Competing for Fun?

An interdisciplinary approach to the concept, measurement, and relevance of individual competitiveness

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PREFACE

This thesis consists of four chapters examining the concept, measurement, and relevance of individual competitiveness. Research reported in Chapter II is joint work with my supervisors, Werner Bönte and Diemo Urbig. Chapter III reports data from an experiment I conducted at the newly established behavioral economic laboratory of the Schumpeter School of Business and Economics. Research reported in Chapters IV and V is joint work with Werner Bönte, Vivien Procher, and Diemo Urbig. This research is part of a project of the Jackstädt Center of Entrepreneurship and Innovation Research. For the co-authored chapters, I have contributed significantly to all aspects of the research process, including theory development, design of the empirical approach, analyses, discussion, and the writing process.

An earlier version of Chapter II has been published in *Personality and Individual Differences* under the title "Economics meets Psychology: Experimental and Self-reported Measures of Individual Competitiveness" (Bönte, Lombardo, & Urbig, 2017a). A previous working-paper version of this chapter is available online as *Schumpeter Discussion Paper No. 6* under the same title (Bönte, Lombardo, & Urbig, 2016). Analyses presented in Chapter II of this thesis provide substantial extensions to these previous versions. Furthermore, an adjusted version of Chapter IV has been accepted for publication (January 2019) and is forthcoming in *Small Business Economics* under the title "Entrepreneurs embrace competition: evidence from a lab-in-the-field study" (Urbig, Bönte, Procher, & Lombardo, 2019). Moreover, all of the chapters in this thesis have been accepted and presented at the following scientific conferences and seminars: Conference on Interdisciplinary Perspectives on Decision Making, WZB, Berlin (2015); 16th conference of the International Schumpeter Society, Montreal (2016); London Experimental Workshop (2016); 15th TIBER Symposium on Psychology and Economics, Tilburg (2016); EIC JERSeminar at Friedrich-Schiller-Universität, Jena (2017); Berlin Behavioral Economic Seminar, German Institute for Economic Research (DIW), Berlin (2018); 4th ZEW Conference on the Dynamics of Entrepreneurship (CODE), Mannheim (2018); Jahrestagung der Wissenschaftlichen Kommission Technologie, Innovation und Entrepreneurship (TIE), Hamburg (2018); 22th G-Forum - Interdisziplinäre Jahreskonferenz zur Gründungsforschung, Stuttgart (2018); 17th International Schumpeter Society (ISS) Conference, Seoul (2018).

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Chapter I

An Introduction to Individual Competitiveness

1.1 MOTIVATION

Competition is an integral part of life: "plants compete for sunlight and water, animals for territory and food, and humans for mates and income" (Leibbrandt, Gneezy, & List, 2013, p. 9305). While competition is omnipresent in current societies, institutions can differ in the importance they place on competitiveness (Niederle, 2017) and the deliberate design of competition within and between organizations, such as promotion contests or innovation contests, has been intensively studied for more than 30 years (Lazear & Rosen, 1981; Connelly, Tihanyi, Crook, & Gangloff, 2014).

In addition to standard economic explanations, the role of individual preferences to enter competitive environments has only recently gained prominence (Niederle, 2017). During the past decade experimental studies in behavioral economics have intensely investigated individual's self-selection into competitive environments (Niederle & Vesterlund, 2007; Bartling, Fehr, Maréchal, & Schunk, 2009; Shurchkov, 2012; Leibbrandt, et al., 2013; Buser, Niederle, and Oosterbeek, 2014; Wozniak, Harbaugh, & Mayr, 2014; Reuben, Sapienza, & Zingales, 2015; Niederle, 2017; Reuben, Wiswall, & Zafar, 2017). In their seminal study Niederle and Vesterlund (2007) investigate the self-selection of men and women into a competitive tournament. They find that men are more likely to self-select into competition than women and conclude that there is heterogeneity in preferences for entering competition. Their empirical findings have been reproduced and extended for many tasks and contexts (e.g. Kamas & Preston, 2009; Vandegrift & Yavas, 2009; Ertac & Szentes, 2010; Dohmen &

Falk, 2011; Booth & Nolen, 2012; Mayr, Wozniak, Davidson, Kuhns, & Harbaugh, 2012; Shurchkov, 2012; Gupta, Poulsen, & Villeval, 2013; Andersen, Ertac, Gneezy, List, & Maximiano, 2013; see Niederle 2016 for a review). Moreover, several studies provide evidence for heterogeneity in self-selection into competitive environments between individuals from different countries (Cárdenas, Dreber, von Essen, & Ranehill, 2012), different cultures (Gneezy, Leonard, & List, 2009; Leibbrandt et al., 2013), and different age groups (Mayr et al., 2012).

Potential heterogeneity among individuals regarding preferences to enter competitive situations has substantial and practically relevant consequences for economic decision-making, for instance, for behavior in labor markets (Buser et al., 2014; Flory, Leibbrandt, & List, 2015; Reuben et al., 2015). Reuben, Sapienza, and Zingales (2015), for instance, find that individuals having a preference to enter competitive situations earn more than less competitive individuals and are more likely to work in high-paying industries. Individuals who tend to be reluctant to enter competitive situations might be less likely to pursue very competitive career paths, such as a managerial or entrepreneurial career. Even high-performing individuals may refuse high-profile jobs, which are very competitive, and this may lead to inefficient allocation of labor. Moreover, many experimental studies indicate that men are, on average, more competitively inclined than women (Croson & Gneezy, 2009) and this gender difference in competitiveness has been suggested to partly explain gender differences in labor market outcomes (Buser et al., 2014; Flory et al., 2015; Reuben et al., 2015).

While current research on individual competitiveness is creating valuable insights, it focuses solely on revealed preferences derived from observed behavior and has made little effort to explain the widely observed phenomenon. Most studies agree that there are large differences in competitiveness between individuals that *cannot* be readily explained by genetic endowments, abilities, or risk attitudes (cf. Leibbrandt et al., 2013). Hence, it remains unclear why individuals self-select into competition. To explain these differences, sometimes studies refer to *competitive preferences* (e.g. Croson & Gneezy, 2009), or *preferences for competition* (e.g. Shurchkov, 2012), while others consider competitiveness as a *taste for competition* (Reuben et al., 2015), or even as a *behavioral trait* (Niederle, 2017). In their seminal study Niederle and Vesterlund (2007) refer to *preferences for performing in a competition*, but Ifcher and Zarghamee (2016b) conclude that *performing* might not be necessary for heterogeneity in

competitiveness. Explicit definitions, however, are rarely provided and the economic interpretation of individual competitiveness remains unclear. This conceptual ambiguity may substantially impede the identification of the nature and drivers of the phenomenon, that is, we do not know what drives individuals to self-select into competitive environments or to shy away from these environments.

This thesis provides an interdisciplinary approach to enhance the understanding of the nature of self-selection into competition. I address the gap in conceptual foundations of individual competitiveness by introducing concepts from psychological research, where competitiveness has been studied for more than 100 years (cf. Triplett, 1898). The presented research tests the compatibility of psychological and economic competitiveness research and examines how these psychological concepts can help us improve the economic understanding of individual competitiveness. For this purpose this thesis conceptually and empirically examines two related research questions that I consider essential to improve the conceptual foundations of individual competitiveness and better understand its relation with career choices:

Research Question 1:

What drives individuals' decisions to self-select into competitive versus non-competitive environments?

This first research question emphasizes the conceptualization and measurement of individual's competitive preferences itself. In current behavioral economic literature the identification of competitive preferences typically relies on some kind of group heterogeneity in the self-selection into competition, e.g. that men are, on average, more likely than women to self-select into competition (Niederle & Vesterlund, 2007). After controlling for some confounds, such as risk preferences and confidence in winning, a residual group difference suggests heterogeneity in competitive preferences (e.g. Niederle & Vesterlund, 2007), but without such group differences individual competitive preferences could not be identified. In order to identify a single individual's competitive preference, I seek to develop a positive conceptualization of competitive preferences indicating why individuals would enter competition and what they value about competitive environments. With this conceptualization I seek to develop

measurement techniques that allow the identification of competitive preferences on the individual level based on the individual's self-selection into competitive versus non-competitive environments.

Research Question 2:

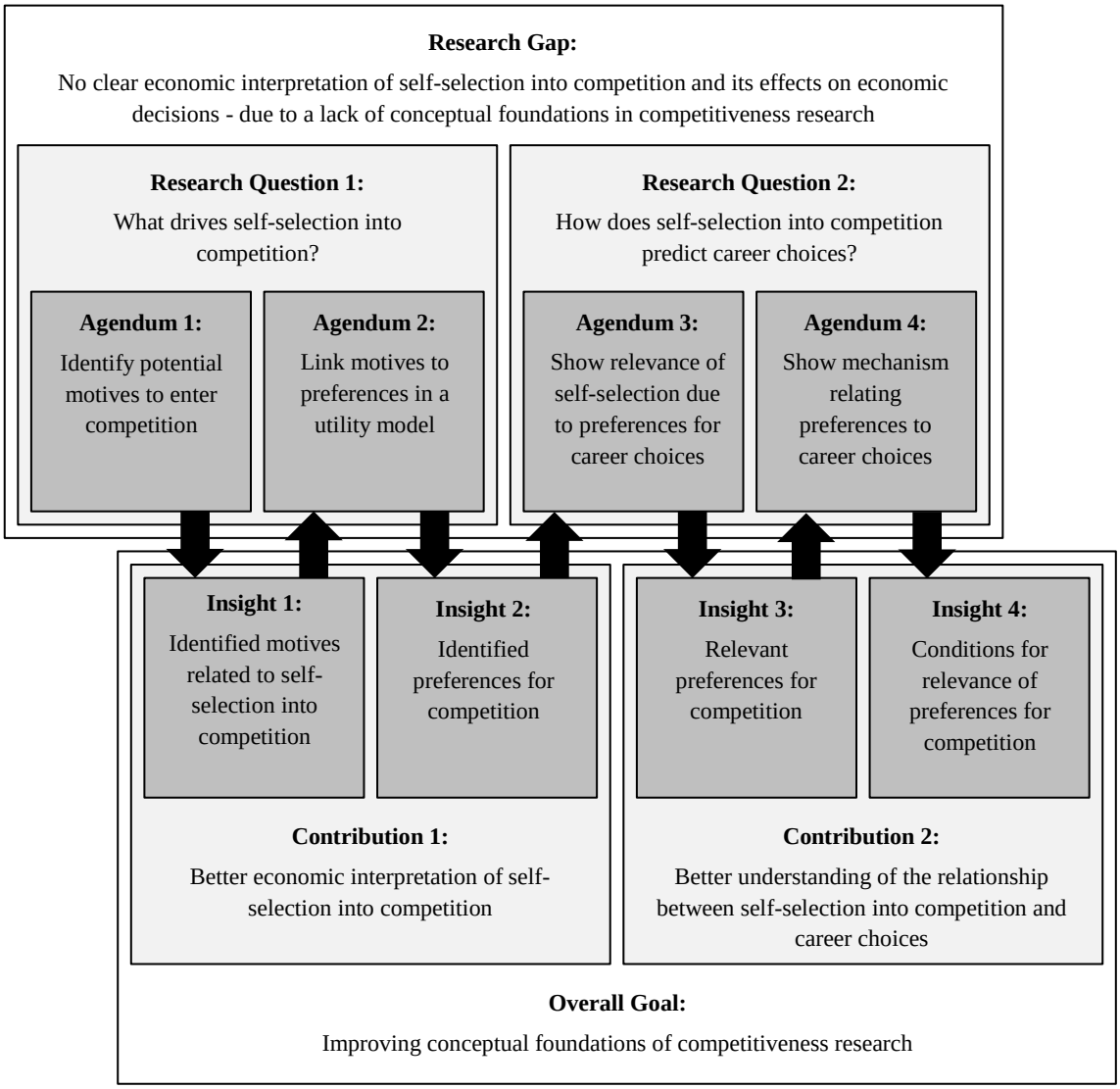
How are individuals' decisions to self-select into competitive versus non-competitive environments in economic experiments related to these individuals' decisions to pursue certain career paths rather than others?

This second research question emphasizes the relation between an individual's competitive preferences and other economic decisions. While experimental studies have provided ample evidence for a substantial and practically relevant relationship between self-selection into competition and career choices (Buser et al., 2014; Flory et al., 2015; Reuben et al., 2015), previous research has provided little evidence in regard to possible explanations for this relationship. Neither do we know why self-selection into competition is related to certain career paths and occupational choices, nor does the literature derive predictions indicating for which career paths and occupational choices we can expect the strongest relationships with self-selection into competition. In this thesis I seek to provide a better understanding of conditions for the relationship between competitive preferences and certain career choices. Moreover, I attempt to provide a systematic approach to predict the relevance of an individual's competitive preferences for choices between certain career paths and occupations.

As a further operationalization of these research questions I set up the research agenda shown in Figure 1.1 for this thesis. First, I identify potential motives of self-selection into competition. Current economic literature provides little information about what drives individuals to self-select into competitive environments. I draw on psychological literature on individual competitiveness, which has studied several different motives of individual competitiveness as personality characteristics. In a first study my co-authors and I empirically test whether and to what extent these different motives are related to the self-selection into competition studied by behavioral economists. This analysis contributes to economic literature on individual competitiveness by better explaining what drives individuals to self-select into

competitive environments. Moreover, it contributes to both economic and psychological competitiveness research by examining the link between these previously rather isolated, but conceptually related literatures.

Figure 1.1: Research agenda of this thesis



Second, I test whether these motives constitute preferences for competitive environments. While the identified motives of self-selection into competition shed some light on the interpretation of this phenomenon, it is not per se clear, whether such personality characteristics reflect well-known economic preferences, or whether economic theory can benefit from the inclusion of these personality characteristics as model parameters (see Borghans, Duckworth, Heckman, & Weel, 2008). I link self-

selection into competition to an individual's utility maximizing behavior by providing a utility-based model that includes the identified motives in the individual's utility function. Furthermore, I experimentally quantify the individual value of these motives and provide evidence for a genuine preference for competing. Linking self-selection into competition to an individual's utility function contributes to the theoretical foundation of competitiveness research by facilitating the economic interpretation of self-selection into competitive environments.

Next, I demonstrate the relevance of the identified drivers for the relation between self-selection into competition and the respective individual's career choices. Identifying preferences in the lab does not imply that these preferences are relevant for economic decisions in less artificial contexts. In current economic competitiveness literature the practical relevance of self-selection into competitive environments (in the lab) builds in large parts on the demonstration of its predictive power for career choices (see Buser et al., 2014; Flory et al., 2015; Reuben et al., 2015; Buser, Peter, & Wolter, 2017). In order to test the external validity (Loewenstein, 1999) of the identified preferences underlying self-selection into competition, I examine their relation to these main findings of competitiveness literature. Individuals' decisions to start a business and become an entrepreneur provide an ideal case for this study, since the competitiveness of entrepreneurs and entrepreneurship has been prominently theorized (Schumpeter, 1934; Kirzner, 1973), yet empirical evidence is scarce (see Bönte & Piegeler, 2013 as exception). This analysis contributes to the behavioral economic literature by empirically confirming the importance of individual competitiveness for entrepreneurship entry. Moreover, it contributes to the entrepreneurship literature, which has only conceptually described the competitiveness of entrepreneurs and entrepreneurship, by providing empirical evidence for these conjectures.

Finally, I investigate the general mechanisms by which the identified competitive preferences influence the relation between self-selection into competition and the respective individual's career choices. Previous research has provided evidence that self-selection into competition relates to particular career choices. For instance, Buser and colleagues (2014, 2017) demonstrate that high school students, who self-select into competition in an experiment, are more likely to choose a math-intensive academic track later. Reuben, Sapienza, and Zingales (2015) find that competitive MBA students are more likely to work in consulting and finance industry. Furthermore, it has

been conjectured that competitive individuals are more likely to become top-level managers (Gneezy, Niederle, & Rustichini 2003; Niederle & Vesterlund, 2007). While these studies make valuable contributions, they have not provided a systematic approach to predict the relevance of an individual's competitive preferences for choices between certain career paths or occupations. Based on individuals' beliefs regarding competition in a broad variety of occupations my co-authors and I investigate conditions for the relationship between competitive preferences and certain career choices showing why self-selection into competition is more strongly related to entry into some occupations than to entry into others. This study makes two main contributions to the existing literature: First, it demonstrates the relevance of individual's beliefs about competition. Second, it shows for which occupational choices self-selection into competition can be expected to be most predictive.

