row “All” of Table 3A), we find that 50.16% of the 612 shootouts were won by the team kicking first with a p -value of 0.9678. This is well below the APH finding that first-movers have a significant 60.5% chance of

winning a shootout. In fact, as Figure 2 represents, if we were to start from the 2016/17 season and work backwards taking every year into account (horizontal axis), we see that all relative winning frequencies fall short of 60.5% regardless of the time range. The relative frequencies were highest at 52.31% with 525 shootouts taking seasons 2005/06 – 2017/18 and lowest at 40.0% with 37 shootouts taking only seasons 2015/16 – 2016/17. Using single seasons (see Figure 3), obtaining a relative frequency of above 60% would have only been possible if the dataset consisted of 28 shootouts from season 2009/10.

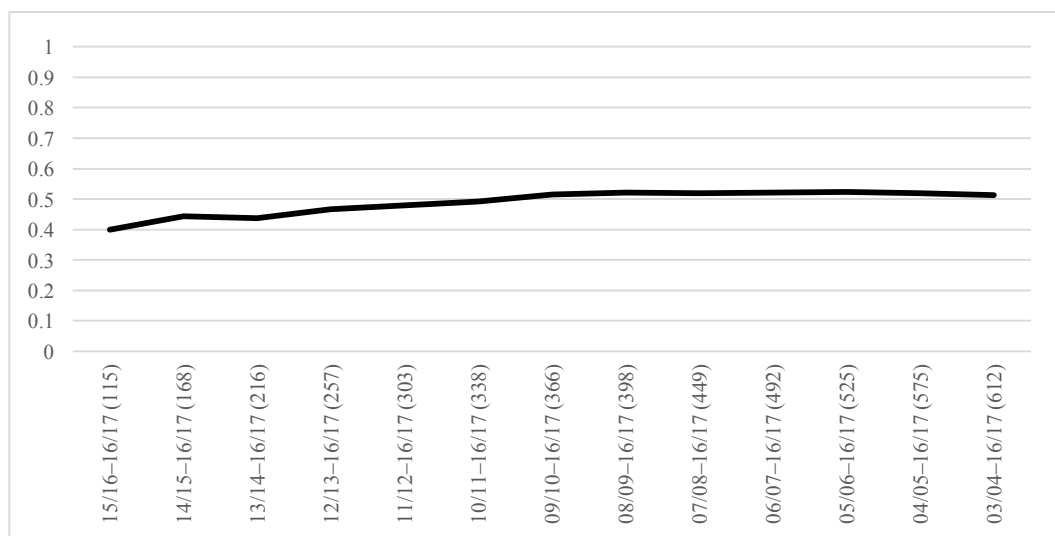


Figure 2— Relative frequency of first kicking team wins in shootout by season (cumulating backward season by season)

Notes: AGGREGATE data. Number of shootouts in parentheses.

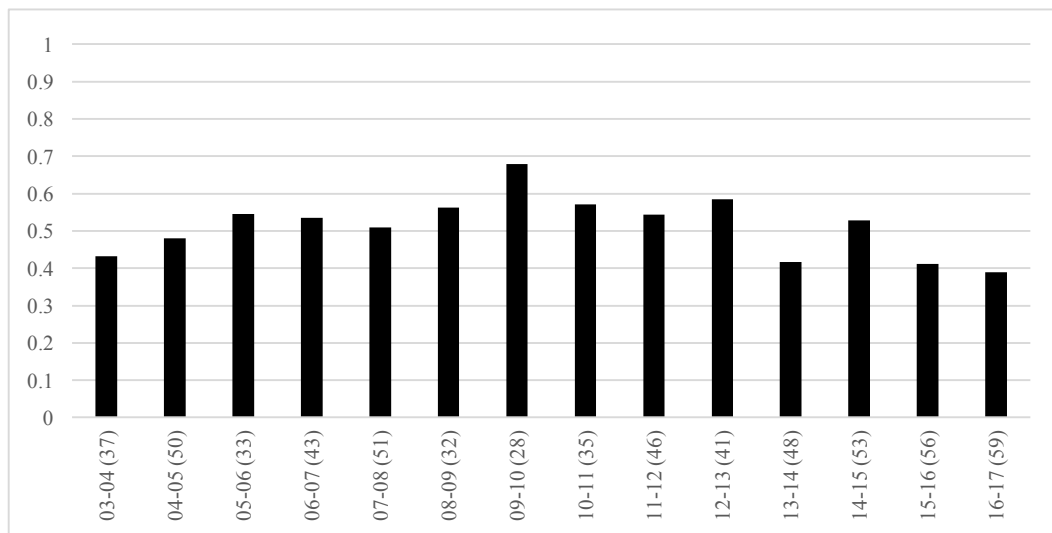


Figure 3— First kicking team wins in shootout by season (relative frequency)

Notes: AGGREGATE data. Number of shootouts in parentheses.

Testing our results further we estimate two probit models (see Table 4) on the AGGREGATE data: (1) a model testing the outcome of first kicking team alone, and (2) a model controlling for whether the team is home or on neutral ground. In models (3) and (4) we repeat this process using SUBSET 1 and, as a robustness check, add an additional model (5) that includes further controls. As made evident by KLS, to account for the dependency of outcomes between two teams involved in a shootout (i.e. if one team wins, the second team must lose, and vice versa), all models use robust SEs adjusted for clustering over shootout-ID.

Table 4— Determinants of WIN in penalty shootouts

Dependent	WIN Objectively observable result of penalty shootout: 0 when team loses, 1 when team wins							
	[A] PROBIT		[B] PROBIT			[C] PROBIT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent								
FIRSTKICK	0.0003 0.1004	0.0016 0.1005	0.0954 0.1478	0.0923 0.1485	0.0876 0.1487		-0.2028 0.2527	-0.2269 0.2548
DECIDED						0.5754* 0.2483	0.6132* 0.2517	0.6456* 0.2529
Control factors								
HOME		-0.0297 0.1109		0.0380 0.1758	0.3550 0.1759		0.3405 0.3606	0.3304 0.3582
NEUTRAL		-0.0223 0.0561		0.0190 0.0879	0.0213 0.0899		0.1703 0.1803	0.2116 0.1919
TOURNAMEN					YES			YES
STAGE					YES			YES
ATTENDANCE					YES			YES
POSITION					YES			YES
Evaluation								
<i>N</i>	1214	1214	578	578	578	212	212	212
McFadden's <i>R</i> ²	0.000	0.000	0.001	0.001	0.002	0.037	0.048	0.059
Observations correctly classified	50.25%	50.74%	51.90%	51.90%	54.33%	61.32%	61.32%	61.32%
Log-Likelihood	-841.466	-841.392	-400.220	-400.174	-399.827	-141.466	-139.875	-138.297
BIC'	7.102	14.055	-0.838	5.428	259.118	-10.963	-3.431	138.041

Notes: Robust standard errors in bold and marginal effects in italics.

** Significant at the 1 percent level.

* Significant at the 5 percent level.

† Significant at the 10 percent level.

The regression results further indicate no significant positive or negative effect of kicking first on winning probability. Our results, which represent 94.9% of shootouts from July-2003 to August-2017, are consistent with KLS, which represent 76.2% of all shootout data from 1970 to June-2003. We therefore fail to support H1 that teams

kicking first in a shootout have a significant advantage over teams kicking second due to a lagging-behind effect and cannot reject the null hypothesis that both teams have an a priori equal probability of winning.

As our results conflict with a recent study by Palacios-Huerta (2014), in an additional measure, we combine our results with those of KLS to establish a SUPERSET of 1096 penalty shootouts between 1970 and August-2017 (see Table 5). The SUPERSET contains data from 95 more shootouts than Palacios-Huerta (2014) and is, as far as we know, the largest penalty shootout dataset used to investigate links between psychological pressure and FMA. Consistent with our previous tests, we continue to find no significant lagging-behind effect. First kicking teams win in 50.6% of cases with a p -value of 0.6946. This is well below the significant 60.6% chance of winning reported by Palacios-Huerta (2014). As shown in column [H] of Table 5, across almost all tournaments, none of the p -values recorded is significant at the 5% or 10% levels. The only tournament to report a significant advantage at the 5% level is the UEFA Champions League with $p = 0.0479$. Of all 58 penalty shootouts in the UEFA Champions League, first-movers have experienced a significant 63.8% advantage. Although this result appears to be the exception rather than the rule, it has nevertheless prompted UEFA and the English Football Association (FA) to recently test a new penalty kick format in order to reduce the advantage to the first-mover.²⁴

²⁴ UEFA trialed a new format of penalty kicks at the 2017 UEFA European Women's Under-17 Championship finals in the Czech Republic. The new 'ABBA' format features the first-moving team kicking one kick, followed by the second-moving team kicking two consecutive kicks, before the first-mover kicking again. The final of the 2017 FA Community Shield also adopted this new format. Out of the two matches, the first-mover won in 50.0% of cases.

Table 5— Shootout data from 1970 to 2017

Tournament	[SUPERSET] 1970 - 2017							
	[A] Shoot- outs <i>n</i>	[B] First- kick- ing team wins	[C] KLS Shoot- outs <i>n</i>	[D] KLS First- kick- ing team wins	[E] TOTAL Shoot- outs <i>n</i>	[F] TOTAL First- kicking team wins	[G] TOTAL First- kicking team wins (rel. freq.)	[H] TOTAL P-value (two- sided binomial test)
[1] FIFA World Cup	10	8	16	7	26	15	0.5769	0.5572
[2] European Championship	9	4	9	3	18	7	0.3889	0.4807
[3] Copa America	11	6	12	8	23	14	0.6087	0.4049
[4] Africa Cup of Nations	13	4	13	9	26	13	0.5000	1.0000
[5] Gold Cup	7	4	5	2	12	6	0.5000	1.0000
[6] Asian Cup	10	6	8	3	18	9	0.5000	1.0000
[7] UEFA Champions League	30	19	28	18	58	37	0.6379	0.0479
[8] UEFA Europa League	68	33	74	39	142	72	0.5070	0.9332
[9] German Cups (<i>DFB Pokal, Premiere Liga Pokal</i>)	109	55	122	61	231	116	0.5022	1.0000
[10] English Cups (<i>FA Cup, League Cup, Community Shield</i>)	177	84	122	62	299	146	0.4883	0.7287
[11] Copa del Rey	112	44	131	76	243	120	0.4938	0.8979
<i>All</i>	556	267	540	288	1096	555	0.5064	0.6946

4.5.2 A new perspective: The decision-making effect

To measure whether there exists a positive relationship between teams deciding to act and teams winning the penalty shootout we calculate the relative win frequencies across all 24 tournaments where a decision is known. Of the total 106 matches where a decision is known, teams deciding to act had a 61.3% winning probability. We again calculate two-sided binomial tests to check whether the observed frequency is

significantly different from the a priori equal winning probability of 50%. The relative frequency is significant at the 5% level ($p = 0.025$). Results remain unchanged when applying probit model (7) and models (8) and (9) including all additional covariates (see Table 4). All probit regressions result in a significant positive effect of DECIDED on teams' winning probability. Therefore, results of both our binomial tests and probit regressions reject the null hypothesis and support H2 that there exists a positive relationship between teams deciding to act and winning probability.

4.6 Implications

Our results have at least four important implications for the debate surrounding psychological pressure in sequential competitive settings. First, our results dispute previously established indications that a lagging-behind effect may provide first-movers with an advantage in sequential tournaments. Results of all of our analyses, which constitute the largest penalty shootout dataset to date, indicate that sequential tournaments are not significantly affected by psychological pressure. Second, our results suggest a *decision-making effect*, rather than a lagging-behind effect, may give performers a competitive edge. Decision-makers have a 61.3% advantage, whereas in the same sample, first-movers won in only 41.2% of cases. Table 6 shows a breakdown of the winning and losing frequencies for teams deciding to act the sample of 106 shootouts.

Table 6— Breakdown of win and lose frequencies for DECIDED

	Decision	
	Kick First	Kick Second
N	59	47
Win Frequency	0.576	0.660
Lose Frequency	0.424	0.340

Third, our results support the combined use of pre- and post-2003 shootout data for investigating potential links between psychological pressure and FMA. Although APH and KLS assert that shootout data from the old format should be analysed exclusive to data from the new format due to potential endogeneity problems (omitted variable bias), we find no significant correlation between the covariate DECIDED and FIRSKICK. Thus, for explicit analyses of whether a first-mover has an advantage in penalty shootouts, our results show no significant influence of the 2003 rule change. Palacios-Huerta’s (2014) also support the use of data from both old and new formats. The author argues that “The fact that after 2003 players are required to choose the order (whether to kick first or second) is irrelevant [...] All we can conclude after 2003 is the rationality or irrationality (the correctness or incorrectness) of the choices the teams make” (pp. 74-75). In fact, APH tested such rationality when they surveyed “240 players and coaches in the professional and amateur leagues in Spain” (p. 2554) asking them whether they would shoot first or second after hypothetically winning a shootout coin toss. The authors find that “96 percent of the subjects answered that they would prefer to go first” (p. 2556) and interpret their results by suggesting that subjects are

perfectly aware of FMA and “they respond optimally to it” (p. 2556). Our data does not support their findings. As shown in Table 6, of the 106 instances where teams decided to act, only 59 (55.7%) actually decided to shoot first. Furthermore, taking the winning probabilities, of 59 teams deciding to kick first, 34 (57.6) won, and of 47 teams deciding to kick second, 31 (66.0%) won. The data indicates no fixed strategy (e.g., always shoot first or always shoot second) that will lead to higher winning probabilities; the choice is dependent on a case by case basis. To APH’s argument of rationality therefore, we note that, under circumstance where FMA exists, one could test captains’ decisions to observe if they decide to kick first and thus the rationality of the decision. However, where there is no FMA, as concluded in our results, there is no such rational choice to be tested. The only rational choice is whether teams make the decision to kick first or second according to what is best for their resources and competencies.

To gain further insight into decision dynamics of professionals in sequential tournaments, we conducted a survey of 340 amateur and professional coaches from Germany, Switzerland and Austria at the 2017 Federation of German Football-Coaches Congress. Drawing on the survey used by APH, we asked: “Assume your team is playing in a penalty shootout. Your captain wins the coin toss and has to choose whether to kick first or second. Which would you recommend your captain to choose: to kick first; to kick second”.

We found that 87.7% of coaches would recommend their captains to kick first. When asked “Please explain your decision: why would you make that choice?”, the majority of responses featured psychological reasons such as intention to put pressure on the kicker of the second-kicking team or specifically referenced FMA. Other common responses included the preference to take control of the situation by acting

proactively, and preference to kick first because of the strength of their team kickers or goalkeeper.

Overall, our survey results are complementary of APH's finding that moving first is the preferred option for coaches in a shootout. However, as the existence of FMA due to a lagging-behind effect was not substantiated in our data, the findings show a startling misconception of coaches regarding the utility of penalty shootout entry-order. Furthermore, these results do not correlate with the empirical data. Of the 106 decisions collected from major tournaments, only 59 (55.7%) teams decided to shoot first. One possible explanation for the mismatch could be the influence of recent media attention and efforts by football associations to introduce a new shootout format due to potential FMA.²⁵

In a subsequent question, we asked "Out of 100 teams that chose to kick first, how many do you think won the shootout?". Interestingly, on average, coaches believed teams would win approximately 60% of the time. This result corresponds to the figure reported by APH and various media outlets. Our analysis of approximately 85% of all penalty shootouts since 1970s refines this figure to 50.6% and shows no support for FMA due to a lagging-behind effect.