1.2 GENERAL FRAMEWORK

1.2.1 Competitive Individuals and Competitive Environments

The examination of individual competitiveness presented in this thesis largely builds on a strand of experimental studies in behavioral economics that have investigated self-selection into competitive environments over the past decade. In the seminal experiment by Niederle and Vesterlund (2007) subjects are given a choice, whether to be paid according to a piece-rate scheme or according to a winner-take-all tournament. The piece-rate depends only on the subject's own performance, while the winner-take-all tournament includes the comparison with the performance of other subjects. The current behavioral economic literature on individual competitiveness consists of a large body of experimental studies that either adapt the experimental design by Niederle and Vesterlund (2007) or use similar designs (e.g. Bartling et al., 2009; Kamas & Preston, 2010; Cárdenas et al., 2012; Leibbrandt et al., 2013; Buser et al., 2014, 2017; Reuben et al., 2015). In this work I adopt this perspective and apply a broad definition of individual competitiveness, which is consistent with this strand of research:

Individual competitiveness *is an individual's general tendency to select into competitive environments.* ***Competitive individuals*** *are those individuals who favor competitive over non-competitive environments (Niederle & Vesterlund, 2011; Smither & Houston, 1992).*

This thesis investigates such individual heterogeneity in self-selection into competitive environments. In particular, I study why and to what extent some individuals are more competitive than others and under which conditions individual competitiveness can predict career choices. This perspective on competitive individuals introduces heterogeneity within the individual response to competitive environments. Hence, it is essential to clarify what constitutes a competitive environment and to unambiguously distinguish between competitive and non-competitive environments. For this purpose I use a broad definition of competitive environments provided in Deutsch's (1949) Theory of Competition:

Competitive environments *are characterized by institutions where individuals' goals are not simultaneously achievable given the sets of possible strategies. In competitive environments every attempt of individuals to get closer to their own goals makes it less likely for other individuals to achieve their goals* (Deutsch, 1949).

Competitive and non-competitive environments differ in how individuals' actions and resulting performances relate to their payoffs. Situations where payoffs solely depend on an individual's own performances or where an individual's rewards relate positively to increases in the performances of other individuals are considered as non-competitive environments. Hence, competitive environments require strategic interaction between at least two individuals. If the degree of goal achievement of individual A depends negatively on individual B's action or strategy towards B's own goal, then individual B can be considered a **competitor** for individual A. This does not imply that individual A is also a competitor for individual B. The definition allows for asymmetric goal relations: If B is a competitor for A, but A's attempts to reach A's goal relate positively (or are not at all related) to B's goal achievement, then A is not a competitor for B. Zero-sum games and winner-take-all situations represent examples of extremely competitive environments (Lazear, 1999).

My focus on individual heterogeneity in *self-selection into competitive environments* is conceptually distinct from individual heterogeneity in the *behavior and*

performance within competitive environments. In ecological as well as economic context competitiveness is sometimes defined as individual ability to win competitions or to perform better than others (e.g., Manning & Taylor, 2001; Hönekopp, Manning, & Müller, 2006). Individual heterogeneity in the performance within competition can not only be due to differences in ability, but also due to heterogeneity in individual's willingness to increase efforts to leverage odds of winning (Ryckman, Hammer, Kaczor, & Gold, 1990). Marshall (1920), for instance, asserts that "a manufacturer or a trader is often stimulated much more by the hope of victory over his rivals than by the desire to add something to his fortune" (p.19) and, hence, accepts lower profits within a competition for the sake of winning. Aggressive behavior within competitive environments does not necessarily imply, however, that individuals generally favor situations in which they compete with others. For instance, individuals who dislike competitions may be forced to enter competitive environments and may respond to this by competing aggressively. Yet, such behavioral tendencies within competitive environments are distinct from a tendency to enter competitions.

Similarly, individuals maximizing relative rewards are sometimes considered as *competitive* individuals (e.g., van Lange, De Bruin, Otten, & Joireman, 1997; Fehr & Schmidt, 1999). While significant correlations between such distributional preferences and individual competitiveness have been reported (Bartling et al., 2009), distributional preferences also differ from my conceptualization of individual competitiveness, because they relate to behavior in contexts where individuals' rewards are mutually dependent on one another, that is, to behavior within competitive environments, but not to a tendency to self-select into such environments.

1.2.2. Motives & Preferences

While each individual's self-selection into competitive or non-competitive environments is a distinct observable behavior, which can be considered a revealed preference, the economic interpretation of this observed behavior is not obvious. In the simplest case self-selection into either competitive or non-competitive environments reflects the individual's payoff-maximizing decision. In experimental studies on individual competitiveness subjects choosing between a winner-take-all tournament and a piece-rate payment usually maximize their payoff by selecting the tournament, if they

expect to win it, and selecting the piece-rate otherwise (e.g. Niederle and Vesterlund, 2007). Yet, empirical results provide ample evidence for substantial deviation from such payoff-maximizing behavior (e.g. Niederle and Vesterlund, 2007; Mayr et al., 2012; Shurchkov, 2012; Reuben et al., 2015).

While payoff-maximization alone cannot explain the observed individual heterogeneity in self-selection into competitive environments, the observed results might be composed of well-established beliefs and preferences. As any competition implies a chance of winning and a risk of losing, both an individual's risk preferences and (over-)confidence may make competitive environments more attractive. Hence, risk taking or optimism in terms of confidence in winning may make individuals appear as if they favor competitive environments (Gneezy et al., 2003).

However, in the conceptualization of individual competitiveness presented above, competitive individuals select into competitive environments, because they have preferences over particular institutions linking individuals' performances to their rewards. While payoff-maximization, risk preference, and (over-)confidence are likely to influence self-selection into competition, they are conceptually distinct from individual competitiveness as they do not relate to a unique preference for competitive versus non-competitive environments (Niederle, 2017; Niederle & Vesterlund, 2007). From current economic literature it is an open question, whether the empirical findings imply such a unique preference for competitive environments, or whether differences in self-selection into competition might be fully explained by overconfidence and risk preferences (Van Veldhuizen, 2017).

As outlined above this thesis aims to contribute to the clarification of this question. In order to identify potential drivers for self-selection into competitive environments, which are unique for choices between competitive and non-competitive environments, I draw on psychological competitiveness research. Recent psychological research considers individual competitiveness as a multidimensional construct (e.g. Houston, Mcintire, Kinnie, & Terry, 2002a; Houston, Harris, McIntire, & Francis, 2002b; Newby & Klein, 2014) and investigates different motives to seek or avoid competitive environments. It has been suggested that individuals are motivated to enter competitions, for instance, because they consider it "as a means of maintaining or enhancing feelings of self-worth" (Ryckman et al., 1990, p. 630) or "for the purposes of

demonstrating self-competence, mastery, achievement and self-improvement" (Newby & Klein, 2014). Three of the different motives of competitiveness that have been identified are examined in recent psychological research (e.g. Houston, Edge, Anderson, Lesmana, & Suryani, 2012):

(1) seeking personal development in competition,

(2) a desire to win in competition, and

(3) an enjoyment of competition.

Individuals motivated for competition by opportunities for personal development value competition because it helps them to improve their competence, to be the best they can be, and to judge their level of competence (Newby & Klein 2014; Ryckman, Hammer, Kaczor, & Gold, 1996). Individuals motivated for competition by a desire to win implied by the concept of hypercompetitiveness, which refers to an individual's indiscriminate need to compete, win, and to avoid losing at any cost (Horney, 1937; Ryckman et al., 1990). Individuals with a desire to win compete for the sake of winning itself, independent of associated rewards. Individuals, who enjoy competing against others, gain non-monetary benefits related to the institution of competition itself, independent of the outcome of a competition. Such an enjoyment of competition has been associated with emotional arousal in the state of competing against others (Nakamura & Csikszentnihalyi, 2003; Schneider et al., 2005, Newby & Klein, 2014).

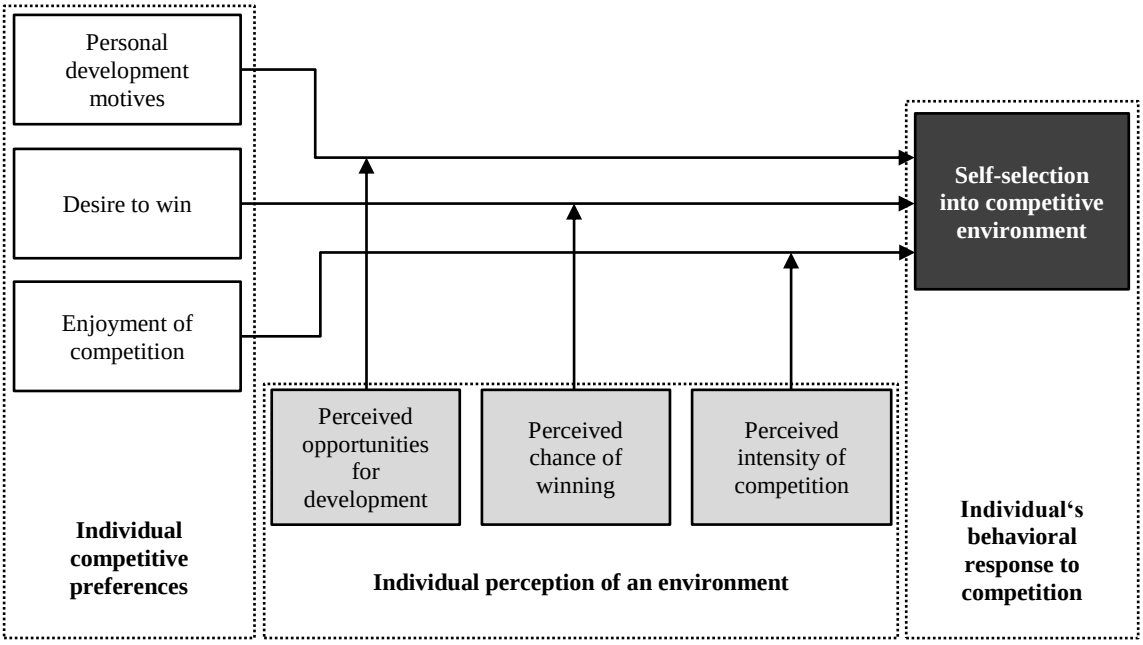
I examine how each of these motives is related to an individual's self-selection into competitive environments, and whether any of these motives constitutes a unique preference for competitive environments that goes beyond the effects of payoff-maximization, risk preference, and (over-)confidence. In doing so I follow Borghans, Duckworth, Heckman, and Weel (2008) who show how economic theory can benefit from the inclusion of personality characteristics as model parameters.

1.2.3 Critical contingencies

In my conceptualization, individual competitiveness represents a *general tendency* to enter competitive environments, but an individual's observable self-selection is always a choice between *specific environments.* Depending on their

motives, individuals may react differently to different types of competitive environments. Individuals can be expected to favor a specific competitive environment to the extent to which this competitive environment allows the satisfaction of motives that make competition attractive to them. Hence, the relation between each motive and a specific environment depends on a critical contingency, i.e. a belief that the individual holds about that specific environment. Figure 1.2 illustrates the general framework proposed in this thesis.

Figure 1.2: A general framework of individual competitiveness



Individuals competing to satisfy personal development goals, do not focus on winning a competition, but rather seek mastery of a given task (Ryckman et al., 1996). Hence, personal development motives can be expected to be especially relevant for selection into competition based on tasks that require and challenge individuals' skills and competencies. In contrast, such personal development motives are likely to be irrelevant, if competition does not offer opportunities to develop or demonstrate mastery of skills.

In order to win in a competition, it is inevitable to enter a competition. Hence, the desire to win can be an important motivation to enter competitive rather than non-competitive environments. This motivation, however, is conditioned on individuals'

expectations of winning the competition. Individuals might even shy away from competitions they believe they are not able to win (Conelly et al., 2014; Coffey & Maloney, 2010), because they have a strong desire to win and to avoid losing at any cost (Ryckman et al. 1990).

Individuals, who enjoy competing, can be expected to generally seek competitive environments. The critical contingency for this motive is the individual's belief about the intensity of competition associated with certain environments. An environment allows satisfaction of the enjoyment of competition motive to the extent to which it is believed to be sufficiently competitive. Hence, the relationship between individual competitiveness motivated by enjoyment of competition and self-selection into an environment depends on the individual's perceptions of the intensity of competition in the respective environment.

1.3 METHODOLOGY

This thesis empirically investigates the framework proposed above in Figure 1.2 and provides empirical evidence in regard to the four tasks (Agendum 1-4) in the research agenda shown in Figure 1.1. In the following chapters I present results of primary data from five empirical studies with a total 2,405 observations from 889 participants. Table 1.1 provides an overview of these studies.

This thesis makes methodical contributions to the literature on individual competitiveness by introducing several refinements and extensions of experimental designs for competitiveness measurement. In order to examine self-selection into competitive environments, all chapters include behavioral measures of individual competitiveness as typically used in behavioral economic studies. While all these measures can be considered applications of the seminal Niederle and Vesterlund (2007) experiment, where individuals perform a task and choose between piece-rate payments and winner-take-all tournaments, the specific design of each of the studies is tailored to the respective research question (and will be discussed in detail in the respective chapter). Throughout this thesis my I present multiple methodological approaches to identify different drivers of self-selection into competitive environments.

Table 1.1: Overview of empirical studies

Chapter	Type	Sample	Competitiveness	Obs. (Ind.)
II	Classroom experiment + Classroom Survey	Students	Behavioral *(Quiz)* + Self-reported	186 (186)
III	Lab Experiment	Students	Behavioral *(Math + Dice)*	300 (50)
IV	Lab-in-field study	General Population	Behavioral *(Math + Dice)*	224 (224)
V	Classroom Survey	Students	Self-reported + Perception	887 (227)
V	Lab-in-field study	General Population	Behavioral *(Math + Dice)* + Perception	808 (202)

Note: *Obs. = number of observations; Ind. = number of individuals*

First, my co-authors and I relate behavioral measures of self-selection into competitive environments to **self-reported measures** of individuals' different motives of competitiveness. Psychological research has investigated individual competitiveness as a multidimensional construct and has developed multiple psychometric item scales to elicit different motives of individual competitiveness (Ryckman et al., 1990, 1996; Houston et al., 2002a, 2002b). We apply psychometric scales consistent with those proposed by recent psychological research as self-reported measures.

Second, based on the standard behavioral measure of competitiveness (Niederle & Vesterlund, 2007) I introduce **refined experimental designs** that allow for distinguishing behavioral responses that indicate different preferences of entering competitive environments. I show within-subject designs, where subjects can choose to self-select into competitive environments multiple times under varying conditions, i.e. different tasks, different chances of winning, or different outside options (piece-rate payments). Analyzing the within-subject effects of these varying conditions on self-

selection into competition provides additional information regarding the subjects' underlying motives and preferences.

Third, together with my co-authors I investigate effects of **moderation by critical contingencies** of the respective drivers. As proposed in my general framework the influence of each motive on an individual's self-selection into an environment depends on the individual's beliefs about the respective critical contingency. We use the moderations of these critical contingencies with behavioral (and self-reported) competitiveness measures to separate the effects of different motives: Through the inherent interaction between confidence in winning a competition as a belief, and the desire to win as a preference, we are able to empirically discriminate between a desire to win and other motives of individual competitiveness. Furthermore, varying the degree to which a competition depends on individuals' skills provides a way to indirectly identify the potential influence of personal development motives on individuals' tendencies to enter competitions. Finally, the interaction of competitiveness measures with an individual's perception of competitive intensity within an environment helps to isolate the effect of enjoyment of competition from the effects of other motives.

Examining my research questions with multiple methods facilitates the presented research in two ways. First, it allows for broadening the scope of my investigation, since each of the methods is best suited for the respective study designs and contexts. Second, it reduces the threat of incurring a common method bias (Lindell & Whitney, 2001; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and scrutinizes the robustness of results.

1.4 CHAPTER OVERVIEW

Chapter II focusses on the identification of potential motives of individuals' self-selection into competitive environments. For this purpose my co-authors and I introduce a multidimensional competitiveness concept from psychological literature and examine the relationship between economic and psychological measurement of individuals' competitiveness. While psychologists typically use self-reported psychometric scales, economists tend to use behavioral measures obtained from economic experiments, where subjects confronted with specific paid tasks have to self-select into either a

competitive tournament or a non-competitive piece-rate payment scheme. Both measurement approaches have remained largely isolated from one another. The study presented in Chapter II investigates three different motives of competitiveness that have been identified by psychological research: (1) seeking personal development in competition, (2) a desire to win in competition, and (3) an enjoyment of competition.

Our study demonstrates that a standard behavioral measure and a psychometric scale of individual competitiveness are positively associated and that this association is primarily driven by the enjoyment of competition. However, we also show that the two measurement approaches are distinguishable with respect to the role of personal development motives. While self-reported competitiveness also emerges from personal development motives, the behavioral measure does not reflect such motives. The distinction between both measures is validated based on divergent associations with personality and interests in a competitive management career. In conclusion, our study identifies the enjoyment of competition as a motive for self-selection into competitive environments, while personal development motives do not seem to drive self-selection into competitive environments and the evidence regarding the desire to win is less clear. Chapter II provides four implications for future research:

(1) Since personal development motives are unrelated to current behavioral competitiveness measures, researchers who intent to cover personal development motives in their behavioral measures, need revised experimental designs.

(2) Behavioral measures of individual competitiveness may be approximated by self-reported multi-item scales focusing on enjoyment of competition.

(3) Personal development motives and a desire to win both seem to be relevant for career choices, and that effect is unrelated to self-selection into competitive environments in the lab.

(4) Their respective relations to the Big Five personality dimensions confirm the association between the enjoyment of competition and self-selection into competition. Our study shows how personality frameworks can be employed to better understand economic behavior.

In Chapter III I provide an attempt to disentangle a genuine competitive preference from utility maximizing behavior that can be explained by other factors. I suggest a utility model of an individual's self-selection into competitive environments. The model distinguishes environments, where individuals provide their maximum feasible performance, from environments, where individuals optimize their performance by providing a lower performance level. I analyze an individual's choice between a competitive winner-take-all tournament and its non-competitive piece-rate equivalent. As shown in Chapter II self-selection into competition is related to individual competitiveness which is not due to personal development motives. Hence, the model includes the phenomenon that individuals enjoy competing as well as an individual's desire to win in competition and separates these competitive preferences from the effects of other factors, such as risk aversion and (over-)confidence.

To examine the usefulness of the model empirically I introduce an experimental treatment that allows manipulating the probability of winning the competition exogenously and calculating a non-monetary value of competing as well as a non-monetary value of winning. In support of the model I identify a causal effect of the treatment on subjects' piece-rate equivalent. This effect does not differ between a math task, where performance depends on ability and effort, and a dice task, where performance is the result of pure luck. Subjects' deviation from the benchmark model provides evidence for a positive value of competing, but no evidence for a value of winning among the subjects. Moreover, the individual value of competing increases the likelihood of entering the tournament in a classical Niederle and Vesterlund (2007) experiment substantially. Chapter III provides four implications for future research:

(1) Individuals value competing. Hence, competitive preferences are shown to be a distinct phenomenon, which is not fully explained by other factors such as risk preferences and (over-)confidence. Further theoretical and experimental examination of these preferences is therefore a promising field for behavioral economists.

(2) Individuals do not seem to value winning. I am not able to identify a non-monetary value of winning and additional research might be required to understand the role of winning for self-selection into competitive environments.

(3) Measuring the value of competing allows the investigation of individual competitive preferences as a comparison between the observed decisions and a utility

based benchmark, which is conceptually and empirically independent from the identification of group differences in such preferences.

(4) Self-selection into competition might be most effectively studied in environments, where individuals provide a maximum feasible performance, e.g. due to restrictions to effort provision.

Chapters II and III have identified an enjoyment of competition as a relevant motive of individuals' self-selection into competition and indicated that such a non-monetary value of competing constitutes a competitive preference. Chapter IV aims to transfer these findings from the lab to less artificial contexts. My co-authors and I examine the relevance of the enjoyment of competition for the relation between self-selection into competition and career choices. Referring to Israel M. Kirzner (1973) and Joseph A. Schumpeter (1934), who emphasized the competitive nature of entrepreneurship, Chapter IV investigates whether entrepreneurs are more competitive than non-entrepreneurs. We provide a conceptual framework that links entrepreneurship to the three motives of individual competitiveness: a desire to win, striving for personal development, and an enjoyment of competition.

Following recent economic research linking competitive behavior in experiments to career choices (e.g. Buser et al., 2014, 2017; Reuben et al., 2015), we conduct a lab-in-the-field study and demonstrate that both potential and revealed entrepreneurs are more likely to enter competitions than non-entrepreneurs. Accounting for individual desires to win and mastery-related achievement motivations, our results indicate that entrepreneurs tend to enter competition for the sake of competition itself rather than for the prospect of winning a competition or for personal development in competition. Our results suggest that enjoyment of competition might be an additional factor driving entrepreneurs' market entry decisions beyond well-known factors like (over-)confidence and risk taking. This study demonstrates that an individual's enjoyment of competition is a sufficient constituent for the relation between that individual's self-selection into an artificial competitive environment and the individual's career choices. Chapter IV provides two implications for future research:

(1) While our results suggest that entrepreneurs' market entry decisions are to some extent explained by individuals' enjoyment of competition, considering a non-

monetary value from competing itself might also explain why entrepreneurs do not give up so easily, once winning becomes less likely, but continue competing.

(2) Future research studying the link between competitive behavior in economic experiments and selection into particular sectors or industries (e.g. Reuben et al., 2015), might additionally control for whether a career will be pursued as an entrepreneur or in paid employment; the relationships may differ substantially.

Chapter V seeks to further scrutinize the findings of the previous chapters and investigates the mechanisms by which the condition that some individuals enjoy competing more than others influences the relation between self-selection into competition and the respective individual's career choices. In Chapter V I introduce individual heterogeneity with respect to the perceptions of intensity of competition and argue that such individual beliefs about competitive intensity in various occupations moderates the relation between self-selection into competition and self-selection into the respective occupation. Together with my co-authors I examine individual and systematic perceptions of competitive intensity in 27 different occupations. We focus on a comparison between entrepreneurship versus paid employment and further distinguish these groups with respect to business founders versus other self-employment as well as managerial employment versus non-managerial employment. The empirical analysis is based on two complementary studies with 429 participants with 8,553 judgments of competitive intensity of particular occupations; the first study with 227 students includes 10 forms of entrepreneurship and 17 forms of paid employment and employs self-reported measures of both competitive preferences and the intentions for particular occupational categories. The second study with 202 people from the general population includes reduced sets of 3 forms for each of these four occupational categories and employs incentivized behavioral measures of competitiveness from a lab-in-the field experiment and revealed occupational choices.

Both studies provide empirical evidence for the moderating effect of individuals' perceptions of competitive intensity. Competitive individuals are shown to be more likely to prefer and enter those occupations, they perceive as more competitive, while non-competitive individuals tend to avoid those occupations. Our findings suggest that the differences in relations between self-selection into competition and preferences for

respective occupations are largely explained by the competitive intensity individuals perceive in the respective occupations. Moreover, our results indicate that individuals assess entrepreneurship, on average, as more competitive than paid employment. Furthermore, our analyses support entrepreneurship research calling for a distinction between more growth-oriented entrepreneurship and self-employment as we find substantial differences in perceived competitive intensity between start-up founders versus other self-employment as well as between managerial employment versus non-managerial employment. Chapter V provides four implications for future research:

(1) Since individual heterogeneity in perceived competitive intensity moderates the influence of competitive preferences on career choices, future competitiveness research might explore ways to influence such perceptions e.g. by providing information regarding certain career paths. In some cases changing beliefs about competitive institutions rather than changing the institutions might be an alternative tool to affect individuals' responses to these institutions in a similar way.

(2) Our studies of perceived competitive intensity provide a systematic approach to the relationship between self-selection into competition in economic experiments and different career choices and enables future researchers to predict which occupational choices are most likely influenced by individuals' preferences for competition.

(3) Depending on the specific research question and definition of individual competitiveness future research might either control for heterogeneous perceptions, or include the role of heterogeneous perceptions in the interpretations of findings.

(4) Winner-take-all tournaments are perceived as highly competitive, while piece-rate payments are perceived as far less competitive. Hence, our results confirm that experimental designs where subjects choose between these payment schemes, reflect the subjects' deliberate decision to self-selection into (or avoid) competition.

Chapter VI discusses general conclusions from the results presented in Chapters II to V and summarizes the main contributions of this thesis. I derive implications and outline directions for future research.

Chapter II

Economics meets Psychology: Experimental and Self-reported Measures of Individual Competitiveness

2.1 INTRODUCTION

In this chapter we focus on the identification of potential motives of individuals' self-selection into competitive environments. Individuals' competitiveness has only recently received greater attention in economics and economic research has shown little interest in individuals' motivation to enter or avoid competition. Related research on individual competitiveness, however, has a tradition of more than 100 years in psychology (e.g., Deutsch, 1949; Triplett, 1898), where competitiveness is generally recognized as playing a significant role in interpersonal processes (Houston et al., 2002a). While economic research typically examines individuals' self-selection into competitive environments and employs behavioral measures obtained from incentivized experiments as indicators for competitive preferences (e.g., Niederle & Vesterlund, 2007), psychological research rather conceptualizes individual competitiveness as a multidimensional personality characteristic and builds on self-reported psychometric scales (e.g., Newby & Klein, 2014; Smither & Houston, 1992). Research streams employing these different measures of individual competitiveness remained largely isolated from one another.

In this chapter we bring together economic and psychological research on individual competitiveness to improve the understanding of how specific behaviors are related to deeper psychological motives and how these differences relate to the

respective measures of competitiveness. We argue that economic and psychological measurements of individuals' competitive preferences build on common conceptual ground and are positively related, but differ systematically. While competitiveness resulting from needs to gauge or enhance one's own abilities is a key component of competitiveness in psychological research (Newby & Klein, 2014), it plays a less important and possibly unintentionally marginalized role in economic measures of competitiveness. To investigate the difference between economic and psychometric measures of competitiveness, we separate competitiveness driven by such personal development motives from competitiveness not driven by them, but instead driven by a desire to win and enjoyment of competition, and relate these motives to our behavioral measure of self-selection into competition. Furthermore, we demonstrate distinct relationships with the Big Five personality dimensions and career interests.

The remainder of this chapter proceeds as follows. Section 2.2 outlines the economic and the psychological approach to individual competitiveness and derives hypotheses about the relationship between the respective measures. Section 2.3 describes the dataset, study design, variables, and the empirical approach. Section 2.4 presents the results including validations and robustness checks. Section 2.5 provides a discussion of the findings and derives implications for future research.

2.2 CONCEPTUAL BACKGROUND

We define *competitiveness* as an individual's general tendency to select into competitive environments. This conceptualization of competitiveness is compatible, but not necessarily identical, with both, economic and psychological definitions. In both disciplines *competitive individuals* are usually seen as those individuals who favor competitive over non-competitive environments (Niederle & Vesterlund, 2011; Smither & Houston, 1992). *Competitive environments* are characterized by institutions where individuals' goals are not simultaneously achievable given the sets of possible behaviors, i.e. in competitive environments every attempt of individuals to get closer to their own goals makes it less likely for other individuals to achieve their goals (Deutsch, 1949; Lazear, 1999). Hence, competitive and non-competitive environments differ in how individuals' behaviors and resulting performances relate to their payoffs. In competitive environment, such as tournaments and contests, individuals compete for

prizes that are awarded based on individuals' relative performances. Zero-sum games and winner-take-all tournaments represent examples of extremely competitive environments (Lazear, 1999). Situations where payoffs solely depend on an individual's own performances or where an individual's rewards relate positively to increases in the performances of other individuals are considered as non-competitive environments.

Our conceptualization of competitiveness as tendency to *self-select into* competitive environments differs from individuals' responses *within* a competitive environment (Croson & Gneezy, 2009), such as their willingness to increase efforts to leverage odds of winning. We also distinguish competitiveness from tendencies to maximize own relative to others' rewards. While individuals maximizing relative rewards are sometimes considered as *competitive* individuals (e.g., van Lange et al., 1997; Fehr & Schmidt, 1999), the defining feature does not relate to the selection into, but to the behavior *within* competitive environments. Finally, while risk taking or optimism in terms of confidence in winning may make individuals appear as if they favor competitive environments (Gneezy et al., 2003), we consider them as distinct from individual competitiveness.

2.2.1 Economic and psychological measurements of competitiveness

Economic approaches to measuring individual competitiveness are based on the assumption that revealed behavior best approximates individuals' unobservable preferences. Consequently, they rely on the *revealed preference paradigm* and measure participants' competitiveness by observing their behavior in incentivized experiments (e.g., Gneezy et al., 2003; Leibbrandt et al., 2013; Niederle & Vesterlund, 2007; for a review see Croson & Gneezy, 2009). Within these experiments participants typically have to perform a task and choose between a competitive tournament and a non-competitive payment scheme (e.g., piece-rate or flat wage) (e.g., Niederle & Vesterlund, 2007). Table 2.1 provides an illustrative overview of experimental designs used in this research.

In the tournament participants face a competitive environment in the sense of Deutsch (1949), as their goals are interdependent and not simultaneously achievable. This is not the case under a piece-rate or flat wage scheme, where payments are independent of other participants' actions.

Table 2.1: Behavioral measures of competitiveness

Study	Payment Choice	Task	Competitors	Time limit
Niederle and Vesterlund 2007	0.50$ PR vs. 2.00$ WTA	Math *(adding two-digit numbers)*	3 random identifyable	5 min.
Bartling, Fehr, Maréchal, and Schunk 2009	2.00€ PR vs. 6.00€ WTA	Math *(adding two-digit numbers)*	1 random anonymous	90 sec.
Gneezy, Leonard, and List 2009	X$ PR vs. 3X$ WTA	Ball tossing *(tennis ball into bucket)*	1 random anonymous	10 tries no time limit
Große and Riener 2010	0.50€ PR vs. 1.40€/0.20€ RC vs. 0.50€ RS	Math *(adding two-digit numbers)* Verbal *(word order task)*	3 random identifyable	5 min. 4 min.
Hoffman and Gneezy 2010	20₹ PR vs. 60₹ WTA	Ball tossing *(tennis ball into bucket)*	1 random anonymous	10 tries no time limit
Kamas and Preston 2010	0.20$ PR vs. 0.80$ WTA	Math *(adding two-digit numbers)* Verbal *(word in word puzzle)*	3 random identifyable	2 min.
Cárdenas, Dreber, von Essen, and Ranehill 2012	X PR vs. 2X WTA	Math *(solving exercises)* Verbal *(word search)*	1 random identifyable	2 min.
Shurchkov 2012	X$ PR vs. 4X$ WTA	Math *(number in number puzzle)* Verbal *(word in word puzzle)*	3 random identifyable	2 min. & 10 min.
Leibbrandt, Gneezy, and List 2013	X$ PR vs. 3X$ WTA	Ball tossing *(tennis ball into bucket)*	1 random anonymous	10 tries no time limit
Buser, Niederle, and Oosterbeek 2014	0.25$ PR vs. 1.00$ WTA	Math *(adding two-digit numbers)*	3 random anonymous	3 min.
Masclet, Peterle, and Larribeau 2015	Flatwages: 2.50€/2.50€ vs. 4.50€/0.50€	Decoding *(numbers into letters)*	1 random anonymous	3 min.
Wozniak, Harbaugh, and Mayr 2014	0.25$ PR vs. 0.50$ WTA	Math *(checking simple equations)*	1 random anonymous	30 sec.
Reuben, Sapienza, and Zingales 2015	4.00$ PR vs. 16.00$ WTA	Math *(adding two-digit numbers)*	3 random identifyable	150 sec.
Buser, Peter, Wolter 2017	0.25 CHF PR vs. 1.00 CHF WTA	Math *(adding two-digit numbers)* Verbal *(counting letters)*	3 random anonymous	3 min.
van Veldhuizen 2017	0.50$ PR vs. 2.00$ WTA	Math *(adding two-digit numbers)*	3 random identifyable	5 min.

Notes: *PR = piece-rate; WTA = winner-take-all tournament; RC = ranked compensation; RS = revenue sharing*

Individuals preferring the competitive tournament over the non-competitive payment are considered as competitive individuals. Hence these economic measures reflect individuals' *behavioral* competitiveness. The advantage of observed real behavior carries a less salient drawback when attempting to measure general characteristics, which should characterize individuals across larger sets of different contexts. By construction, revealed behavior is an individual's response within a very concrete and often specific situation. Asking for the extent to which this observed behavior characterizes an individual more generally and across many contexts is, in fact, an instantiation of concerns of external validity. External validity, defined as "the ability to generalize from the research context to the settings that the research is intended to approximate" (Loewenstein, 1999, p. F26), is considered the largest thread to experimental research, both in psychology and economics (Berkowitz & Donnerstein, 1982; Loewenstein, 1999).

Because several studies have already demonstrated that minor changes in the experimental setting can lead to substantially different outcomes regarding competitive behavior (e.g., Shurchkov, 2012; Wozniak et al., 2014), there is a threat of context-specificity to the external validity of economic measurements of individuals' general competitiveness. Despite these general concerns, existing experimental measures of individual competitiveness have been demonstrated to show predictive validity for real-world economic choices, such as the choice of study programs (e.g., Buser et al., 2014), which nevertheless suggests a sufficient external validity.

Psychological approaches to measuring individual competitiveness mostly build on self-reported psychometric scales (e.g., Smither & Houston, 1992; Newby & Klein, 2014). These scales are composed of items like "*I enjoy competing against others*." (Newby & Klein, 2014) or "*I find competitive situations unpleasant*" (Smither & Houston, 1992). Respondents usually rate their agreement or disagreement with each of these statements. Hence these psychometric measures reflect individuals' *self-reported* competitiveness.

These measures do not incentivize respondents to provide truthful answers and, hence, rely on what economists refer to as "*epsilon truthfulness*", the assumption that individuals indifferent between lying and telling the truth, tell the truth (see Cummings, Elliott, Harrison, & Murphy, 1997).

Table 2.2: Psychometric measures of individual competitiveness

Scale		Authors	Dimensions	Items
Competition-Cooperation Attitude scale	**CCAS***	Martin and Larsen 1976	aggression orientation	9
			fascist tendencies	10
			work ethic orientation	4
			power orientation	9
			independence orientation	6
Work and family orientation questionnaire	**WOFO**	Helmreich and Spence 1978	work	6
			mastery	8
			competitiveness	**5**
			personal unconcern	4
Jenkins Activity Survey	**JAS**	Jenkins et al. 1979	Type A	21
			speed and impatience	21
			job involvement	24
			hard driving and competitive	**20**
Sports Competition Trait Inventory	**SCTI**	Fabian and Ross 1984	competitiveness	17
Sports Orientation Questionnaire	**SOQ**	Gill and Deter 1988	competitiveness	13
			win orientation	6
			goal orientation	6
Hypercompetitive Attitude Scale	**HAS**	Ryckman et al. 1990	hypercompetitiveness	26
Competitiveness Questionnaire	**CQ**	Griffin-Pierson 1990	interpersonal competitiveness	8
			goal competitiveness	7
Competitiveness Index	**CI**	Smither and Houston 1992	emotion	9
			argument	6
			games	5
Personal Development Competitive Attitude Scale	**PDCAS**	Ryckman et al. 1996	pers. dev. competitiveness	14
Competitiveness Index - Revised	**CI-R**	Houston et al. 2002b	enjoyment of competition	9
			contentiousness	5
Competitive Orientation Measure	**COM**	Newby and Klein 2014	general competitiveness	12
			dominance	13
			competitive affectivity	8
			personal enhancement	4
Multidimensional Competitive Orientation Inventory	**MCOI**	Orosz et al. 2018	hypercompetitive orientation	3
			anxiety-driven comp. avoidance	3
			self-dev. comp. orientation	3
			lack of interest in competition	3

** The CCAS contains a total 28 items. Several items were reported to load either on multiple dimensions or on no dimension at all (Martin and Larsen, 1976).*

While violations of this assumption represent a threat to the validity of psychological competitiveness measurements, this disadvantage may be outweighed by the advantage of measuring competitiveness in less context-specific ways. It has been shown that these scales meaningfully predict, e.g., students' vocational interests, such that competitive individuals are attracted to jobs involving competitive pressure (e.g., Houston et al., 2015).