4.7 Conclusion

The decisions and implications of moving first or moving later in high pressure dynamic tournaments are critical to strategic management literature. Yet examining whether psychological pressure and the order of making moves influence tournaments' outcomes present many challenges. As APH state, "Nature seldom create

²⁵ Include, but are not limited to, the BBC (BBC, 2017, July 31), the Independent (Independent, 2017, May 3), and UEFA (UEFA, 2017, May 1).

circumstances that allow a transparent view of psychological elements at work. And, when it does, the phenomena are typically too complex to clearly discern the impact of these elements on human behaviour.” (p. 2563) Penalty shootouts, however, are tournaments where psychological elements and behavioural outcomes of highly paid professionals competing in their natural environment are transparently available. Such tournaments offer unique opportunities to examine factors that may improve winning probabilities for performers in dynamic competition with interim feedback and performance observability, such as competitions for promotion in labour markets or R&D races between companies. Previous related analyses have given theoretical and empirical evidence in support of FMA. That is, in sequential competition, if first-movers have already successfully completed the task, later participants may be under greater psychological pressure to perform due to lagging-behind in interim performance. The additional psychological pressure negatively influences later participants’ subsequent actions and delivers first-movers with an advantage.

We set out to examine the evidence of a psychological lagging-behind effect. Our analytic results, based on 94.9% of all penalty shootout since July-2003 (612 matches), suggest that first-movers enjoy no advantage mediated by a lagging behind effect. First-movers won in only 50.16% of cases. Observing this outcome in our competitive setting refutes earlier research that there exists a significant advantage for first-movers in dynamic tournaments (Apesteguia & Palacios-Huerta, 2010; Palacios-Huerta, 2014; Vandebroek et al., 2016). Our results are thus in line with a previous critique of the existence of a lagging-behind effect (KLS). Furthermore, based on unique data from 106 professionals making decisions in their natural environment, we tested how decision-making may influence performance in sequential tournaments. We find that teams deciding whether to kick first or second, win in a significant 61.3% of

cases. This result indicates the existence of a decision advantage, where the decision rather than the entry-order may be the deciding factor for success.

Admittedly, the study is limited by its relatively small sample size, particularly that of decisions. Hence, for the findings to be generalizable, they must be validated using a larger data pool, preferably one that includes decision data from all matches since 2003. This study does, however, take a useful step towards quantifying the links between psychological pressure and FMA while identifying the role of decision making on the timing-performance relationship.

5 Conclusion

In this study, we provided three research articles to advance our understandings of the psychological factors that may determine performance in competitive career settings.

In our first article, we showed how various general and specific human capital measures vary in their predictability of individuals' chances of promotion. The inclusion of both specific and general HC measures enabled us to account for the literatures current lack of accountability for individuals' decision-making trade-offs involved throughout their HC development. Similar to extant literature, we found a generally positive relationship between HC factors and promotion, but were unable to find support for the suggestion that specific HC factors are more predictive of promotions than general HC factors, despite clear demands placed on individuals for specific skills in our setting. Additionally, we found strong support for the use of objective rather than subjective HC measures for predicting individuals' promotions. Taken together, this article's findings suggest that when investigating the effect of individuals human capital on their extrinsic career success, researchers should link the cognitive ability factors being measured to job specific requirements and appropriately account for cognitive factors that are most suited to cope with the demands of the workplace.

In our second article, we extend on recent studies investigating the role of non-cognitive traits on career success. Using unique personality data, we found that individuals who scored low on the tendency to be principled were significantly more likely to enjoy career success through job promotion. This finding contributes to

management literature as it contradicts previous suggestions that the relation between personality traits and career success is not important in job contexts where clear demands are made on behaviour. By also testing the effect of individuals' human capital factors, whilst taking into account their personality, we find further support for the results of our first article that individuals with high cognitive processing speed enjoyed better chances of promotion.

Finally, in our third article, we explored the role of psychological pressure on individuals in sequential contests. Much research investigating the effect of entry-order on performance in sequential contests supports the theory that first-movers have an advantage. We specifically tested for the existence of a lagging-behind effect, that is, the hypothesis that first-movers inflict psychological pressure on later entrants and thus negatively influence their subsequent actions. Contrary to previous theoretical and empirical evidence, we find no support for the existence of a lagging behind effect and almost even probabilities of success between first- and later-movers. Our result is in line with the findings of recent critiques of previous literature that suggest the existence of a lagging-behind effect. More importantly, we contribute to the literature by including a unique analysis on the influence of decision-making in sequential competitions. Our findings suggest that individuals who make choices about their starting positions according to their resources and competencies, have significantly higher winning probabilities. We therefore posit that the decision, rather than the entry-position, may deliver advantage in sequential competitions.

The approach undertaken in all of our articles take useful steps towards quantifying the relationship between psychological factors and performance in competitive career settings. As outlined in our first two articles, we provide the theoretical and methodological basis for future work where mass volumes of related

data may become available. Here we expect to significantly increase the sampled observations and include data from many youth academies across Germany, and where possible, from international academies. The articles' analyses would also be greatly improved through the inclusion of data from women's teams. Comparison of potential gender differences, or similarities, in terms of the effects of human capital, personality traits and psychological pressure on career success would be of particular interest to the literature. Furthermore, given our preliminary findings that decision-making may deliver advantages to individuals in sequential competitions, extending on these findings through additional data or new data from field experiments would help to validate our results. We nevertheless feel that contributions made in each of our three articles, through the analysis of human capital, personality traits and psychological pressure, provide new insights to our understandings of extrinsic career success in competitive career related settings.

References

- Agarwal, R., & Sarkar, M. (2002). The conditioning effect of time on firm survival: An industry life cycle approach. *Academy of Management Journal*, 45(5), 971-994.
- Altman, D. G., & Bland, J. M. (1994). Diagnostic tests. 1: Sensitivity and specificity. *BMJ: British Medical Journal*, 308(6943), 1552.
- Alvarez, S. A. (2007). Entrepreneurial rents and the theory of the firm. *Journal of Business Venturing*, 22(3), 427-442.
- Anderberg, D., & Andersson, F. (2003). Investments in human capital, wage uncertainty, and public policy. *Journal of Public Economics*, 87(7), 1521-1537.
- Apestequia, J., & Palacios-Huerta, I. (2010). Psychological pressure in competitive environments: Evidence from a randomized natural experiment. *The American Economic Review*, 100(5), 2548-2564.
- Ariely, D., Gneezy, U., Loewenstein, G., & Mazar, N. (2009). Large stakes and big mistakes. *The Review of Economic Studies*, 76(2), 451-469.
- Ballout, H. I. (2007). Career success: The effects of human capital, person-environment fit and organizational support. *Journal of Managerial Psychology*, 22(8), 741-765.
- Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: a meta-analysis. *Personnel Psychology*, 44(1), 1-26.
- Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment*, 9(1-2), 9-30.
- BBC. (2017, July 31). Penalty shootouts: EFL to trial 'ABBA' format in 2017-18. Retrieved from <http://www.bbc.com/sport/football/40783273>
- Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5, Part 2), 9-49.
- Becker, G. S. (1983). *Human Capital*. Chicago: University of Chicago Press.
- Becker, G. S. (1993). Nobel lecture: The economic way of looking at behavior. *Journal of Political Economy*, 101(3), 385-409.
- Bedard, K., & Dhuey, E. (2006). The persistence of early childhood maturity: International evidence of long-run age effects. *The Quarterly Journal of Economics*, 121(4), 1437-1472.
- Berger, J., & Pope, D. (2011). Can losing lead to winning? *Management Science*, 57(5), 817-827.
- Bohlmann, J. D., Golder, P. N., & Mitra, D. (2002). Deconstructing the pioneer's advantage: Examining vintage effects and consumer valuations of quality and variety. *Management Science*, 48(9), 1175-1195.
- Boudreau, J. W., Boswell, W. R., & Judge, T. A. (2001). Effects of personality on executive career success in the United States and Europe. *Journal of Vocational Behavior*, 58(1), 53-81.
- Breiman, L. (1996). Bagging predictors. *Machine Learning*, 24(2), 123-140.
- Breiman, L. (2001). Random forests. *Machine Learning*, 45(1), 5-32.
- Bronars, S. G., & Oettinger, G. S. (2006). Estimates of the return to schooling and ability: evidence from sibling data. *Labour Economics*, 13(1), 19-34.