There is a large diversity of psychometric scales measuring individuals' competitiveness (see discussion by Smither & Houston, 1992, and by Newby & Klein, 2014). The Competitive-Cooperative Attitude Scale (Martin & Larsen, 1976), the Competitiveness Questionnaire (Griffin-Pierson, 1990), the Competitiveness Index (Smither & Houston, 1992) and the competition subscale of the Work and Family Orientation Scale (Helmreich & Spence, 1978) are examples of widely used psychometric scales**.** Table 2.2 provides an overview of psychometric competitiveness scales. While many psychological competitiveness scales discriminate between different *motives* for why people enter competitive environments (e.g. Ryckman et al., 1996; Newby & Klein, 2014), several competitiveness scales aim at measuring general competitiveness and are, thus, motive-independent (e.g. Newby & Klein, 2014; Smither & Houston, 1992).

Our conceptualization of individual competitiveness is general with respect to the context and does not discriminate competitiveness with respect to the underlying motives. This conceptualization is consistent with Smither's and Houston's (1992, p. 412) operationalization of competitiveness, which builds on "items designed to identify persons who prefer competitive situations over cooperative ones". Consistent with economics approaches to competitiveness building on the revealed preference paradigm, we initially focus on psychological measures of competitiveness that do not discriminate with respect to deeper motives underlying individual tendencies to enter competitions. Supporting our approach, Newby and Klein (2014, p. 880) reported factor analyses of a multitude of existing psychological competitiveness scales revealing a strong factor that they refer to as general competitiveness and that they not only conceptually qualify as superordinate dimension but also "found to discriminate between individuals that choose to enter or refrain from entering competitive activities".

Despite their substantial differences, economic and motive-independent psychological measurement approaches are consistent with our conceptualization of individual competitiveness as a tendency to self-select into competitive environments. Since economic and general psychological measures of competitiveness share such common conceptual ground, we expect them to be positively associated.

Hypothesis 1: *There is a significant positive relationship between the behavioral measure and the self-reported measure of individual competitiveness.*

2.2.2 Motives and contexts I: personal development

Employing Ajzen's and Fishbein's (2005) *principle of compatibility*, we argue that differences in the relevance of individuals' personal development motives in economic and psychological measures of competitiveness create a meaningful difference between these measures. The principle of compatibility suggests that different measures of individuals' evaluation or appraisal of a behavior and the related observed behavior must be defined at the same level of generality or specificity to observe reasonable relationships between them (Ajzen & Fishbein, 2005). Thus, if psychologists' self-reported measures and economists' behavioral measures of competitiveness involve different levels of specificity, we may observe a substantially weakened relationship between these two types of measures.

In our case, individual competitiveness represents a *general tendency* to enter competitive environments, but the behavioral measure of competitiveness relates to a behavior in a *specific experimental environment* possibly not representative of other individually relevant competitive environments. Behavioral measures are therefore by design context-specific. While most psychometric competiveness scales do not refer to specific contexts, they often discriminate between different *motives* for why people enter or why they positively respond to competitive environments. Depending on their motives, individuals may react differently to different types of competitive environments. Individuals can be expected to favor a specific competitive environment to the extent that this competitive environment allows the satisfaction of motives that make competition attractive to them. If a specific motive for competing reflected in self-

reported measures of individual competitiveness is not satisfied by the very specific context provided by the experimental environment in behavioral measures, we observe a violation of the compatibility principle, which implies a divergence of what is measured by psychological self-reported measures and economic behavioral measures.

Individuals motivated for competition by opportunities for personal development seek competition because it helps them to improve their competence, be the best that they can be, and to judge their level of competence (Newby & Klein, 2014; Ryckman et al., 1996). As indicated by meta-analyses in psychological research, the personal development motive has emerged as one of the most important motives to enter competition in general (Houston et al., 2002a; Newby & Klein, 2014). Analyzing a multitude of measures of competitiveness, Houston and colleagues (2002a) identify two major factors underlying all these scales with one of them described as personal development, where competition is considered to improve oneself instead of being an instrument to winning over others. Moreover, pooling items from eleven competitiveness scales, Newby and Klein (2014) validate the distinction between general competitiveness and, among others, personal enhancement competitiveness, which reflects personal development motives. An estimated correlation of 0.67 between general competitiveness and competitiveness motivated by personal development indicates that despite being psychometrically distinct, a substantial amount of general competitiveness is explained by personal development motives.

Personal development motives, however, are unlikely to play an important role for explaining selection into competitive environments within economic experiments. In typical economic measurements of competitive preferences, competition relates to trivia quizzes, mini games like ball tossing (Leibbrandt et al., 2013), or solving simple math tasks (Gneezy et al., 2003, Niederle & Vesterlund, 2007), often under time pressure against randomly assigned competitors (e.g. Niederle & Vesterlund, 2007). These simple tasks do not require training or specific qualifications and, thus, are hardly representative for competitive situations that offer opportunities for personal development, like competition at work, in sports, arts or academic environments.

Thus, despite aiming at measuring the same underlying construct, linking psychological and economic measures of competitiveness reflects a potential violation of the compatibility principle. Individuals, whose self-reported competitiveness is

substantially driven by a personal development motive, will be less attracted by competitive environments in economic experiments than individuals, whose self-reported competitiveness is driven by other motives. Thus, the compatibility principle suggests that personal development motives contributing to individuals' competitiveness reduce the strength of the relationship between psychometric and experimental measures of competitiveness. Distinguishing between competitiveness motivated by personal development and competitiveness not related to such motives, we thus hypothesize that the former relates less strongly than the latter to economists' behavioral measures of competitiveness.

Hypothesis 2a: *The behavioral measure of competitiveness is less strongly related to self-reported competitiveness motivated by personal development than to self-reported competitiveness not motivated by personal development motives.*

By construction, general measures of competitiveness that do not discriminate between motives why individuals enter competitive environments comprise all motives for individual competitiveness. If, however, different motives lead to different relationships, then these measures are likely to display relationships that reflect the average of those relationships associated with the more specific ones. Therefore, we expect that the general self-reported measure of competitiveness correlates with the experimental measure less than competitiveness not motivated by personal development but more so than competitiveness motivated by personal development.

Hypothesis 2b: *The relationship between the behavioral measure of competitiveness and the overall self-reported measure is larger than its relationship with the self-reported competitiveness motivated by personal development.*

Hypothesis 2c: *The relationship between the behavioral measure of competitiveness and the overall self-reported measures is smaller than its relationship with the self-reported competitiveness not motivated by personal development.*

We also hypothesize that this asymmetry extends to correlations with the Big Five personality dimensions, such that measures of competitiveness not motivated by personal development show correlations similar to behavioral measures but different from measures of competitiveness motivated by personal development.

2.2.3 Motives and contexts II: competing and winning

While the original analysis stopped at this point, subsequent work allows us to further analyze competitiveness not motivated by personal development. Recent psychological research examines three motives of individual competitiveness: (a) personal development; (b) hypercompetitiveness; and (c) enjoyment of competition (cf. Houston et al., 2012), where the concept of hypercompetitiveness refers to an individual's indiscriminate need to compete, win, and to avoid losing at any cost (Horney, 1937; Ryckman et al., 1990). This suggests that competitiveness not motivated by personal development can be either motivated by enjoyment of competition or motivated by a desire to win.

Individuals, who enjoy competing against others, gain non-monetary benefits related to the institution of competition itself, independent of the outcome of a competition. An environment allows satisfaction of the enjoyment of competition motive to the extent to which it is seen as competitive; i.e. individuals, who enjoy competing, are likely to gain more such enjoyment from more competitive environments[1]. Typical economic measurements of competitive preferences apply winner-take-all tournaments, which are considered as extremely competitive environments (Lazear, 1999). Hence, we argue that enjoyment of competition is likely to play an essential role for explaining selection into competitive environments within economic experiments. As argued in Section 2.2.2 personal development motives are less likely to play an important role for explaining self-selection into competitive environments within economic experiments, because typical experimental tasks are hardly representative for competitive situations that offer opportunities for personal development. Therefore, we expect that individuals, whose self-reported competitiveness is substantially driven by enjoyment of competition, are more attracted

[1] This will be discussed in more detail in Chapter V.

by competitive environments in economic experiments than individuals, whose self-reported competitiveness is driven by personal development motives.

Hypothesis 3a: *The behavioral measure of competitiveness is less strongly related to self-reported competitiveness motivated by personal development than to self-reported competitiveness motivated by enjoyment of competition.*

As discussed above, if different motives lead to different relationships, then self-reported general measures of individual competitiveness tend to reflect an average of the different motives for entering competitions. Therefore, we expect that the general self-reported measure of competitiveness correlates with the experimental measure less than competitiveness motivated by enjoyment of competition.

Hypothesis 3b: *The relationship between the behavioral measure of competitiveness and the overall self-reported measures is smaller than its relationship with self-reported competitiveness motivated by enjoyment of competition.*

In our conceptualization of competitiveness as an individual's tendency to select *into* competitive environments, we have distinguished competitiveness from individuals' preferences over distributions of rewards, and from individuals' preferences related to behavior *within* competitive environments. A desire to win can be expected to have a direct effect on behavior within competition. Within a competition individuals with a stronger desire to win might try harder, and spend more effort and resources in order to actually win the competition[2]. The expected effects of a desire to win on selection into competition are more ambiguous. On the one hand, individuals, who seek to win a competition, have to enter a competition first. On the other hand, individuals, who seek to win and avoid losing at any cost, may either not at all be willing to enter competitions with a low chance of winning, or anticipate spending excessive effort and resources, once they have entered such a competition, and prevent this by not entering it.

[2] This effect will be discussed more formally in Chapter III.

Therefore, we do not have ex-ante hypotheses for the relationship between competitiveness motivated by a desire to win and other measures of competitiveness, but tentatively explore this relationship in this study.

2.3 METHOD

2.3.1 Sample and study design

To study the relationship between psychologists' self-reported and economists' behavioral measurements of competitiveness we employ a survey among undergraduate students with a directly following classroom experiment. Our sample includes 186 students who are on average 23 years old and all achieved the education level required to access a university in Germany. Participants were enrolled in business and economics (70%) and related fields such as health economics (15%), a few were enrolled in a teacher program (9%), and 6% are majoring in other subjects. Table 2.6 summarizes descriptive statistics.

At the beginning of the survey, students were informed that participation was voluntary and that their identities are not recorded to ensure confidentiality. Participants were not informed about the specific research question. The survey contained questions regarding competitiveness, risk-taking preferences, general self-efficacy, Big Five personality, and career anchors; demographic information were gathered at the end of the questionnaire. During the survey, participants were informed that at the end of the survey 30 participants would be randomly selected to participate in an experiment involving decisions and performing a task, where they could earn up to €20.00. After describing the experiment in detail, participants were asked to fix their decisions for the experiment; these decisions were binding and could not be changed afterwards.

To reduce problems stemming from participants' potential tendency to be self-congruent with respect to their self-reported competitiveness and their plans for their behavior in the experiment, self-reported competitiveness scales were administered *before* participants knew the content of the incentivized experiment. Because the experiment is associated with real pay-offs, we believe that behavior in the experiment is less likely to be affected by earlier self-reported competitiveness than vice versa.

For the experiment, we adopt a design that is frequently used to measure individual competitiveness (e.g. Niederle & Vesterlund, 2007; Shurchkov, 2012; see Table 2.1), wherein participants perform a real task and have a choice between a non-competitive piece-rate compensation and a competitive winner-take-all tournament compensation for their task performance. In the task participants were to answer up to 20 trivia questions within 5 minutes (question taken from Eberlein, Ludwig, & Nafziger, 2011). For each question participants had to choose the one correct answer out of four given options. Questions were presented on a quiz sheet and could be answered in any order. No feedback was provided during the quiz. The experiment took about 20 minutes including the payment. During the survey, participants got four example questions, which they could solve (without any incentives) to familiarize with the task.

Then, participants had to choose the payment for their task performance. With piece-rate payment, participants got their payoffs according only to their own performance and received €0.50 for every correctly answered question in the quiz. With the tournament payment, each participant's score was compared to the score of a randomly matched competitor. If participants had more correct answers than their respective competitor they received €1.00 per correct answer; otherwise they received €0.00. Ties were broken randomly. After the survey questionnaires were collected, the randomly selected participants performed the task, and participants were paid accordingly[3].

To further validate the hypothesized relations among different competitiveness measures we attempt to embed the competitiveness measures into their nomological network and test their differential relationships to broad personality dimensions as well as to career orientation. We follow psychological research, which has employed the Big Five model to relate competitiveness to broad-bandwidth personality inventory (Fletcher & Nusbaum, 2008; Müller & Schwieren, 2012; Ross, Rausch, & Canada, 2003; Ryckman, Thornton, Gold, & Collier, 2011). Specifically, Ross et al. (2003) reported that different measures of competitiveness differently relate to the five-factor model of personality. Furthermore, since both behavioral and psychometric measures of competitiveness have been related to choosing more competitive careers (e.g., Bönte &

[3] The random selection of participants was performed via code numbers. The experimenters could verify the code, only if the selected participants showed-up for the task. From the 30 randomly selected participants, 23 showed up and actually performed the task.

Piegeler, 2013; Buser et al., 2014; Houston et al., 2015), we assess the practical relevance of potential differences between behavioral and psychometric measures by investigating their respective relations to a measure of a competitive career orientation.

2.3.2 Measures of competitiveness

The *behavioral measure of competitiveness* (BC) is reflected by participants' choices of the competitive payment scheme; a dummy variable is generated, that takes the value zero for participants choosing the non-competitive piece-rate payment and the value one for participants choosing the competitive tournament payment. Out of our sample, 56 participants (30%) chose the competitive payment in our experiment, while 130 preferred the piece-rate payment (70%).

General self-reported competitiveness (SC) is operationalized through a short-scale that seeks to straightforwardly cover our definition of competitiveness. We select four items from different sources that we consider most suitable to distinguish between more and less competitive individuals, and which do not explicitly include reasons why individuals prefer competitive environments. We include the highest-loading item from Newby's and Klein's (2014) 'general competitiveness' subscale ("*I enjoy competing against others*."), the highest-loading reverse-coded item from Smither's and Houston's (1992) subscale related to general affective responses to competition ("*I find competitive situations unpleasant.*"), an adaptation of an item from Helmreich's and Spence's (1978) WOFO competitiveness subscale as employed within a large European survey ("*I like situations in which I compete with others.*", Bönte & Piegeler, 2013), and a newly created item that at a general level focuses on settings where one's goal could also be pursued outside a competitive environment ("*I prefer competing with others when pursuing a goal over pursuing the goal alone.")*[4]. Participants responded to each item on a scale from "does not apply at all" (1) to "fully applies" (7). The average score of responses to these items reflects our self-reported measure of competitiveness (α=0.78).

[4] Note that our items focus on self-reports and avoid normative statements (e.g., "Outside the world of sports, people should compete as little as possible", Kleinjans, 2009, p. 705), which may but do not need to relate to one's own behavior.

Table 2.3: Three dimensions of self-reported competitiveness

Dimension	Items
General self-reported Competitiveness (SC)	*I find competitive situations unpleasant.*
	I enjoy competing against others
	I like situations in which I compete with others
	I prefer competing with others when pursuing a goal over pursuing the goal alone
Personal development motive (PD)	*I can improve my competence by competing*
	Competition allows me to judge my level of competence
	I use competition as a way to prove something to myself
	Competition allows me to measure my own success
Desire to win (DW)	*It annoys me when other people perform better than I do*
	I try to be the best person in the room at almost anything
	It is important to me to perform better than others on a task
	I like to be better than others at almost everything

We measure individuals' personal development motives (PD) with the 4-item personal enhancement subscale from Newby's and Klein's (2014) Competitiveness Orientation Measure, e.g. "*I can improve my competence by competing.*" Participants responded on a scale from "does not apply at all" (1) to "fully applies" (7). Confirmatory factor analyses demonstrate that PD is distinct from SC; the two-factorial model ($\chi^2(19)=47.68$, CFI=0.955, SRMR=0.047, AIC=4884.25, BIC=4964.90) fits better than the unidimensional model ($\chi^2(20)=90.52$, CFI=0.889, SRMR=0.060, AIC=4925.10, BIC=5002.52). The average response to these four items scaled with a constant factor β_1, which is explained below, forms our score for *competitiveness motivated by personal development* (SC_{PD}, α=0.83).

The *desire to win* is measured by two items from the Newby's & Klein's (2014) dominant competitiveness subscale ("*I try to be the best person in the room at almost anything.*" and "*I like to be better than others at almost everything.*") and two related items from the competitiveness subscale of Helmreich's & Spence's (1978) WOFO scale ("*It annoys me when other people perform better than I do.*" and "*It is important to me to perform better than others on a task*"). Participants responded to each item on a 7-point scale from "does not apply at all" (1) to "fully applies" (7). The average response to these four items scaled with a constant factor β_2, which is explained below, forms our score for *competitiveness motivated by a desire to win* (SC_{DW}, α=0.84).

Confirmatory factor analyses demonstrate that these four items form a factor that is distinct from both our 4-item measurement of general competitiveness and the 4-item personal development scale. The fit of the three-factorial model ($\chi^2(51)=98.17$, CFI=0.947, SRMR=0.055, AIC=6167.22, BIC=6285.91) is much better than both two-factorial models assuming that the desire to win is either the same factor as SC ($\chi^2(53)=$ 252.69, CFI=0.775, SRMR=0.097, AIC=6317.73, BIC=6430.34) or the same factor as SC_{PD} ($\chi^2(53)=$ 209.83, CFI=0.823, SRMR=0.089, AIC=6274.88, BIC=6387.49).

2.3.3 Personality: The Big Five

To measure personality we employ the German translation (Gerlitz & Schupp, 2005) of the 25-item Big Five Inventory (BFI; John, Donahue, & Kentle, 1991) with five items for each dimension. Participants responded to each item on a scale from "does not apply at all" (1) to "fully applies" (7). Average responses to the respective five items form scores for Openness to experience (α=0.76), Conscientiousness (α=0.76), Extraversion (α=0.89), Agreeableness (α=0.68), and Neuroticism (α=0.66)[5].

2.3.4 Career Orientation

We measure participants' intent to work in competitive management positions by the five-item subscale *general management career anchor* (GM) from the German translation (Schein, 2005) of Schein's Career Anchors Orientation Inventory (Schein, 1990). Due to its frequent application in industrial trainings (e.g., Kniveton, 2004) and its consideration in research on vocational behavior (e.g. Rodrigues, Guest, & Budjanovcanin, 2013), we believe this scale to be appropriate for the exploratory part of our study. A career orientation is a meaningful measure within our sample, because despite being in a very early stage of their professional career, students have typically developed a general idea about their career goals (Scherer, Adams, Carley, & Wiebe, 1989). Participants rated the importance of management-related job aspects on a scale

[5] The relatively low Cronbach's alphas found in our sample match with those found in the study developing and validating the German items (see Gerlitz & Schupp, 2005, p.12) and are comparable with observations for other short versions of the Big Five (e.g., Rammstedt & John, 2005). These low values can be explained by the fact that a few items per personality dimension are aimed to cover a broad range of facets within each dimension (Gerlitz & Schupp, 2005).

from “completely unimportant” (1) to “extremely important” (9). The average response forms the score for the orientation towards a general management career (α=0.76).

2.3.5 Control variables

Because competitiveness is defined independent of risk preferences and expectations of winning (Niederle & Vesterlund, 2007) and task stereotypes may differently influence the willingness to enter competition of women and men (Shurchkov, 2012), we include related variables as statistical controls. As personality and career anchors are rather context-independent, we also control for general risk preferences and performance expectations. For completeness and consistency, all our analyses include the same set of control variables reported in Table 2.6.

We adapt an experimentally validated measure of *risk preferences* from the German Socio-Economic Panel (Dohmen et al., 2011). On a scale from “unwilling to take risks” (1) to “very prone to take risks” (7), respondents indicate their willingness to take risk related to four domains relevant in our study: games, and financial investments (both because of the experiment’s nature), professional career (because of addressing participants’ intentions to take management jobs), and general (to cover additional aspects not reflected by the domain-specific measures).

To measure *confidence*, we ask participants to forecast their own score (number of correctly answered questions) and the average score of all other participants. Respondents also estimate the percentage of other respondents who correctly answered more questions than they themselves do. Due to the potentially complex interplay between judgments of individual and others’ performances, e.g. anchoring effects, we included all three measures of expectations as separate controls. To capture more general aspects of confidence we included general self-efficacy (GSE) measured by Chen, Gully, and Eden’s (2001) New General Self-Efficacy scale. Participants rate each item on a scale from “does not apply at all” (1) to “fully applies” (7); responses to all items were averaged (α=0.86).

We included a dummy variable indicating respondents’ *gender* (female) and a variable indicating their age.

2.3.6 Response Style markers

When multiple constructs are measured with the same method an observed correlation between these constructs can be inflated by a common method variance (Lindell & Whitney, 2001), which has been particularly highlighted for behavioral self-reports (Feldman & Lynch, 1988; Podsakoff & Organ, 1986). While common method variance may stem from a variety of sources (Podsakoff et al., 2003), response styles have been emphasized as a particularly problematic source in questionnaires using Likert-type rating scales (Weijters, Cabooter, & Schillewaert, 2010). For a subsample of our respondents we can control for related biases and, thereby, test the robustness of our findings.

At the end of our survey 30 randomly selected participants were to perform the experimental task. During that time the other participants were provided an additional survey including marker questions measured in the same way as the self-reported competitiveness measures but not related to the content of our survey, which could be used to identify participants' response styles (Weijters et al., 2010). For this subsample of participants we perform additional robustness checks including these variables as additional controls. Table 2.4 reports all marker questions.

2.3.7 Measurement of Response Styles

To measure response styles, we follow recommendations by Weijters, Schillewaert, and Geuens (2008) for studies in which response styles are of secondary interest. We use responses to 15 items about economic policy shown in Table 2.4, which do not relate to variables of interest in our study, to generate indicators for acquiescent response style (ARS), disacquiescent response style (DRS), extreme response style (ERS) and midpoint response style (MRS).

Table 2.4: Questions for response style markers

Original Item	English Item Text	Response Style Marker
Bisher habe ich mein VWL-Wissen noch nicht mit der Realität in Verbindung bringen können.	So far I have not been able to relate my knowledge of economics to reality.	1
Der Staat sollte die Marktmacht großer Unternehmen, wie Amazon, Google oder Facebook, beschränken.	The state should restrict market power of large companies, such as Amazon, Google or Facebook.	1
Für den Klimaschutz muss die Wind- und Solarenergie finanziell gefördert werden.	For the purpose of climate protection wind energy and solar energy have to be financially subsidized.	1
Jede CO2 Einsparung ist gut.	Every CO2 saving is good.	1
Steuern auf die Emission von Schadstoffen bieten einen besseren Anreiz für die Beschränkung von Emissionen als die Festlegung von Schadstoffobergrenzen.	Taxes on the emission of pollutants offer better incentives to reduce emission than the regulation of maximum pollution levels.	1
Wir müssen überall CO2-Emissionen verringern.	We need to reduce CO2 emission everywhere.	2
Ökonomische Modelle sollten ein möglichst exaktes Abbild der Realität liefern.	Economic models should display reality as exactly as possible.	2
Hohe Staatsschulden haben negative Effekte auf das gesamtwirtschaftliche Wachstum.	High public debt has negative effects on economic growth.	2
Der Staat sollte die F&E Aktivitäten privater Unternehmen subventionieren.	The state should subsidize R&D activities of private firms.	2
Inflation ist generell schlecht für die Wirtschaft.	Inflation is generally bad for the economy.	2
Mir ist bislang unklar, was volkswirtschaftliche Forschung eigentlich ist.	So far I do not clearly understand what economic research actually is.	3
Es ist gut, dass der Taxidienst „Uber“ den Markt aufmischt.	It is good that the taxi service “Uber” roughs up the market.	3
Unternehmen investieren aus gesamtwirtschaftlicher Sicht zu wenig in Forschung und Entwicklung.	From an economic perspective firms do not invest enough in R&D.	3
Wir müssen dort CO2-Emissionen verringern, wo viel emittiert wird.	We should reduce CO2 emission there, where most is emitted.	3
Alle Länder der EURO-Zone sollten ihre Staatsverschuldung senken.	All countries of the EURO-zone should reduce public debt.	3

Notes**:** *Items used to calculate response style markers.*

Participants responded to these items on a 7-point Likert scale. We randomly split the 15 items into three sets of 5 items as reported in Table 2.4, each of which we use to calculate an indicator for each response style using the prescriptions by Baumgartner and Steenkamp (2001). Table 2.5 reports summary statistics of the calculated markers for each item group.

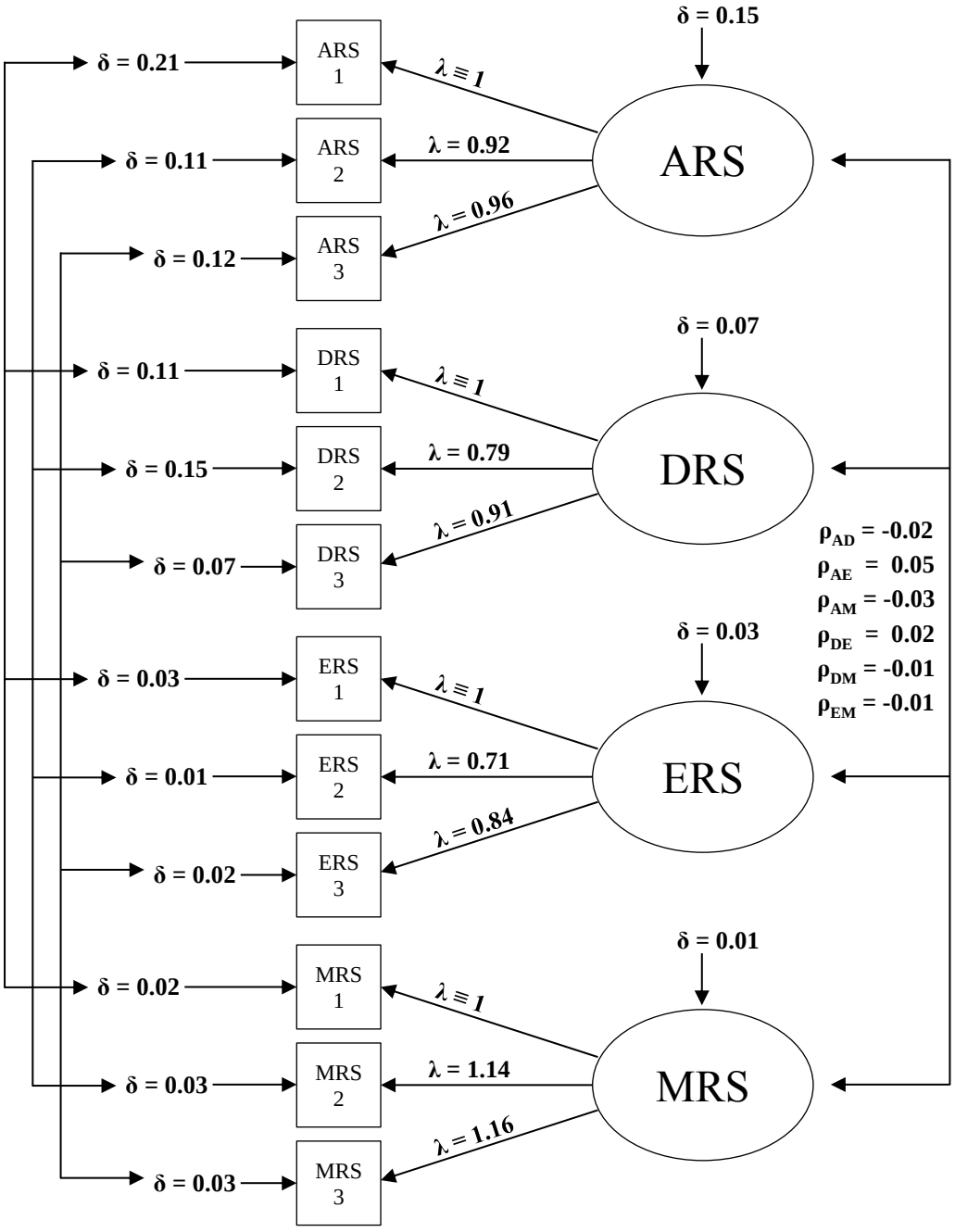
Table 2.5: Summary statistics of response style markers

			correlation										
	mean	**s.d.**	**ARS1**	**ARS2**	**ARS3**	**DRS1**	**DRS2**	**DRS3**	**ERS1**	**ERS2**	**ERS3**	**MRS1**	**MRS2**
ARS 1	1.03	0.60	1.00										
ARS 2	0.74	0.49	0.50	1.00									
ARS 3	0.93	0.52	0.50	0.54	1.00								
DRS 1	0.42	0.43	-0.46	-0.14	-0.03	1.00							
DRS 2	0.48	0.46	-0.21	-0.39	-0.05	0.44	1.00						
DRS 3	0.47	0.35	-0.16	-0.03	-0.24	0.40	0.34	1.00					
ERS 1	0.17	0.24	0.58	0.40	0.38	0.26	0.10	0.16	1.00				
ERS 2	0.13	0.16	0.30	0.53	0.32	0.22	0.28	0.26	0.58	1.00			
ERS 3	0.17	0.20	0.38	0.48	0.62	0.20	0.07	0.26	0.57	0.55	1.00		
MRS 1	0.17	0.17	-0.45	-0.23	-0.36	-0.18	-0.07	-0.04	-0.25	-0.19	-0.26	1.00	
MRS 2	0.28	0.22	-0.08	-0.38	-0.31	-0.23	-0.47	-0.23	-0.20	-0.29	-0.28	0.24	1.00
MRS 3	0.23	0.21	-0.15	-0.30	-0.55	-0.17	-0.15	-0.37	-0.17	-0.20	-0.29	0.33	0.42

Notes: *N=163*

We conduct confirmatory factor analysis to identify the latent response style factors ARS, DRS, ERS, and MRS using the "RIRSMACS model for cross-mode style comparison" of Weijters et al. (2008, p. 415). Results of the four-factor model are reported in Figure 2.1. The model shows sufficient fit ($\chi^2(30) = 37.83$, CFI = 0.994, SRMR = 0.051, AIC = -433.11, BIC = -247.48). Predicted scores for these four latent variables (ARS, DRS, ERS, and MRS) are included as controls in a robustness check.

Figure 2.1: Results of the RIRSMACS model



Notes: *N=163. Figure reports results of maximum likelihood estimation of four factor model. For observed items and latent factors δ indicates error variance, ρ indicates covariance, and λ indicates factor loading.*

Table 2.6: Summary statistics

Variable	Obs.	mean	s.d.	sk.	kurt.	Quantiles										
						min	p1	p5	p10	p25	p50	p75	p90	p95	p99	max
Behavioral competitiveness (BC)	186	0.30	0.46	0.87	1.75	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Self-reported competitiveness (SC)	186	4.21	1.18	-0.19	3.02	1.00	1.00	2.00	2.75	3.50	4.25	4.75	5.75	6.00	7.00	7.00
SC: Personal development (SC_{PD})	186	4.46	1.25	-0.42	3.03	1.00	1.00	2.25	2.75	3.75	4.50	5.25	6.00	6.50	7.00	7.00
SC: Not personal development (SC_{noPD})	186	1.55	0.91	-0.59	3.79	-1.68	-0.93	-0.23	0.57	1.07	1.61	2.11	2.62	2.92	3.51	3.76
SC: Desire to win (SC_{DW})	186	3.66	1.30	0.00	2.34	1.00	1.00	1.50	2.00	2.75	3.75	4.75	5.25	5.50	6.75	6.75
SC: Enjoyment of competition(SC_{EC})	186	1.52	0.91	-0.59	3.80	-1.69	-0.97	-0.30	0.55	0.99	1.59	2.09	2.63	2.88	3.44	3.75
Openness to experience	186	4.73	1.01	0.06	2.50	2.40	2.60	3.00	3.40	4.00	4.60	5.40	6.20	6.40	7.00	7.00
Conscientiousness	186	5.12	0.97	-0.24	2.48	2.40	2.80	3.40	3.80	4.40	5.20	5.80	6.40	6.60	7.00	7.00
Extraversion	186	4.59	1.26	-0.28	2.36	1.20	1.80	2.40	2.80	3.60	4.60	5.40	6.40	6.40	6.80	7.00
Agreeableness	186	5.47	0.88	-0.76	3.53	2.40	2.60	3.80	4.40	5.00	5.60	6.00	6.60	6.60	7.00	7.00
Neuroticism	186	4.10	0.95	0.17	2.58	2.20	2.20	2.60	2.80	3.40	4.20	4.80	5.40	5.60	6.60	7.00
General management	186	5.10	1.37	0.16	2.89	2.00	2.00	2.80	3.60	4.00	5.00	6.00	6.80	7.40	8.60	9.00
Control variables																
Risk: General	186	4.81	1.35	-0.19	2.39	1.00	2.00	3.00	3.00	4.00	5.00	6.00	7.00	7.00	7.00	7.00
Risk: money	186	2.99	1.50	0.46	2.50	1.00	1.00	1.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	7.00
Risk: job	186	4.01	1.34	-0.21	2.64	1.00	1.00	2.00	2.00	3.00	4.00	5.00	6.00	6.00	7.00	7.00
Risk: games	186	5.44	1.68	-1.19	3.52	1.00	1.00	2.00	3.00	5.00	6.00	7.00	7.00	7.00	7.00	7.00
Confidence: Own expected score	186	10.45	3.45	-0.16	3.25	0.00	1.00	5.00	5.00	8.00	10.00	13.00	15.00	15.00	20.00	20.00
Confidence: Average expected score	186	10.74	2.71	-0.32	4.80	0.00	1.00	6.00	8.00	10.00	10.00	12.00	15.00	15.00	17.00	19.00
Confidence: Probability to win	186	59.12	18.25	-0.33	2.76	0.00	10.00	30.00	40.00	50.00	60.00	70.00	80.00	85.00	95.00	98.00
Confidence: GSE	186	5.37	0.75	-0.30	3.46	3.00	3.00	4.13	4.50	4.88	5.38	5.88	6.38	6.75	6.88	7.00
Age	186	22.97	3.39	1.65	7.08	18.00	19.00	19.00	20.00	20.00	22.00	25.00	27.00	29.00	37.00	39.00
Female	186	0.62	0.49	-0.49	1.24	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Acquiescence response style (ARS)	163	0.00	0.35	0.58	3.08	-0.69	-0.61	-0.48	-0.41	-0.28	-0.04	0.24	0.44	0.62	1.05	1.13
Disacquiescence response style (DRS)	163	0.00	0.22	1.27	4.92	-0.38	-0.30	-0.25	-0.22	-0.17	-0.05	0.08	0.33	0.41	0.77	0.85
Midpoint response style (MRS)	163	0.00	0.08	0.61	3.89	-0.17	-0.16	-0.12	-0.10	-0.06	0.00	0.04	0.11	0.14	0.24	0.32
Extreme response style (ERS)	163	0.00	0.16	0.88	2.80	-0.19	-0.18	-0.16	-0.15	-0.14	-0.06	0.12	0.23	0.30	0.39	0.49