-
- Brunello, G., & Schlotter, M. (2011). *Non-cognitive skills and personality traits: Labour market relevance and their development in education & training systems*. IZA Discussion Papers 5743. Institute for the Study of Labor (IZA).
- Buchholtz, A. K., Ribbens, B. A., & Houle, I. T. (2003). The role of human capital in postacquisition CEO departure. *Academy of Management Journal*, 46(4), 506-514.
- Burnham, T. A., Frels, J. K., & Mahajan, V. (2003). Consumer switching costs: a typology, antecedents, and consequences. *Journal of the Academy of Marketing Science*, 31(2), 109-126.
- Cameron, S. V., & Heckman, J. J. (1993). The nonequivalence of high school equivalents. *Journal of Labor Economics*, 11(1, Part 1), 1-47.
- Campbell, B. A., Coff, R., & Kryscynski, D. (2012). Rethinking sustained competitive advantage from human capital. *Academy of Management Review*, 37(3), 376-395.
- Cantner, U., Dreßler, K., & Krüger, J. J. (2006). Firm survival in the German automobile industry. *Empirica*, 33(1), 49-60.
- Capone, G., Malerba, F., & Orsenigo, L. (2013). Are switching costs always effective in creating first-mover advantage? The moderating role of demand and technological regimes. *Long Range Planning*, 46(4), 348-368.
- Cawley, J., Heckman, J., & Vytlačil, E. (2001). Three observations on wages and measured cognitive ability. *Labour Economics*, 8(4), 419-442.
- Chatterjee, R., & Sugita, Y. (1990). New product introduction under demand uncertainty in competitive industries. *Managerial and Decision Economics*, 11(1), 1-12.
- Chiappori, P.-A., Levitt, S., & Groseclose, T. (2002). Testing mixed-strategy equilibria when players are heterogeneous: The case of penalty kicks in soccer. *American Economic Review*, 1138-1151.
- Cobb-Clark, D. A., & Schurer, S. (2012). The stability of big-five personality traits. *Economics Letters*, 115(1), 11-15.
- Cooper, W. H., & Withey, M. J. (2009). The strong situation hypothesis. *Personality and Social Psychology Review*, 13(1), 62-72.
- Cortes, C., & Mohri, M. (2004). AUC optimization vs. error rate minimization *Advances in neural information processing systems* (pp. 313-320): MIT Press.
- David, R. J., & Han, S. K. (2004). A systematic assessment of the empirical support for transaction cost economics. *Strategic Management Journal*, 25(1), 39-58.
- de Figueiredo Jr, R. J., & Spiller, P. T. (2000). Strategy, structure and regulation: telecommunications in the new economy. *L. Rev. MSU-DCL*, 253.
- Dohmen, T. J. (2008). Do professionals choke under pressure? *Journal of Economic Behavior & Organization*, 65(3), 636-653.
- Feri, F., Innocenti, A., & Pin, P. (2011). *Psychological pressure in competitive environments: Evidence from a randomized natural experiment: Comment*. Working Papers in Economics and Statistics. University of Innsbruck.
- Feri, F., Innocenti, A., & Pin, P. (2013). Is there psychological pressure in competitive environments? *Journal of Economic Psychology*, 39, 249-256.
- Finnie, R., & Meng, R. (2001). Cognitive skills and the youth labour market. *Applied Economics Letters*, 8(10), 675-679.
- Fosfuri, A., Lanzolla, G., & Suarez, F. F. (2013). Entry-timing strategies: The road ahead. *Long Range Planning*, 46(4), 300-311.
-

-
- Franco, A. M., Sarkar, M., Agarwal, R., & Echambadi, R. (2009). Swift and smart: the moderating effects of technological capabilities on the market pioneering–firm survival relationship. *Management Science*, 55(11), 1842-1860.
- Frederiksen, A., & Kato, T. (2017). Human capital and career success: Evidence from linked employer-employee data. *The Economic Journal*.
- Friedman, J., Hastie, T., & Tibshirani, R. (2010). Regularization paths for generalized linear models via coordinate descent. *Journal of Statistical Software*, 33(1), 1.
- Fuchs, H., & Huber, A. (2002). *Die 16 Lebensmotive: was uns wirklich antreibt; [mit persönlichem Motiv-Profil]*: Dt. Taschenbuch-Verlag.
- Gal-Or, E. (1985). First mover and second mover advantages. *International Economic Review*, 649-653.
- Gal-Or, E. (1987). First mover disadvantages with private information. *The Review of Economic Studies*, 54(2), 279-292.
- Garcia-Sanchez, J., Mesquita, L. F., & Vassolo, R. S. (2014). What doesn't kill you makes you stronger: The evolution of competition and entry-order advantages in economically turbulent contexts. *Strategic Management Journal*, 35(13), 1972-1992.
- Gattiker, U. E., & Larwood, L. (1988). Predictors for managers' career mobility, success, and satisfaction. *Human Relations*, 41(8), 569-591.
- Genakos, C., & Pagliero, M. (2012). Interim rank, risk taking, and performance in dynamic tournaments. *Journal of Political Economy*, 120(4), 782-813.
- Genakos, C., Pagliero, M., & Garbi, E. (2015). When pressure sinks performance: Evidence from diving competitions. *Economics Letters*, 132, 5-8.
- Gervais, M., Livshits, I., & Meh, C. (2008). Uncertainty and the specificity of human capital. *Journal of Economic Theory*, 143(1), 469-498.
- Ghosh, A., & Buchanan, B. (1988). Multiple outlets in a duopoly: a first entry paradox. *Geographical Analysis*, 20(2), 111-121.
- Giarratana, M. S., & Torrisi, S. (2010). Foreign entry and survival in a knowledge-intensive market: emerging economy countries' international linkages, technology competences, and firm experience. *Strategic Entrepreneurship Journal*, 4(1), 85-104.
- Gibbons, R., & Waldman, M. (2004). Task-specific human capital. *The American Economic Review*, 94(2), 203-207.
- Glamser, F. D., & Vincent, J. (2004). The relative age effect among elite American youth soccer players. *Journal of Sport Behavior*, 27(1), 31.
- Golder, P. N., & Tellis, G. J. (1993). Pioneer advantage: Marketing logic or marketing legend? *Journal of Marketing Research*, 158-170.
- Goldman, M., & Rao, J. M. (2016). *Loss aversion around a fixed reference point in highly experienced agents*. Unpublished Manuscript. UC San Diego. Retrieved from <http://ssrn.com/abstract=2782110>
- González-Díaz, J., Gossner, O., & Rogers, B. W. (2012). Performing best when it matters most: Evidence from professional tennis. *Journal of Economic Behavior & Organization*, 84(3), 767-781.
- González-Díaz, J., & Palacios-Huerta, I. (2016). Cognitive performance in competitive environments: Evidence from a natural experiment. *Journal of Public Economics*.
- Greenhaus, J. H., Parasuraman, S., & Wormley, W. M. (1990). Effects of race on organizational experiences, job performance evaluations, and career outcomes. *Academy of Management Journal*, 33(1), 64-86.
-