Table 2.7: Correlations of competitiveness variables

Variable	Obs.	BC	SC	SC_{PD}	SC_{noPD}	SC_{DW}	SC_{EC}
Behavioral competitiveness (BC)	186	1					
Self-reported competitiveness (SC)	186	.32***	(.78)				
SC: Personal development (SC_{PD})	186	.10	.63***	(.83)			
SC: Not personal development (SC_{noPD})	186	.33***	.77***	0	1		
SC: Desire to win (SC_{DW})	186	.07	.36***	.54***	.03	(.84)	
SC: Enjoyment of competition(SC_{EC})	186	.33***	.77***	0	.99***	0	1
Openness to experience	186	.23**	.13	.05	.13	.08	.13
Conscientiousness	186	-.10	.04	-.01	.06	.03	.05
Extraversion	186	.22**	.24**	-.04	.34***	-.13	.34***
Agreeableness	186	-.09	-.14	-.27***	.03	-.36***	.04
Neuroticism	186	-.28***	-.18*	.09	-.31***	.19**	-.32***
General Management	186	.17*	.27***	.28***	.11	.40***	.10
Control variables							
Risk: General	186	.24**	.19*	.18*	.10	.06	.10
Risk: money	186	.33***	.23**	.14	.18*	.11	.18*
Risk: job	186	.27***	.23**	.16*	.16*	.11	.16*
Risk: games	186	.17*	.20**	.26***	.05	.11	.05
Confidence: Own expected score	186	.37***	.21**	.16*	.14	.06	.14
Confidence: Average expected score	186	-.03	.00	.05	-.04	-.09	-.03
Confidence: Probability to win	186	.26***	.13	.01	.16*	.02	.16*
Confidence: GSE	186	.22**	.30***	.18*	.23**	.11	.23**
Age	186	.08	-.05	-.15*	.05	-.15*	.06
Female	186	-.45***	-.27***	-.09	-.28***	-.19*	-.27***
Acquiescence response style (ARS)	163	-.00	.00	.10	-.08	.14	-.08
Disacquiescence response style (DRS)	163	.09	.07	.16*	-.05	.01	-.04
Midpoint response style (MRS)	163	-.02	-.04	-.20**	.12	-.16*	.12
Extreme response style (ERS)	163	.08	.00	.11	-.09	.07	-.09

Notes: *Significance levels: *** p<0.001, ** p<0.01, * p<0.05.*

Table 2.8: Correlations of other variables

	Variable	Obs.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Openness to Experience	186	(.76)																			
2	Conscientiousness	186	.09	(.76)																		
3	Extraversion	186	.20**	.15*	(.89)																	
4	Agreeableness	186	.10	.26***	.11	(.68)																
5	Neuroticism	186	.05	-.01	-.20**	-.03	(.66)															
6	General Management	186	.06	.13	.07	-.15*	.01	(.76)														
	Control variables																					
7	Risk: General	186	-.05	.22**	-.11	-.17*	.21**	-.05	1													
8	Risk: money	186	-.24**	.17*	-.19*	-.13	.23**	-.24**	.41***	1												
9	Risk: job	186	-.07	.04	-.20**	-.13	.32***	-.07	.43***	.41***	1											
10	Risk: games	186	-.23**	.12	-.21**	.08	.02	-.23**	.14	.26***	.05	1										
11	Conf.: Own exp. Score	186	.03	.11	-.16*	-.16*	.15*	.03	.25***	.29***	.12	.18*	1									
12	Conf.: Av. exp. Score	186	.21**	.13	.05	.02	.11	.21**	.07	-.09	-.10	.04	.34***	1								
13	Conf.: Prob. to win	186	.06	.14	-.10	-.09	.02	.06	.21**	.16*	.17*	.08	.43***	-.12	1							
14	Conf.: GSE	186	.37***	.26***	.10	-.21**	.35***	.37***	.40***	.23**	.21**	.03	.23**	.04	.24***	(.86)						
15	Age	186	.36***	.07	.04	.16*	-.00	-.09	.07	.14	.16*	-.03	.04	.08	.14	.10	1					
16	Female	186	-.12	.27***	-.04	.25***	.28***	-.10	-.26***	-.35***	-.26***	-.09	-.32***	.22**	-.34***	-.10	-.02	1				
17	ARS	163	.05	.08	.05	.04	.20**	.01	.13	.08	-.01	.02	.17*	.00	.05	.12	-.11	.03	(.75)			
18	DRS	163	.05	.10	.15	-.10	.06	-.04	.18*	.06	.05	.12	.21**	.23**	.07	.15	.11	-.17*	-.12	(.65)		
19	MRS	163	-.09	-.09	-.05	.08	-.18*	.01	-.18*	-.09	-.08	-.09	-.29***	-.11	-.16*	-.13	-.02	.11	-.72***	-.40***	(.59)	
20	ERS	163	.09	.09	.16*	.00	.21**	-.07	.22**	.12	-.06	.05	.19*	.11	.04	.17*	-.05	-.08	.75***	.44***	-.66***	(.78)

Notes: *Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

2.4 RESULTS

2.4.1 Personal development motives vs. other motives of competitiveness

We measure *competitiveness not motivated by personal development* (SC_{noPD}) through residualizing SC_{PD} from SC[6]. We regress PD on SC using a simple ordinary least squares estimation:

$$SC_i = \beta_1 \cdot PD_i + \alpha + \varepsilon_i \quad (2.4.1)$$

with β_1 as the estimated coefficient for PD, α being the constant, and ε_i the error term. Variation in *competitiveness not motivated by personal development* is given by $SC_{noPD} = \alpha + \varepsilon_i$. Scaling PD with β_1, such that $SC_{PD} = \beta_1 \cdot PD_i$, ensures that SC equals the sum of the perfectly uncorrelated components SC_{PD} and SC_{noPD}, which permits a meaningful interpretation and comparison of both coefficients. Table 2.9 reports results of the residualization.

Table 2.9: Residualization of self-reported competitiveness I

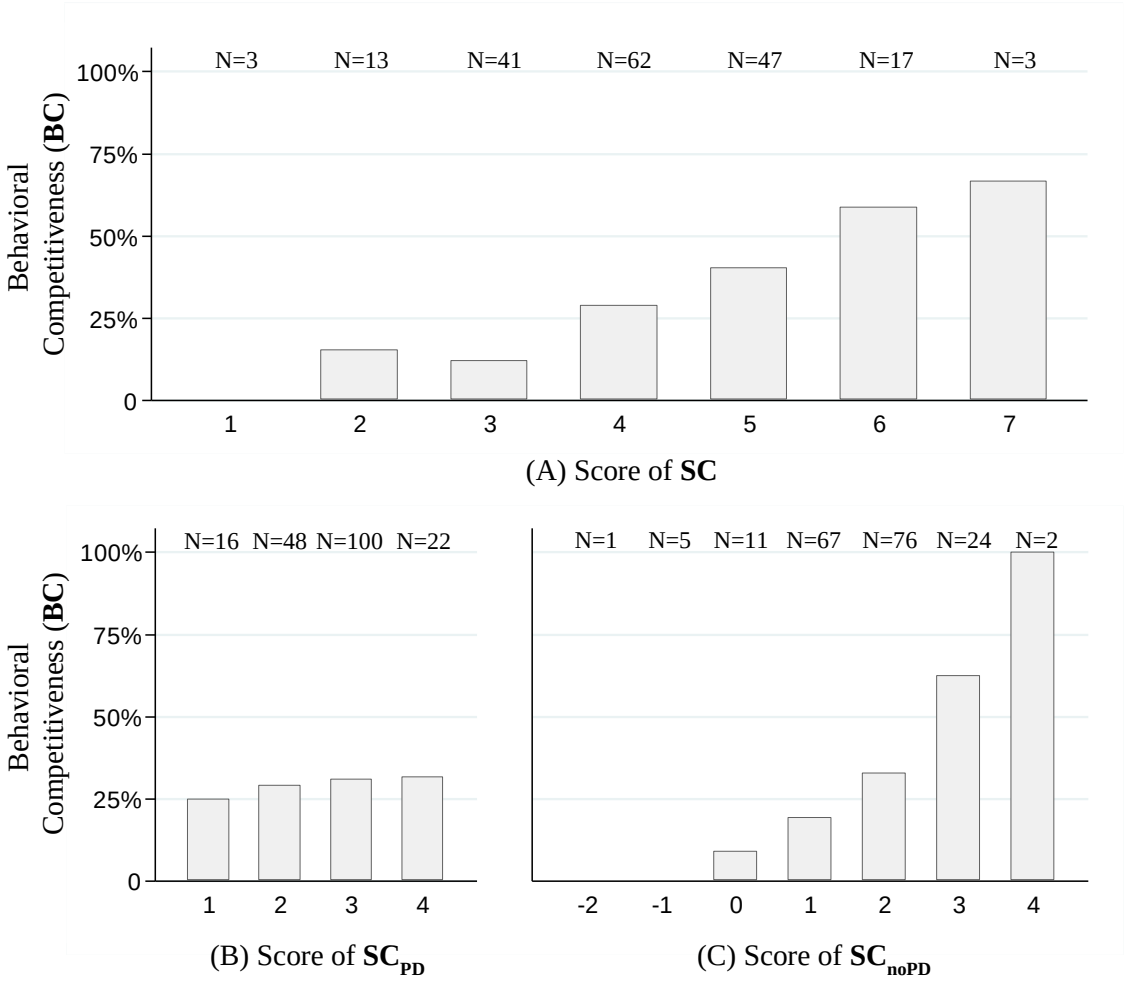
Dep-Var.: Self-reported Competitiveness (SC)		**Coef.**	**(s.e.)**
Personal development Motive (PD)	β_1 =	0.5964	(0.0536)***
Constant	α =	1.5498	(0.2483)***
R^2		0.4022	

Notes: *N=186. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

Figure 2.2 reports shares of participants choosing the competitive payment in the experiment, i.e. the behavioral competitiveness (BC), sorted by scores of self-reported competitiveness; as expected, this share is higher among individuals with higher self-reported competitiveness scores (SC). In contrast, there is almost no increase in shares of participants choosing the competitive payment with higher SC_{PD}. As expected, however, the share of participants choosing the competitive payment continuously increases with SC_{noPD}.

[6] Including both SC and its antecedent PD as explanatory variables would create a bad control problem (Angrist & Pischke, 2008), which complicates a meaningful interpretation of estimated coefficients. To avoid this, we partition variation in SC into uncorrelated parts, SC_{PD} driven by variations in personal enhancement motives and SC_{noPD} not driven by them.

Figure 2.2: Behavioral and self-reported competitiveness

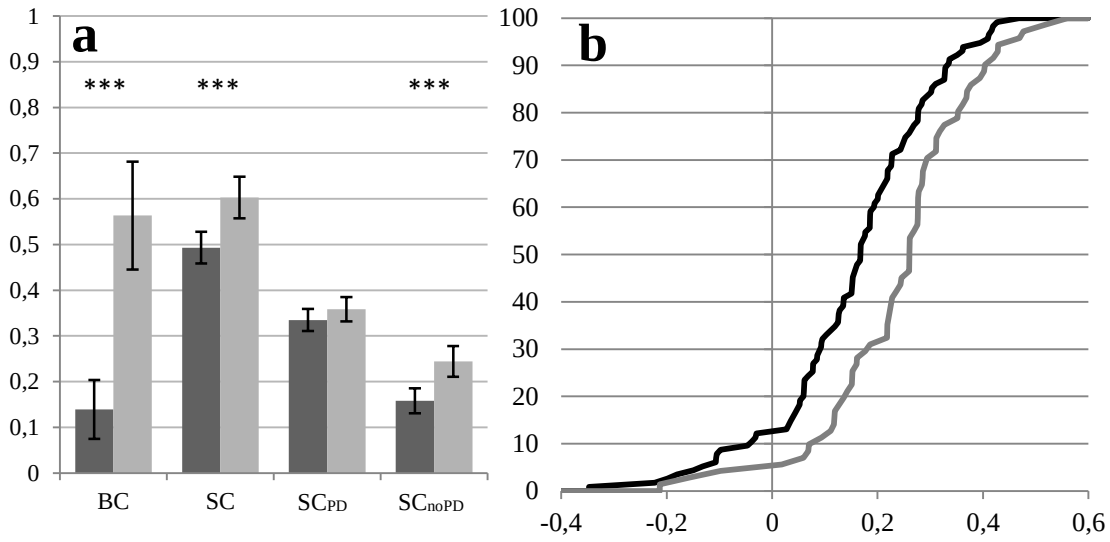


Notes: *Relative frequency of participants selecting tournament in the experiment (BC) conditional on scores of (A) self-reported competitiveness (SC), (B) self-reported competitiveness due to personal development motives (SC_{PD}), and (C) self-reported competitiveness due to other motives (SC_{noPD}). Scores categorized in classes (n-0.5, n+0.5]. Number of Observations within each category provided within or above bars.*

To get a first impression of the relationship between the competitiveness experiment and the self-reported measures, we look at the plain binary correlations reported in Table 2.7. Consistent with Hypothesis 1, the behavioral measure of competitiveness displays a positive correlation with self-reported competitiveness (SC = 0.32, p<0.001). The behavioral measure, however, is not and, thus, less correlated with competitiveness that is due to personal development motives (SC_{PD} = 0.10, p=0.170), which is consistent with Hypothesis 2b. In contrast and consistent with Hypothesis 2a, the behavioral measure is more strongly correlated with competitiveness that is not due to personal development motives (SC_{noPD} = 0.33, p<0.001). Because the

correlations of the behavioral measure with both SC and SC_{noPD} are almost identical, this first inspection of our data does not seem to support our Hypothesis 2c.

Figure 2.3: Replicating gender differences in competitiveness



Notes: *N=186. Figure 2.3a (left) shows averages of competitiveness measures for females (dark grey) and males (light grey). Self-reported competitiveness (SC) is scaled to the interval [0, 1]. Figure 2.3b (right) shows cumulative distribution of SC_{noPD} for females (dark grey) and males (light grey). Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

Moreover, we replicate the finding of previous studies that men are more likely than women to choose competitive pay (Croson & Gneezy, 2009). Both experimental and self-reported measures of competitiveness display substantial negative correlations with being female. While 56 percent of the male students chose competitive pay, only 14 percent of the female students chose competitive payment (Two-sample test of proportions: diff=0.56-0.14=0.42>0, z=6.13, p<0.001). For self-reported competitiveness we observe a score of 4.62 for male students and of 3.96 for female students (Two-sample t test: diff=4.62-3.96=0.66>0, t=3.83, p<0.001). Regarding the components of self-reported competitiveness SC_{PD} and SC_{noPD}, we find a negative correlation of SC_{noPD} with being female, but no substantial correlation between gender and SC_{PD}. While male students show higher average scores in both measures, these gender differences are only significant for SC_{noPD} (Two-sample t test: diff=1.87-1.35=0.52>0, t=3.90, p<0.001), but insignificant for SC_{PD} (Two-sample t test: diff=2.75-2.61=0.14>0, t=1.25, p=0.213). Figure 2.3a illustrates those gender

differences. Figure 2.3b shows the cumulative distribution of SC_{noPD} by gender indicating a first-order stochastic dominance of the male distribution.

Regression analyses provide further insights by statistically controlling for confounding variables, such as risk preferences, competence perceptions, and gender effects (Niederle & Vesterlund, 2007; Shurchkov, 2012). All hypotheses involve a relationship of the behavioral measure of competitiveness (BC) with self-reported competitiveness (SC) or a component of it (SC_{PD} and SC_{noPD}). Therefore, we employ logistic regression analyses with BC as dependent variable. The baseline estimation (Model 1) includes all controls, but no measure of self-reported competitiveness. While male students and more confident individuals are more likely to self-select into competition, the estimated effects of risk preferences are statistically insignificant (individually and jointly tested). Estimating the relationship between the behavioral and self-reported measures of competitiveness (Model 2), we observe that also with control variables included, there is still a significant relationship between BC and SC, which provides support for Hypothesis 1.