References

- Guion, R. M., & Gottier, R. F. (1965). Validity of personality measures in personnel selection. *Personnel Psychology*, 18(2), 135-164.
- Heckman, J. J. (2000). Policies to foster human capital. *Research in Economics*, 54(1), 3-56.
- Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics*, 24(3), 411-482.
- Heiens, R. A., Pleshko, L. P., & Al-Zufairi, A. (2015). Making Up Lost Ground: The Relative Advantage of Achieving Relationship Marketing Outcomes Versus Time-In-Market Effects. *Journal of International Consumer Marketing*, 27(1), 84-96.
- Heineck, G. (2011). Do your brains help you out of unemployment? *Economics Letters*, 111(1), 34-36.
- Heineck, G., & Anger, S. (2010). The returns to cognitive abilities and personality traits in Germany. *Labour Economics*, 17(3), 535-546.
- Helmreich, R. L., Sawin, L. L., & Carsrud, A. L. (1986). The honeymoon effect in job performance: temporal increases in the predictive power of achievement motivation. *Journal of Applied Psychology*, 71(2), 185.
- Hogan, V., & Walker, I. (2007). Education choice under uncertainty: Implications for public policy. *Labour Economics*, 14(6), 894-912.
- Howard, A., & Bray, D. W. (1990). Predictions of managerial success over long periods of time: Lessons from the Management Progress Study *Measures of leadership* (pp. 113-130). West Orange, NJ, US: Leadership Library of America.
- Independent. (2017, May 3). Uefa to trial brand-new penalty shootout format designed to even out advantage of going first or second. Retrieved from <http://www.independent.co.uk/sport/football/international/uefa-penalty-shooutout-rules-system-new-trial-a7715026.html>
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning* (Vol. 112): Springer.
- Judge, T. A., & Bretz Jr, R. D. (1994). Political influence behavior and career success. *Journal of Management*, 20(1), 43-65.
- Judge, T. A., Cable, D. M., Boudreau, J. W., & Bretz, R. D. (1995). An empirical investigation of the predictors of executive career success. *Personnel Psychology*, 48(3), 485-519.
- Judge, T. A., Higgins, C. A., Thoresen, C. J., & Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 52(3), 621-652.
- Judge, T. A., & Kammeyer-Mueller, J. D. (2007). Personality and career success. *Handbook of Career Studies*, 59-78.
- Judge, T. A., & Zapata, C. P. (2015). The person–situation debate revisited: Effect of situation strength and trait activation on the validity of the Big Five personality traits in predicting job performance. *Academy of Management Journal*, 58(4), 1149-1179.
- Jung, V., Schmidt, S. L., & Torgler, B. (2012). Antecedents of attitudes towards risky career choices. *EBS Business School Research Paper*(12-10).
- Kagel, J., & McGee, P. (2014). Personality and cooperation in finitely repeated prisoner's dilemma games. *Economics Letters*, 124(2), 274-277.
- Kahn, L. M. (2000). The sports business as a labor market laboratory. *The Journal of Economic Perspectives*, 14(3), 75-94.
-

- Kalyanaram, G., Robinson, W. T., & Urban, G. L. (1995). Order of market entry: Established empirical generalizations, emerging empirical generalizations, and future research. *Marketing Science*, 14(3_supplement), G212-G221.
- Kaplan, S., & Tripsas, M. (2008). Thinking about technology: Applying a cognitive lens to technical change. *Research Policy*, 37(5), 790-805.
- Kassis, M., Schmidt, S. L., & Schreyer, D. (2017a). *The decision-making effect: Psychological pressure and the role of decision making on the timing-performance relationship*. Unpublished Paper.
- Kassis, M., Schmidt, S. L., & Schreyer, D. (2017b). *The effect of individuals' human capital investment decisions on their career promotions: Evidence from a highly competitive professional football environment*. Unpublished Paper.
- Kassis, M., Schmidt, S. L., Schreyer, D., & Torgler, B. (2017). Who gets promoted? Personality factors leading to promotion in highly structured work environments: evidence from a German professional football club. *Applied Economics Letters*, 24(17), 1222-1227.
- Kerin, R. A., Varadarajan, P. R., & Peterson, R. A. (1992). First-mover advantage: A synthesis, conceptual framework, and research propositions. *The Journal of Marketing*, 33-52.
- Klingebiel, R., & Joseph, J. (2015). Entry timing and innovation strategy in feature phones. *Strategic Management Journal*.
- Kocher, M. G., Lenz, M. V., & Sutter, M. (2012). Psychological pressure in competitive environments: New evidence from randomized natural experiments. *Management Science*, 58(8), 1585-1591.
- Kocher, M. G., Lenz, M. V., Sutter, M., Andersson, P., Ayton, P., & Schmidt, C. (2008). Performance Under Pressure—The Case of Penalty Shootouts in Football. *Myths and Facts about Football: The Economics and Psychology of the World's Greatest Sport*. Cambridge: Cambridge Scholars Publishing, 61-72.
- Kogut, B., & Kulatilaka, N. (2004). Real options pricing and organizations: The contingent risks of extended theoretical domains. *Academy of Management Review*, 29(1), 102-110.
- Kolev, G. I., Pina, G., & Todeschini, F. (2010). *Overconfidence in competitive environments: evidence from a quasi-natural experiment*. Mimeo.
- Kolev, G. I., Pina, G., & Todeschini, F. (2015). Decision making and underperformance in competitive environments: evidence from the National Hockey League. *Kyklos*, 68(1), 65-80.
- Kosinski, M., Wang, Y., Lakkaraju, H., & Leskovec, J. (2016). Mining big data to extract patterns and predict real-life outcomes. *Psychological Methods*, 21(4), 493.
- Landy, F. J., & Farr, J. L. (1980). Performance rating. *Psychological Bulletin*, 87(1), 72.
- Lent, R. W., Brown, S. D., Talleyrand, R., McPartland, E. B., Davis, T., Chopra, S. B., . . . Chai, C.-M. (2002). Career choice barriers, supports, and coping strategies: College students' experiences. *Journal of Vocational Behavior*, 60(1), 61-72.
- Lévesque, M., Minniti, M., & Shepherd, D. (2013). How late should Johnny-come-lately come? *Long Range Planning*, 46(4), 369-386.
- Liaw, A., & Wiener, M. (2002). Classification and regression by randomForest. *R News*, 2(3), 18-22.
-

-
- Lieberman, M. B. (2005). *Did first-mover advantage survive the dot-com crash*. Unpublished Working Paper. UCLA.
- Lieberman, M. B., & Montgomery, D. B. (1988). First-mover advantages. *Strategic Management Journal*, 9(S1), 41-58.
- Lieberman, M. B., & Montgomery, D. B. (2013). Conundra and progress: Research on entry order and performance. *Long Range Planning*, 46(4), 312-324.
- Lounsbury, J. W., Sundstrom, E., Loveland, J. M., & Gibson, L. W. (2003). Intelligence, "Big Five" personality traits, and work drive as predictors of course grade. *Personality and Individual Differences*, 35(6), 1231-1239.
- Magnus, J. R., & Klaassen, F. J. (1999). On the advantage of serving first in a tennis set: four years at Wimbledon. *Journal of the Royal Statistical Society: Series D (The Statistician)*, 48(2), 247-256.
- Markides, C. C., & Geroski, P. A. (2004). *Fast second: How smart companies bypass radical innovation to enter and dominate new markets* (Vol. 325): John Wiley & Sons.
- Maurer, T. J., & Chapman, E. F. (2013). Ten years of career success in relation to individual and situational variables from the employee development literature. *Journal of Vocational Behavior*, 83(3), 450-465.
- McAfee, R. P., Mialon, H. M., & Williams, M. A. (2004). What Is a Barrier to Entry? *American Economic Review*, 94(2), 461-465.
- McCullough, J. C., Agarwal, Y., Chandrashekar, J., Kuppaswamy, S., Snoeren, A. C., & Gupta, R. K. (2011). *Evaluating the effectiveness of model-based power characterization*. Paper presented at the USENIX Annual Technical Conf.
- McGee, J., & Thomas, H. (1986). Strategic groups: theory, research and taxonomy. *Strategic Management Journal*, 7(2), 141-160.
- Mellander, C., & Florida, R. (2006). *The creative class or human capital? Explaining regional development in Sweden*. Electronic Working Paper Series in Economics and Institutions of Innovation. KTH/CESIS.
- Menard, S. (2002). *Applied logistic regression analysis* (Vol. 106): Sage.
- Merkel, S., Schmidt, S. L., & Torgler, B. (2015). *Optimistic and Positivity Biases in Employee Ratings: Empirical Evidence from Professional Soccer*. CREMA Working Papers. Center for Research in Economics, Management and the Arts (CREMA). Retrieved from <http://www.crema-research.ch/papers/2015-02.pdf>
- Merkel, S., Schmidt, S. L., & Torgler, B. (2017). The effect of individual uncertainty on the specificity of human capital: empirical evidence from career developments in professional soccer. *Applied Economics*, 49(21), 2083-2095.
- Miller, S. R. (1998). Shortcut: High school grades as a signal of human capital. *Educational Evaluation and Policy Analysis*, 20(4), 299-311.
- Min, S., & Wolfinger, M. (2005). Market share, profit margin, and marketing efficiency of early movers, bricks and clicks, and specialists in e-commerce. *Journal of Business Research*, 58(8), 1030-1039.
- Mittal, S., & Swami, S. (2004). What factors influence pioneering advantage of companies? *Vikalpa*, 29(3), 15-34.
- Musch, J., & Grondin, S. (2001). Unequal competition as an impediment to personal development: A review of the relative age effect in sport. *Developmental Review*, 21(2), 147-167.
- Newbert, S. L. (2007). Empirical research on the resource-based view of the firm: an assessment and suggestions for future research. *Strategic Management Journal*, 28(2), 121-146.
-