To test Hypotheses 2a, 2b and 2c we employ the two variables resulting from the residualization presented in Table 2.9, that is, competitiveness motivated by personal development (SC_{PD}) and competitiveness not motivated by such motives (SC_{noPD}). In a first step we use constrained regression analysis to enforce that both components have the same effect (Model 3). Model 3 illustrates that (by design) SC equals the sum of the perfectly uncorrelated components SC_{PD} and SC_{noPD}, therefore Model 3 equals Model 2.

As a next step, we relax the constraint (Model 4). The two components of self-reported competitiveness SC_{PD} and SC_{noPD} relate differently to BC: SC_{PD} does not relate to BC, but SC_{noPD} relates to BC[7]. Within Model 4 the coefficient of SC_{noPD} is significantly larger than the coefficient of SC_{PD} ($\beta_{SCnoPD} - \beta_{SCPD}=0.829>0$, SE=0.446, p=0.0315). This finding provides empirical support for Hypothesis 2a. In support of Hypothesis 2b, we find a significant positive difference between the coefficient of SC in Model 2 and the coefficient of SC_{PD} in Model 4 ($\beta_{SC} - \beta_{SCPD}=0.503>0$, SE=0.262, p=0.027).

[7] Separately including each of the two components SC_{PD} or SC_{noPD} does not change the result.

Table 2.10: Logistic regressions

of behavioral competitiveness on self-reported competitiveness I

Model	**1**	**2**	**3**	**4**		
	Coef.	Coef.	Coef.	Coef.	Odds Ratios	Marginal Effects
Self-reported competitiveness (SC)		0.43*				
		(0.20)				
SC: Personal development (SC_{PD})			0.43*	-0.08	0.93	-0.01
			(0.20)	(0.31)	(0.29)	(0.05)
SC: Not personal development (SC_{noPD})			0.43*	0.75**	2.12**	0.13**
			(0.20)	(0.27)	(0.57)	(0.04)
Control variables						
Risk: General	-0.06	-0.03	-0.03	0.01	1.01	0.00
	(0.19)	(0.20)	(0.20)	(0.20)	(0.20)	(0.03)
Risk: Job	0.21	0.20	0.20	0.23	1.26	0.04
	(0.17)	(0.17)	(0.17)	(0.18)	(0.22)	(0.03)
Risk: Financial investments	0.10	0.11	0.11	0.11	1.11	0.02
	(0.15)	(0.16)	(0.16)	(0.16)	(0.18)	(0.03)
Risk: Games	0.18	0.10	0.10	0.18	1.19	0.03
	(0.13)	(0.13)	(0.13)	(0.14)	(0.17)	(0.02)
Confidence: General self-efficacy	0.43	0.21	0.21	0.17	1.18	0.03
	(0.31)	(0.33)	(0.33)	(0.34)	(0.40)	(0.06)
Confidence: Own expected Score	0.20*	0.20*	0.20*	0.21**	1.23**	0.03**
	(0.08)	(0.08)	(0.08)	(0.08)	(0.10)	(0.01)
Confidence: Expected average score	-0.04	-0.05	-0.05	-0.04	0.96	-0.01
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.02)
Confidence: Probability to win	-0.00	-0.00	-0.00	-0.00	1.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Age	0.03	0.06	0.06	0.04	1.05	0.01
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.01)
Female	-1.58***	-1.43**	-1.43**	-1.38**	0.25**	-0.25**
	(0.45)	(0.45)	(0.45)	(0.46)	(0.12)	(0.09)
Constant	-6.69**	-7.65***	-7.65***	-7.27**		
	(2.15)	(2.21)	(2.21)	(2.31)		
Pseudo R^2	0.274	0.294	0.294	0.314		
Log Likelihood	-82.67***	-80.33***	-80.33***	-78.09***		
(LR χ^2)	(62.24)	(66.91)	(66.91)	(71.41)		

Notes: *N=186. Model 3 is constrained to equalize coefficients of SC_{PD} and SC_{noPD}. Standard errors reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

In support of Hypothesis 2c, we also find that the coefficient of SC in Model 2 is smaller than the coefficient of SC_{noPD} in Model 4 ($\beta_{SCnoPD} - \beta_{SC}=0.326>0$, SE=0.189, p=0.0425). For a better interpretation of effect sizes we calculate odds ratios and marginal effects for Model 4. Increasing SC_{noPD} by one point on a seven-point scale doubles the odds of choosing competitive payments; the probability of such selection increases by about 13 percentage points (Table 2.10, last two columns).

Analyses of multiple self-reported rating-scale based measures might biased by common method variance (CMV), e.g. resulting from individuals varying in their response styles (Podsakoff et al., 2003; Weijters et al., 2010). We conduct a robustness check with respect to response styles using the subsample of participants, who provided this information. Table 2.11 shows results for Model 4 of the previous analysis when additionally controlling for response styles. The coefficient, odds ratios, and marginal effects of ARS, DRS, MRS, and ERS are all insignificant, which indicates no effect of response styles on behavioral competitiveness. More importantly, we still observe the same relation between competitiveness measures as in the main analysis. The model indicates a positive relation between SC_{noPD} and BC, but no significant relation between SC_{PD} and BC. A generalized Hausmann test indicates no significant changes in the coefficients of SC_{PD} and SC_{noPD} when controls for response styles are included ($\chi^2(2)=2.27$, $p=0.321$). Therefore, we consider our findings to be robust against potential biases stemming from response styles.

Table 2.11: Logistic regressions including controls for response styles

Dep. Var.: Behavioral Competitiveness	Coef.	Odds Ratios	Marginal Effects
SC: Personal development (SC_{PD})	-0.23 (0.34)	0.79 (0.27)	-0.04 (0.06)
SC: Not personal development (SC_{noPD})	0.62 (0.29)*	1.85 (0.54)*	0.11 (0.05)*
Control variables			
Risk: General	-0.06 (0.23)	0.94 (0.22)	-0.01 (0.04)
Risk: Job	0.42 (0.20)*	1.52 (0.31)*	0.08 (0.04)*
Risk: Financial investments	0.16 (0.17)	1.17 (0.20)	0.03 (0.03)
Risk: Games	0.21 (0.15)	1.23 (0.19)	0.04 (0.03)
Confidence: General self-efficacy	0.38 (0.40)	1.46 (0.58)	0.07 (0.07)
Confidence: Own expected Score	0.20 (0.09)*	1.22 (0.12)*	0.04 (0.02)*
Confidence: Expected average score	0.02 (0.10)	1.02 (0.10)	0.00 (0.02)
Confidence: Probability to win	0.01 (0.02)	1.01 (0.02)	0.00 (0.00)
Age	0.00 (0.07)	1.00 (0.07)	0.00 (0.01)
Female	-1.49 (0.54)**	0.23 (0.12)**	-0.28 (0.10)**
Acquiescent response style (ARS)	-2.50 (3.57)	0.08 (0.29)	-0.45 (0.64)
Disacquiescent response style (DRS)	-2.81 (3.92)	0.06 (0.24)	-0.50 (0.70)
Midpoint response style (MRS)	1.57 (8.46)	4.82 (40.77)	0.28 (1.52)
Extreme response style (ERS)	6.24 (6.10)	513.13 (3,129.83)	1.12 (1.09)
Constant	-8.47 (2.67)**		
Pseudo R^2	0.356		
Log Likelihood (χ^2)	-66.25 (73.11)***		

Notes: *N=163. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

The previous analysis suggests that competitiveness motivated by personal development (SC_{PD}) and competitiveness not motivated by personal development (SC_{noPD}) differently relate to the behavioral measure of competitiveness (BC). The divergence between SC_{noPD} and SC_{PD} extends to their respective relationships with personality. Table 2.12 reports partial correlations of competitiveness measures with the Big Five personality dimensions when controlling for risk-preferences, confidence, gender, and age. In contrast to suggestions relating conscientiousness to competitiveness (e.g., Caliendo, Fossen, Kritikos, & Wetter, 2015), conscientiousness and openness to experience, do not relate to any type of competitiveness.

Table 2.12: Partial correlations of competitiveness with personality and managerial career anchor I

	Behavioral competitiveness	**Self-reported competitiveness**		
	BC	SC_{noPD}	SC_{PD}	$SC=SC_{noPD}+SC_{PD}$
Openness to experience	.10	.05	.02	.06
Conscientiousness	-.03	.06	.02	.07
Extraversion	.17*	.32***	-.12	.18*
Agreeableness	.07	.11	-.20**	-.04
Neuroticism	-.16*	-.23**	.17*	-.08
General Management	.03	-.00	.18*	.12

Notes: *N=186. Partial correlations controlling for risk preferences, confidence, gender, and age. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

Extraversion, reflecting individuals being sociable, gregarious, and assertive, positively correlates with SC_{noPD}, which is rather consistent with results from various psychometric scales (e.g., Ross et al., 2003; Ryckman et al., 2011), but does not correlate with SC_{PD}. In contrast, agreeableness, reflecting people being warm, generous, trusting, and altruistic, negatively correlates with SC_{PD}, but not with SC_{noPD}. BC and SC_{noPD} exhibit striking similarities in their correlations patterns as they are positively associated with extraversion but not associated with agreeableness.

Neuroticism, which is low when people are emotionally stable, even-tempered, and self-reliant, displays an interesting correlational pattern. It positively correlates with SC_{PD} and thereby mirrors results on hypercompetitive attitudes (Ross et al., 2003) but negatively with SC_{noPD}. Again, BC behaves like SC_{noPD} and is — consistent with

Müller's and Schwieren's (2012) findings — negatively associated with neuroticism. Thus, depending on the specific competition neuroticism can display both positive and negative relationships with competitiveness. Neurotic individuals might shy away from competition if they associate it with negative experiences, like stress and pressure, but may embrace competition if they associate it with positive experiences like personal development.

Finally, an interest in a managerial career is more strongly associated with SC_{PD} than with SC_{noPD}. Again, BC and SC_{noPD} exhibit remarkable similarities as both do not display a relationship with participants' interest in a managerial career.

2.4.2 Desire to Win & Enjoyment of Competition

We measure *enjoyment of competition* through residualizing SC_{PD} as well as SC_{DW} from SC. We regress PD and DW on SC using a simple ordinary least squares estimation:

$$SC_i = \beta_1 \cdot PD_i + \beta_2 \cdot DW_i + \alpha + \varepsilon_i \quad (2.4.2)$$

with β_1 as the estimated coefficient for PD, β_2 as the estimated coefficient for DW, α being the constant, and ε_i the error term. Variation in *enjoyment of competition* is given by $SC_{EC} = \alpha + \varepsilon_i$. We scale PD with β_1, such that $SC_{PD} = \beta_1 \cdot PD_i$, and we scale DW with β_2, such that $SC_{DW} = \beta_2 \cdot DW_i$. As introduced in Section 2.4.1, this ensures that SC equals the sum of its components SC_{PD}, SC_{DW}, and SC_{EC}. SC_{EC} is perfectly uncorrelated with both SC_{PD} and SC_{DW}, which permits a meaningful interpretation and comparison of all three coefficients.

Table 2.13 reports results of the residualization. The residualization coefficient of the desire to win (β_2) is insignificant, which indicates that in our sample the self-reported measure of the desire to win and the general self-reported competitiveness measure are only weakly related. This is noteworthy, since we observe a substantial positive correlation ($r=0.36$, $p<0.001$) between SC and SC_{DW}. The residualization shows that once controlling for SC_{PD} this relation is substantially reduced.

Table 2.13: Residualization of self-reported competitiveness II

Dep-Var.: Self-reported Competitiveness (SC)		**Coef.**	**(s.e.)**
Personal development Motive (PD)	β_1 =	0.5812	(0.0636)***
Desire to win (DW)	β_2 =	0.0274	(0.0611)
Constant	α =	1.5175	(0.2590)***
R^2		0.4028	

Notes: *N=186. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

Moreover, the resulting measure for the enjoyment of competition SC_{EC} is almost perfectly correlated with SC_{noPD} (r=0.9995, p<0.001), while SC_{DW} has no significant correlation with SC_{noPD}. These first results already strongly suggest that self-reported competitiveness not driven by personal development motives is primarily driven by enjoyment of competition rather than by a desire to win. We observe significant gender differences, such that average male students score higher than average female students in both the desire to win (Two-sample t test: diff=0.109-0.095=0.014>0, t=2.60, p=0.010) and the enjoyment of competition (Two-sample t test: diff=1.83-1.32=0.51>0, t=3.82, p<0.001).

Table 2.14 shows results of logistic regression estimations with three motives of self-reported competitiveness. Again we first use constrained regression analysis to enforce that all three components have the same effect (Model 5) showing that now (by design) SC equals the sum of the three motives SC_{PD}, SC_{DW} and SC_{EC}. Hence, Model 5 equals Model 2 and Model 3. When relaxing the constraint (Model 6) we find a positive effect of SC_{EC} on BC, but no effect of SC_{PD}, or SC_{DW}.

The difference between the coefficient of enjoyment of competition SC_{EC} and the coefficient of SC_{PD} is weakly significant ($\beta_{EC} - \beta_{PD}$=0.767>0, SE=0.506, p=0.0643), which provides weak support for Hypothesis 3a. We also observe weakly significant differences between the coefficients for enjoyment of competition (SC_{EC}) and general SC ($\beta_{EC} - \beta_{GC}$=0.313>0, SE=0.192, p=0.0516), which supports Hypothesis 3b. Furthermore, consistent with Hypothesis 2b, the difference between the coefficients of SC and of SC_{PD} is still weakly significant ($\beta_{GC} - \beta_{PD}$=0.454>0, SE=0.327, p=0.0823). Odds ratios and marginal effects of Model 6 indicate that the effect size for enjoyment

of competition is almost identical to the effect size of SC_{noPD} discussed in the previous section.

Table 2.14: Logistic regressions of behavioral competitiveness on self-reported competiveness II

Model	**5**	**6**			**7**
Dep. Var.: Behavioral competitiveness	Coef.	Coef.	Odds Ratios	Marginal Effects	Coef.
SC: Personal development motive	0.43*	-0.03	0.97	-0.00	-0.11
	(0.20)	(0.36)	(0.35)	(0.06)	(0.40)
SC: Enjoyment of competition	0.43*	0.74**	2.09**	0.12**	0.60*
	(0.20)	(0.27)	(0.56)	(0.04)	(0.29)
SC: Desire to win	0.43*	-2.14	0.12	-0.36	-5.54
	(0.20)	(6.98)	(0.82)	(1.17)	(7.80)
Control variables					
Risk: General	-0.03	0.01	1.01	0.00	-0.08
	(0.20)	(0.20)	(0.20)	(0.03)	(0.23)
Risk: Job	0.20	0.24	1.27	0.04	0.43*
	(0.17)	(0.18)	(0.22)	(0.03)	(0.20)
Risk: Financial investments	0.11	0.11	1.11	0.02	0.17
	(0.16)	(0.16)	(0.18)	(0.03)	(0.17)
Risk: Games	0.10	0.18	1.20	0.03	0.22
	(0.13)	(0.14)	(0.17)	(0.02)	(0.16)
Confidence: General self-efficacy	0.21	0.17	1.18	0.03	0.39
	(0.33)	(0.33)	(0.40)	(0.06)	(0.40)
Confidence: Own expected score	0.20*	0.20*	1.23*	0.03**	0.19*
	(0.08)	(0.08)	(0.10)	(0.01)	(0.10)
Confidence: Expected average score	-0.05	-0.04	0.96	-0.01	0.02
	(0.09)	(0.09)	(0.09)	(0.02)	(0.10)
Confidence: Probability to win	-0.00	-0.00	1.00	-0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.00)	(0.02)
Acquiescent response style (ARS)					-2.23
					(3.59)
Disacquiescent response style (DRS)					-2.70
					(3.90)
Midpoint response style (MRS)					1.70
					(8.48)
Extreme response style (ERS)					5.91
					(6.08)
Age	0.06	0.04	1.04	0.01	-0.00
	(0.06)	(0.06)	(0.07)	(0.01)	(0.07)
Female	-1.43**	-1.41**	0.24**	-0.26**	-1.57**
	(0.45)	(0.47)	(0.11)	(0.09)	(0.56)
Constant	-7.65***	-7.03**			-8.00**
	(2.21)	(2.38)			(2.73)
Obs.	186	186			163
Pseudo R^2	0.294	0.315			0.359
Log Likelihood	-80.33***	-78.00***			-65.93***
(LR χ^2)	(66.91)	(71.58)			(73.74)

Notes: *N=186. Model 1 is constrained to equalize coefficients of SC_{PD}, SC_{EC}, and SC_{DW}. Standard errors reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10.*

Model 7 additionally controls for response styles. Again the coefficients of ARS, DRS, MRS, and ERS are all insignificant, which indicates no effect of response styles on behavioral competitiveness. We still observe a positive relation between SC_{EC} and BC, but no significant relation of BC with SC_{PD} and SC_{DW}. A generalized Hausmann test indicates no significant changes in the coefficients of SC_{PD}, SC_{DW}, and SC_{EC} when controls for response styles are included ($\chi^2(3)=2.52$, $p=0.472$). Therefore, we consider our findings to be robust against potential biases stemming from response styles.