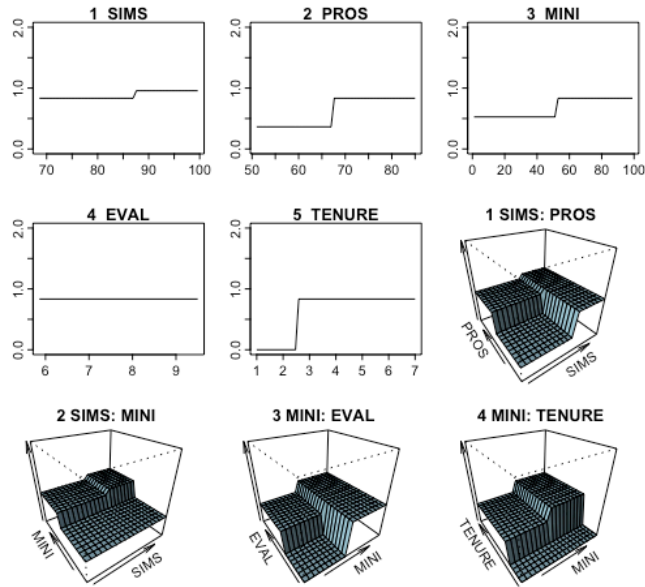
- Ng, T. W., Eby, L. T., Sorensen, K. L., & Feldman, D. C. (2005). Predictors of objective and subjective career success: A meta-analysis. *Personnel Psychology, 58*(2), 367-408.
- O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity, 41*(5), 673-690.
- Ones, D. S., Viswesvaran, C., & Reiss, A. D. (1996). Role of social desirability in personality testing for personnel selection: The red herring. *Journal of Applied Psychology, 81*(6), 660-679.
- Palacios-Huerta, I. (2014). *Beautiful Game Theory: How Soccer Can Help Economics*: Princeton University Press.
- Parsons, F. (1909). *Choosing a vocation*: Houghton Mifflin.
- Pope, D. G., & Schweitzer, M. E. (2011). Is Tiger Woods loss averse? Persistent bias in the face of experience, competition, and high stakes. *The American Economic Review, 101*(1), 129-157.
- Prendergast, C. (1993). The role of promotion in inducing specific human capital acquisition. *The Quarterly Journal of Economics, 108*(2), 523-534.
- Robinson, W. T., & Fornell, C. (1985). Sources of market pioneer advantages in consumer goods industries. *Journal of Marketing Research, 305*-317.
- Rumelt, R. P. (1987). Theory, strategy, and entrepreneurship. *The competitive challenge, 137*, 158.
- Savage, D. A., & Torgler, B. (2012). Nerves of steel? Stress, work performance and elite athletes. *Applied Economics, 44*(19), 2423-2435.
- Schapiro, R. E., Freund, Y., Bartlett, P., & Lee, W. S. (1998). Boosting the margin: A new explanation for the effectiveness of voting methods. *The Annals of Statistics, 26*(5), 1651-1686.
- Schmidt, S. L., Torgler, B., & Jung, V. (2017). Perceived trade-off between education and sports career: evidence from professional football. *Applied Economics, 49*(29), 2829-2850.
- Schmidt, S. L., & Weiss, C. (2010). Integration durch Profifußball: Eine Analyse der Leistungszentren der Fußball Bundesliga. *I. f. SB Society (Ed.). Oestrich Winkel*.
- Schnaars, S. P. (1994). *Managing Imitation Strategies*: New York: The Free Press.
- Schuhfried, G. (2011). Wiener Testsystem (Vienna Test System). *Mödling, Austria: Dr. Gernot Schuhfried GmbH*.
- Schultz, T. W. (1961). Investment in human capital. *The American Economic Review, 51*(1), 1-17.
- Seibert, S. E., & Kraimer, M. L. (2001). The five-factor model of personality and career success. *Journal of Vocational Behavior, 58*(1), 1-21.
- Shamsie, J., Phelps, C., & Kuperman, J. (2004). Better late than never: A study of late entrants in household electrical equipment. *Strategic Management Journal, 25*(1), 69-84.
- Sing, T., Sander, O., Beerenwinkel, N., & Lengauer, T. (2005). ROCr: visualizing classifier performance in R. *Bioinformatics, 21*(20), 3940-3941.
- Srinivasan, R., Lilien, G. L., & Rangaswamy, A. (2004). First in, first out? The effects of network externalities on pioneer survival. *Journal of Marketing, 68*(1), 41-58.
- Steffy, B. D. (1986). Career Mobility in a Corporate Hierarchy. *Administrative Science Quarterly, 31*(2), 326-328.
-

- Stevens, C. E., & Dykes, B. J. (2013). The home country cultural determinants of firms' foreign market entry timing strategies. *Long Range Planning*, 46(4), 387-410.
- Stewart, T., & Ruckdeschel, C. (1998). Intellectual capital: The new wealth of organizations: Wiley Online Library.
- Suarez, F. F., Grodal, S., & Gotsopoulos, A. (2015). Perfect timing? Dominant category, dominant design, and the window of opportunity for firm entry. *Strategic Management Journal*, 36(3), 437-448.
- Suarez, F. F., & Lanzolla, G. (2005). The Half-Truth of First-Mover Advantage. *Harvard Business Review*.
- Suarez, F. F., & Lanzolla, G. (2007). The role of environmental dynamics in building a first mover advantage theory. *Academy of Management Review*, 32(2), 377-392.
- Sullivan, P. (2010). Empirical evidence on occupation and industry specific human capital. *Labour Economics*, 17(3), 567-580.
- Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: a meta-analytic review. *Personnel Psychology*, 44(4), 703-742.
- Tharenou, P. (2001). Going up? Do traits and informal social processes predict advancing in management? *Academy of Management Journal*, 44(5), 1005-1017.
- Tsuchihashi, R., & Hamada, T. (2014). *A Systematic Assessment of First-mover Advantages*. Discussion Paper Series. Faculty of Economics. Nagasaki University.
- Turner, R. H. (1960). Sponsored and contest mobility and the school system. *American Sociological Review*, 855-867.
- UEFA. (2017, May 1). Penalty shoot-out trial at UEFA final tournaments. Retrieved from <http://www.uefa.com/under17/news/newsid=2463576.html>
- Urban, G. L., & Star, S. H. (1991). *Advanced Marketing Strategy*. Englewood Cliffs: NJ: Prentice Hall Inc.
- Usero, B., & Fernández, Z. (2009). First come, first served: How market and non-market actions influence pioneer market share. *Journal of Business Research*, 62(11), 1139-1145.
- Vaeyens, R., Philippaerts, R. M., & Malina, R. M. (2005). The relative age effect in soccer: A match-related perspective. *Journal of Sports Sciences*, 23(7), 747-756.
- Van Hoecke, J., Schoukens, H., Simm, S., Isakowitz, M., & de Sutter, R. (2011). *The classification of youth academies in German professional football clubs*. Paper presented at the Proceedings of the 19th Conference of the European Association for Sport Management.
- Vandebroek, T. P., McCann, B. T., & Vroom, G. (2016). Modeling the Effects of Psychological Pressure on First-Mover Advantage in Competitive Interactions The Case of Penalty Shoot-Outs. *Journal of Sports Economics*, 1527002516672060.
- Walker, M., & Wooders, J. (2001). Minimax play at Wimbledon. *The American Economic Review*, 91(5), 1521-1538.
- Walker, M., Wooders, J., & Amir, R. (2011). Equilibrium play in matches: Binary Markov games. *Games and Economic Behavior*, 71(2), 487-502.
- Wasmer, E. (2006). General versus specific skills in labor markets with search frictions and firing costs. *The American Economic Review*, 96(3), 811-831.
-

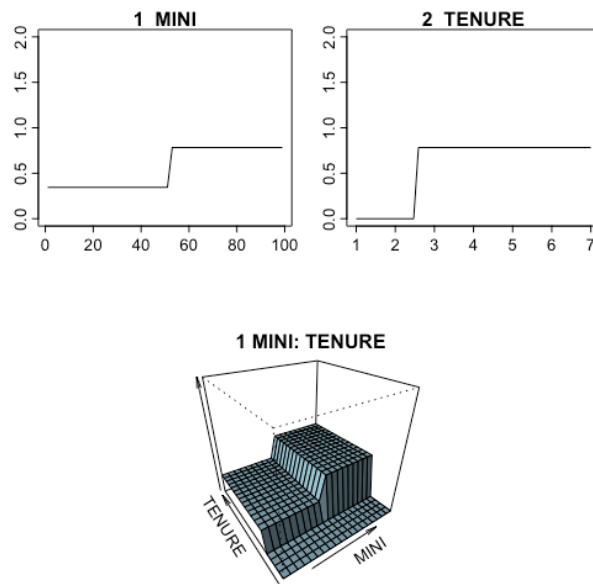
References

- Wayne, S. J., Liden, R. C., Kraimer, M. L., & Graf, I. K. (1999). The role of human capital, motivation and supervisor sponsorship in predicting career success. *Journal of Organizational Behavior*, 577-595.
- Wei, T., & Wei, M. T. (2016). Package 'corrplot'. *Statistician*, 56, 316-324.
- Withey, M. J., Gellatly, I. R., & Annett, M. (2005). The moderating effect of situation strength on the relationship between personality and provision of effort. *Journal of Applied Social Psychology*, 35(8), 1587-1606.
- Wößmann, L. (2003). Specifying human capital. *Journal of Economic Surveys*, 17(3), 239-270.
- Wyer Jr, R. S. (2016). The role of procedural knowledge in consumer judgement and decision making. *Routledge International Handbook of Consumer Psychology*.
- Zax, J. S., & Rees, D. I. (2002). IQ, academic performance, environment, and earnings. *The Review of Economics and Statistics*, 84(4), 600-616.

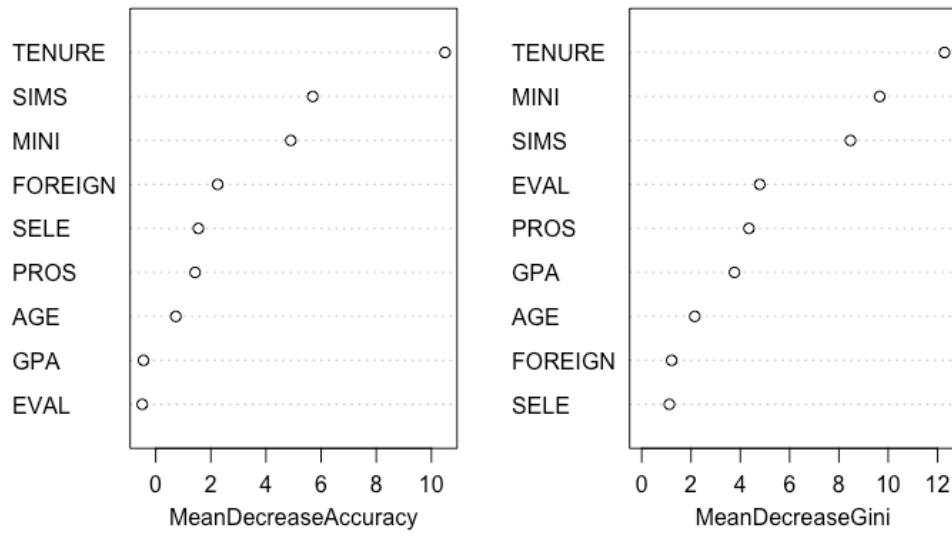
Appendix



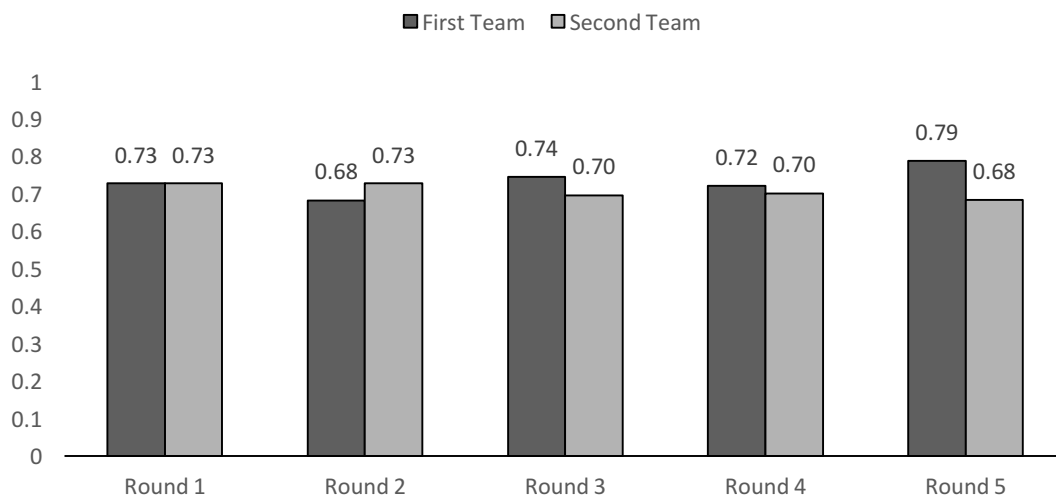
[Article 1] Figure A1— Regression surfaces for unpruned tree built on the PROMOTED data



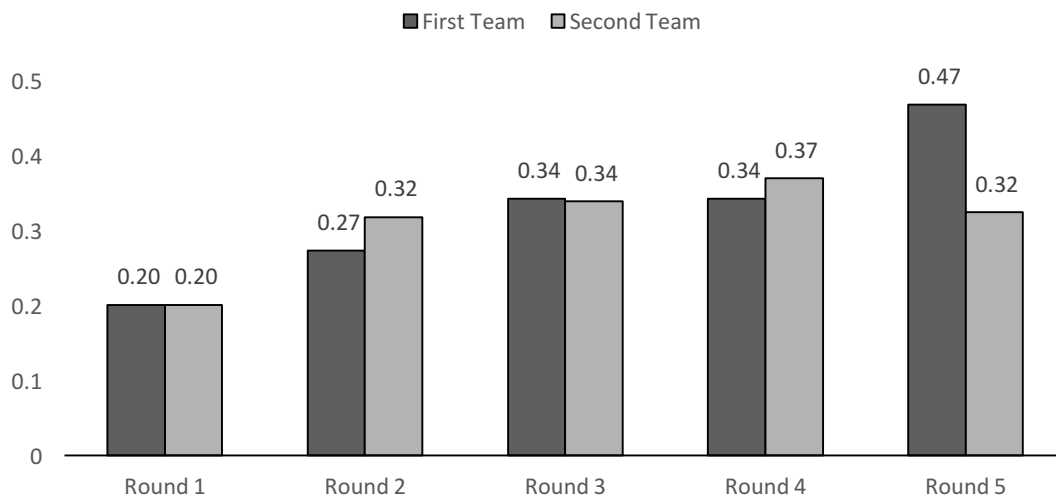
[Article 1] Figure A2— Regression surfaces for pruned tree built on the PROMOTED data



[Article 1] Figure A3— Dotchart of variable importance as measured by random forest



[Article 3] Figure A1— Scoring probabilities per round (SUBSET 1)



[Article 3] Figure A2— Frequency with which a team leads in the score at the end of a round (SUBSET 1)

[Article 3] Table A1— Comparison of shootout data: 1970 to 2017 and Palacios-Huerta (2014)

Tournament	[SUPERSET] 1970 to 2017			Palacios-Huerta (2014)		
	[A] Shoot-outs <i>n</i>	[B] First-kicking team wins	[C] First-kicking team wins (rel. freq.)	[D] Shoot-outs <i>n</i>	[E] First-kicking team wins	[F] First-kicking team wins %
[1] FIFA World Cup	26	15	0.5769	22	13	0.591
[2] European Championship	18	7	0.3889	15	5	0.333
[3] Copa America	23	14	0.6087	18	11	0.611
[4] Africa Cup of Nations	26	13	0.5000	20	12	0.600
[5] Gold Cup	12	6	0.5000	10	7	0.700
[6] Asian Cup	18	9	0.5000	16	9	0.563
[7] UEFA Champions League	58	37	0.6379	49	31	0.633
[8] UEFA Europa League (European Cup Winners' Cup and UEFA Cup)	142	72	0.5070	142	81	0.570
[9] German Cups (<i>DFB Pokal, Premiere Liga Pokal</i>)	231	116	0.5022	183	91	0.497
[10] English Cups (<i>FA Cup, League Cup, Community Shield</i>)	299	146	0.4883	179	96	0.536
[11] Copa del Rey ²⁶	243	120	0.4938	347	251	0.723
<i>All</i>	1096	555	0.5064	1001	607	0.606

²⁶ We were unable to verify Palacios-Huerta (2014) data from 347 Copa del Rey matches despite requesting data from online databases, sports performance data providers, Spanish newspaper libraries, online video databases, the Royal Spanish Football Federation and Spanish football clubs. Nevertheless, we are sceptical that these missing data would have a significant effect on our results. For example, even if we apply a 75% first-mover win rate to the remaining 104 matches – a relative win frequency that is highly unlikely and significantly higher than those found in all other competitions – we would continue to find FMA (52.8%) not significant at the 5% level.

Appendix

[Article 3] Table A2— Shootout data from 1970 to 2013

[SUPERSET] 1970 to 2013						
	[A] KLS	[B] KLS	[C] KLS	[D] 2003-2013	[E] 2003-2013	[F] 2003-2013
Tournament	Shoot-outs Known <i>n</i>	First- kicking team wins	First- kicking team wins (rel. freq.)	Shoot-outs <i>n</i>	First- kicking team wins	First- kicking team wins (rel. freq.)
[1] FIFA World Cup	16	7	0.438	6	6	1.000
[2] European Championship	9	3	0.333	6	3	0.571
[3] Copa America	12	8	0.667	6	3	0.500
[4] Africa Cup of Nations	13	9	0.692	7	3	0.429
[5] Gold Cup	5	2	0.400	5	3	0.600
[6] Asian Cup	8	3	0.375	8	6	0.750
[7] UEFA Champions League (not incl. playoffs)	28	18	0.643	21	12	0.571
[8] UEFA Europa League (European Cup Winners' Cup and UEFA Cup)	74	39	0.527	42	23	0.548
[9] German Cups (<i>DFB Pokal, Premiere Liga Pokal</i>)	122	61	0.500	72	37	0.514
[10] English Cups (<i>FA Cup, League Cup, Community Shield</i>)	122	62	0.508	130	67	0.515
[11] Copa del Rey	131	76	0.580	43	24	0.558
<i>All</i>	540	288	0.533	346	187	0.541

Appendix

[Article 3] Table A3— Comparison of shootout data: 1970 to 2013 and Palacios-Huerta (2014)

Tournament	[SUPERSET] 1970 to 2013			Palacios-Huerta (2014)		
	[A] Shoot-outs N	[B] First-kicking team wins %	[C] First-kicking team wins (rel. freq.)	[D] Shoot-outs N	[E] First-kicking team wins N	[F] First-kicking team wins %
[1] FIFA World Cup	22	13	0.591	22	13	0.591
[2] European Championship	15	6	0.400	15	5	0.333
[3] Copa America	18	11	0.611	18	11	0.611
[4] Africa Cup of Nations	20	12	0.600	20	12	0.600
[5] Gold Cup	10	5	0.500	10	7	0.700
[6] Asian Cup	16	9	0.563	16	9	0.563
[7] UEFA Champions League (not incl. playoffs)	49	30	0.612	49	31	0.633
[8] UEFA Europa League (European Cup Winners' Cup and UEFA Cup)	116	62	0.534	142	81	0.570
[9] German Cups (<i>DFB Pokal,</i> <i>Premiere Liga Pokal</i>)	194	98	0.505	183	91	0.497
[10] English Cups (<i>FA Cup, League Cup, Community Shield</i>)	252	129	0.512	179	96	0.536
[11] Copa del Rey	174	100	0.575	347	251	0.723
<i>All</i>	886	475	0.536	1001	607	0.606

Notes: Alternate results marked in bold.

Appendix

[Article 3] Table A4— Decision data from 2003 to 2017

	[SUBSET 2] Decision Known					
	[A]	[B]	[C]	[D]	[E]	[F]
Tournament	Shootouts <i>N</i>	Shootouts <i>n</i>	First- kicking team wins (rel. frequency)	P-value (two-sided binomial test)	Deciding team wins (rel. frequency)	P-value (two-sided binomial test)
[1] FIFA World Cup	10	9	0.7778	0.1797	0.5556	1.0000
[2] European Championship	9	9	0.4444	1.0000	0.5556	1.0000
[3] Copa America	11	2	1.0000	0.5000	1.0000	0.5000
[4] Africa Cup of Nations	13	2	0.0000	0.5000	1.0000	0.5000
[5] Gold Cup	7	-	-	-	-	-
[6] Asian Cup	10	-	-	-	-	-
[7] UEFA Champions League	30	15	0.6000	0.6072	0.6000	0.6072
[8] UEFA Europa League	60	13	0.2308	0.0923	0.7692	0.0923
[9] DFB Pokal	104	10	0.2000	0.1094	0.7000	0.3438
[10] Premiere Liga Pokal	5	-	-	-	-	-
[11] FA Cup	43	-	-	-	-	-
[12] League Cup	130	-	-	-	-	-
[13] Community Shield	4	-	-	-	-	-
[14] Copa del Rey	112	-	-	-	-	-
[15] FIFA Confederations Cup	4	4	0.2500	0.6250	0.7500	0.6250
[16] FIFA U-20 World Cup	20	16	0.4375	0.8036	0.5000	1.0000
[17] FIFA U-17 World Cup	10	6	0.5000	1.0000	0.6667	0.6875
[18] FIFA Women's World Cup	4	4	0.7500	0.6250	0.5000	1.0000
[19] FIFA U-20 Women's World Cup	6	4	0.5000	1.0000	0.5000	1.0000
[20] FIFA U-17 Women's World Cup	6	4	0.2500	0.6250	0.0000	0.1250
[21] UEFA U21 Championship	7	1	1.0000	1.0000	1.0000	1.0000
[22] UEFA U19 Championship	6	-	-	-	-	-
[23] UEFA U17 Championship	17	-	-	-	-	-
[24] FIFA Club World Cup	9	7	0.7143	0.4531	0.7143	0.4531
<i>All</i>	<i>645</i>	<i>106</i>	<i>0.4717</i>	<i>0.6274</i>	<i>0.6132</i>	<i>0.0250</i>