Table 2.15: Partial correlations of competitiveness with personality and managerial career anchor II

	Behavioral competitiveness	**Self-reported competitiveness**			
	BC	*SC_{EC}*	*SC_{DW}*	*SC_{PD}*	*SC*
Openness to experience	.10	.05	.11	.02	.06
Conscientiousness	-.03	.06	.11	.02	.07
Extraversion	.17*	.32***	-.17*	-.12	.18*
Agreeableness	.07	.11	-.32***	-.20**	-.04
Neuroticism	-.16*	-.24**	.29***	.17*	-.08
General Management	.03	-.01	.37***	.18*	.12

***Notes*: *N=186. Partial correlations controlling for risk preferences, confidence, gender, and age. Significance levels: *** p<0.001, ** p<0.01, * p<0.05*

Table 2.15 reports partial correlations of competitiveness measures with the Big Five personality dimensions when controlling for risk-preferences, confidence, gender, and age. Conscientiousness and openness to experience, do neither relate to SC_{DW}, nor to SC_{EC}. The enjoyment of competition (SC_{EC}) is positively related to Extraversion and negatively related to Neuroticism. Hence, SC_{EC} shows the same correlation pattern as BC and SC_{noPD}. The desire to win (SC_{DW}) is negatively related to Extraversion and Agreeableness, but positively related to Neuroticism. The correlation pattern of SC_{DW} with the Big Five is clearly distinct from the correlations patterns of BC and SC_{EC}, as the respective correlations have opposite signs for Extraversion and Neuroticism. On the contrary, the correlation pattern of SC_{DW} is rather similar to the correlation pattern of SC_{PD}, as both measures have negative relations with Agreeableness, but positive relations with Neuroticism. Furthermore, both SC_{DW} and SC_{PD} are positively associated with an interest in a managerial career, while BC and SC_{EC} are not.

2.5 DISCUSSION

2.5.1 Summary of findings

Following a long tradition of a mutually fruitful exchange between economic and psychological research (e.g., Fetchenhauer et al., 2012; Simon, 1959; Van Praag, 1985), the study presented in this chapter aims at improving our understanding of commonalities and differences between experimental-economic and psychological measurements of individual competitiveness. We discuss how incentivized behavioral experiments as experimental economists' preferred measurement of competitiveness relate to self-reported psychometric scales, which are the dominant measurement of individual competitiveness within psychological research. While the experimental measurement builds on the *revealed preference paradigm* and thereby is rather context-specific, the self-reported scales often explicitly aim at a more general characteristic and build on the *assumption of epsilon-truthfulness*.

In support of Hypothesis 1 we find a robust positive correlation between individuals' payment choices within a behavioral measure of competitive preferences and a general self-reported measure of individual competitiveness based on psychometric scales. These findings suggest that both measures are indicators of the same underlying latent variable, which might be interpreted as a general preference to enter competitive situations.

We argued that the specific contexts of economic experiments measuring individual competitive preferences are likely to provide extremely competitive environments, but offer little opportunities for personal development. Consistent with the *compatibility principle* (Ajzen & Fishbein, 2005) and with our hypotheses our findings suggest, that competitiveness motivated by an enjoyment of competition is strongly related to economists' behavioral measures of competitiveness, while personal development motives are less reflected by individuals' choices to enter a tournament in these behavioral experiments.

In support of Hypotheses 2a, 2b, and 2c choices of competitive payments in the experiment more strongly relate to self-reported competitiveness *not* motivated by personal development motives. In contrast, we could not identify a relationship between the choice of competitive payment in our experiment and self-reported competitiveness

motivated by personal development. These findings support our conjecture that in our experiment, which is similar to setups typically used in economic experiments measuring competitiveness (see Croson & Gneezy, 2009), participants do not perceive competition as an opportunity for personal development.

Furthermore, we find that self-reported competitiveness *not* motivated by personal development is motivated by enjoyment of competition, rather than by a desire to win in competition. In support of Hypotheses 3a and 3b choices of competitive payments in the experiment more strongly relate to self-reported competitiveness motivated by enjoyment of competition, than to self-reported competitiveness motivated by personal development, or to general self-reported competitiveness. This finding is consistent with the claim that our participants perceive the winner-take-all tournament, but not the piece-rate condition, as a highly competitive environment[8].

Moreover, we find no relation between an individual's desire to win in a competition and self-selection into competitive tournaments within behavioral experiments. Consistent with previous psychological studies (e.g., Newby & Klein, 2014; Smither & Houston, 1992), the general self-reported measure of competitiveness is highly correlated with all motives. It captures competitiveness motivated by personal development and by enjoyment of competition to large extents. However, when controlling for personal development motives, we do not observe a substantial relation between the general measure and the desire to win.

Our results confirm that personal development motives, which are captured by self-reported, but not by economists' behavioral measures of competitiveness, constitute a violation of the compatibility principle. Yet, the enjoyment of competition and the desire to win do not.

While we believe this study to make worthwhile contributions to our understanding of measurements of individuals' competitiveness, we acknowledge limitations implied by our specific conceptualizations. By defining *competitiveness* as an individual's general tendency to self-select into competitive environments, we neglected any preferences for specific behaviors *within* competitive environments.

[8] Further empirical evidence for this claim is provided in Chapter V.

2.5.2 Implications

1. Revised experimental designs

Our findings indicate that prior experimental studies measuring individual competitiveness presumably have measured competitiveness that just weakly relates to personal development motives, but is driven by enjoyment of competition. Such a clear focus has advantages. Current behavioral measures of competitiveness are rather capable of separating the effect of enjoyment of competition from the effects of other motives of individual competitiveness[9]. However, if personal development motives are not considered as confounds but rather as essential antecedents (see discussion by Brocklebank Lewis, & Bates, 2011), then economic studies addressing such competitiveness may need adjustments. Related psychometric measures (e.g. Newby & Klein, 2014) include items referring to feedback (e.g. *"Competition allows me to judge my level of competence"*) and learning (e.g. *"I can improve my competence by competing."*). We expect experiments that include more feedback and learning opportunities to be more likely to capture competitiveness motivated by personal development motives than experiments without such opportunities (e.g., Azmat & Iriberri, 2016; Wozniak et al., 2014).

2. Approximating experimental measures by self-reported measures

Our results suggest that both behavioral competitiveness measures and self-reported competitiveness scales are indicators of the same underlying latent variable, which might be interpreted as a general preference to enter competitive situations. Hence, scale-based measures of individual competitiveness, especially when these scales focus on the enjoyment of competition (e.g., Houston et al. 2002b), may be able to approximate behavioral measures, where behavioral measures cannot be reasonably employed. Since incentivized economic experiments are difficult to implement and very costly, they are sometimes not feasible, and short psychometric scales might be employed instead. This might particularly hold for large-scale surveys (see Bönte & Piegeler, 2013), or for representation in socio-economic panels, which also address

[9] The experimental designs presented in Chapter III and Chapter IV show different approaches to implement such a separation.

individuals' psychological backgrounds such as risk attitudes (e.g., Dohmen et al., 2011). Research on individual competitiveness might benefit from the analysis of such representative and large-scale surveys in order to get a more comprehensive understanding of how individual competitiveness is distributed across populations and how it relates to real world behavior. In extreme cases and similar to recent developments in measuring risk preferences (e.g. Dohmen et al., 2011), one might even need to rely on single items to measure individual competitiveness (e.g. Bönte & Piegeler, 2013).

3. Competitive Preferences and career choices

We find that personal development motives as well as the desire to win might be relevant for selection into competitive management positions, whereas the enjoyment of competition is not related to such managerial intentions. These findings are very important when interpreting recent research linking experimental measures of individual competitiveness to career choices (e.g., Buser et al., 2014; Reuben et al., 2015) in conjunction with studies linking self-reported psychometric scales to career choices (e.g., Bönte & Piegeler, 2013; Kleinjans, 2009). These two types of studies are likely to capture slightly different notions of competitiveness.

This difference between these notions might be particularly interesting, when gender differences are emphasized. We are able to replicate the finding of previous studies that men are more competitively inclined than women (Croson & Gneezy, 2009). Both the experiment-based and the scale-based measure of competitiveness point to substantial gender differences. However, while we find gender differences for competitiveness that is motivated by enjoyment of competition and the desire to win, we do not find a gender difference for competitiveness motivated by personal development. Hence, none of the three motives of competitiveness indicates gender differences *and* is related to the behavioral measure *and* is related to managerial intentions. While prior research suggests that gender difference in competitiveness might partly explain gender differences in labor market outcomes (Buser et al., 2014; Flory et al., 2015; Reuben et al., 2015), it remains an open and relevant question, whether and to what extent occupational choice is driven by different motives of competitiveness.

4. Competitive Preferences and personality

We observe striking similarities between behavioral competitiveness and self-reported competitiveness not motivated by personal development with regard to their correlations with the Big Five personality dimensions, whereas the correlation pattern of competitiveness motivated by personal development is very dissimilar. This finding further validates our distinction of types of competitiveness. It furthermore demonstrates that not only economic experiments offer well-defined environments to investigate personality (Ferguson, Heckman, & Corr, 2011), but also personality frameworks can be employed to better understand economic behavior (Borghans et al., 2008; Müller & Schwieren, 2012). Our findings are particularly important for recent studies investigating the relationship between economic measures of competitiveness and personality dimensions such as the Big Five. Müller and Schwieren (2012), for instance, report a negative association of neuroticism with competitiveness. While we replicate this finding for the experiment-based measure of competitiveness, our study highlights that this does not imply that neurotic people will generally avoid competitive environments. If competition provides opportunities for personal development, neurotic individuals may exploit competitions for exactly that reason and have higher tendency to enter such competitions. Thus, the relationship between competitiveness and personality might be highly sensitive to the specific context of a competition.

Chapter III

Exploring the Utility of Competing and Winning

3.1 INTRODUCTION

Institutions can differ in the importance they place on competitiveness (Niederle, 2017) and the deliberate design of competition within and between organizations, such as promotion contests or innovation contests, has been intensively studied for more than 30 years (Lazear & Rosen, 1981; Connelly et al., 2014). In addition to standard economic explanations, the role of individual preferences to enter competitive environments has recently gained prominence (Niederle, 2017). Investigating the self-selection of men and women into a competitive tournament Niederle and Vesterlund (2007) conclude that there is heterogeneity in preferences for entering competition. Recent studies have questioned the identification of competitive preferences by Niederle and Vesterlund (Ifcher & Zarghamee, 2016a; 2016b; Van Veldhuizen, 2017) and argued that gender differences in self-selection into competition might be fully explained by (over-)confidence and risk preferences (Van Veldhuizen, 2017).

Competitiveness research is creating valuable insights and exploring institutional differences in competitiveness and their effects on decision makers with heterogeneous preferences for competition remains an open area of behavioral market design (Niederle, 2017). However, it faces a severe lack of theoretical foundations and the economic interpretation of self-selection into competition remains unclear. In order to provide solid foundations for effective market design, research on competitive preferences needs to inform the utility function (see Ifcher & Zarghamee, 2016b), yet

this link between an individual's self-selection into competition and the individual's utility maximizing behavior is still missing. Currently, it is unclear, whether genuine preferences for competition exist; and if they exist, it is unclear, how individual heterogeneity in self-selection into competition translates into individual heterogeneity in competitive preferences.

Chapter II has investigated different motives to self-select into competition and provided evidence that self-selection into competitive environments is driven by an individual's enjoyment of competition. This finding is consistent with a conjecture that men more than women enjoy competing (Niederle & Vesterlund, 2007). Furthermore, with the results from Chapter II I cannot rule out the desire to win as an additional motive to self-select into competition. Such a desire to win is consistent with another stream of experimental research investigating the performance within competition using experiments, where competition is exogenously imposed (e.g. Falk, Fehr, and Huffman, 2008; Blanes i Vidal & Nossol, 2011; Kosfeld & Neckermann, 2011). In some recent studies competitions are designed as tournaments without prizes, where relative performance feedback is provided to participants (Azmat & Iriberri 2010; Blanes i Vidal & Nossol, 2011), if any rewards are provided to participants, these rewards are purely symbolic – such as e.g. a congratulatory card – ensuring that any behavioral effect is driven by non- material benefit (Blanes i Vidal & Nossol, 2011; Kosfeld & Neckermann, 2011). Results of these studies suggest a high symbolic value of winning a tournament (Delfgaauw et al., 2013). While both an enjoyment of competition and a desire to win may drive self-selection into competition, it needs to be tested, whether such personality characteristics reflect well-known economic preferences, or whether economic theory can benefit from the inclusion of these personality characteristics as model parameters (see Borghans et al., 2008).

In Chapter III I link self-selection into competition to an individual's utility maximizing behavior by providing a utility-based model that includes both an enjoyment of competition and a desire to win in the individual's utility function. Thereby, I provide a theory driven attempt to disentangle a genuine competitive preference from utility maximizing behavior that can be explained by well-known economic preferences. I distinguish environments, where individuals provide their maximum feasible performance, from environments, where individuals optimize their performance by providing a lower performance level. For both types of environments I

examine the interplay of an individual's expected performance and self-selection into competition. Under the assumption of maximum performance provision I subsequently derive the effects of a value of competing reflecting the phenomenon that individuals enjoy competing and of a value of winning reflecting an individual's desire to win on the individual's self-selection into competitive versus non-competitive environments.

To examine the usefulness of my model empirically I utilize recent refinements in measures of competitiveness (Gneezy & Pietrasz, 2013; Petrie & Segal, 2015; Ifcher & Zarghamee, 2016a; 2016b) and identify piece-rate equivalents for multiple competitive environments. Furthermore, I introduce an experimental treatment that allows manipulating the probability of winning the competition exogenously and calculating a non-monetary value of competing as well as a non-monetary value of winning. This study deepens the understanding of competitive preferences by quantifying the behavioral distortion created by such preferences as compared to the benchmark model. Furthermore, it contributes to the integration of competitiveness research by elaborating the link between self-selection into competition and behavior within competition.

The remainder of this chapter proceeds as follows. Section 3.2 introduces a utility-based model of individuals' self-selection into competition depending on a non-monetary value of competing and a non-monetary value of winning. Section 3.3 describes the experimental design and subject pool. Section 3.4 presents the results including replications of related previous studies and robustness checks. Section 3.5 provides a discussion of the findings including implications and limitations.

3.2 A SIMPLE UTILITY MODEL

This section introduces a utility-based model of the effects of individual competitive preferences on individuals' self-selection into competitive environments. First, I model individual utility maximization in non-competitive environments and introduce a distinction between maximum performance environments and optimal performance environments. Second, I operationalize competitive environments and analyze individual utility maximization in competitive environments. Next, I compare optimal performance provided in competitive versus non-competitive environments and

show that individuals' decision to enter competitive environments can be expected to be entangled with effects of competition on optimal performance. Moreover, I show how maximum performance environments can help to disentangle these effects.

Subsequently, I introduce competitive preferences in the form of a non-monetary value of winning and a non-monetary value of competing. For maximum performance environments I model the effect of both values on the individual's self-selection into competitive versus non-competitive environments and show how to quantify both values by observing multiple decisions of the same individual. Finally, I include risk preferences and provide the full model.

3.2.1 Non-competitive environments

I consider a non-competitive environment A in which each individual *i* performs in a task and receives a payment π_{Ai} that depends only on the individual's own performance p_{Ai}. Individual i receives a constant piece-rate of δ_A such that the individual payment π_{Ai} is given by equation 3.1.1:

$$\pi_{Ai} = \delta_A \cdot p_{Ai} \tag{3.1.1}$$

I assume convex cost of performance $c_i(p_i)$ (s.t. $c_i'(p_i) > 0;\ c_i''(p_i) > 0$)[10]. Moreover, I assume that the cost function has a discontinuity at an exogenous performance level p_{MAXi}, which can differ between individuals. For any performance level higher than p_{MAXi} individual i faces infinitely high performance cost, such that p_{MAXi} is the maximum feasible performance level of this individual[11]. The utility U_{Ai} of individual *i* in environment A is assumed to be determined by the payment and the cost:

[10] This assumption of performance cost can, for instance, be interpreted in a way that individual *i* provides some kind of costly effort e_{Ai} and performance p_{Ai} is a deterministic function of individual *i*'s effort e_{Ai}, where more effort leads to a higher performance. Convexity of performance cost can be realized by convex effort cost $c_i(e_i)$ (s.t. $c_i'(e_i) > 0$; $c_i''(e_i) \geq 0$), or by decreasing returns of effort with respect to performance (i.e. $p_{Ai}'(e_{Ai}) > 0$; $p_{Ai}''(e_{Ai}) < 0$).

[11] While this assumption can represent a broad variety of environments, it typically reflects some kind of restriction to the provision of effort or a limited ability of individual *i*. In sports or work environments only performance up to a certain level may be accounted for. In an economic experiment only a limited number of tasks might be provided (cf. Leibbrandt et al., 2013). Experimental tasks with time constrains (e.g. Niederle & Vesterlund, 2007; Shurchkov, 2012) can be considered in a similar way. If an individual is only able to solve tasks at a given rate, the time limit implies the individual's maximum feasible performance.

$$U_{Ai} = \delta_A \cdot p_{Ai} - c_i(p_{Ai}) \tag{3.1.2}$$

A utility maximizing individual can be expected to perform up to the point, where the marginal value of the performance equals marginal performance cost.

$$\frac{\partial U_{Ai}}{\partial p_{Ai}} = \delta_A - \frac{\partial c_i}{\partial p_{Ai}} = 0 \tag{3.1.3}$$

Hence, in environment A individual *i* provides an optimal performance:

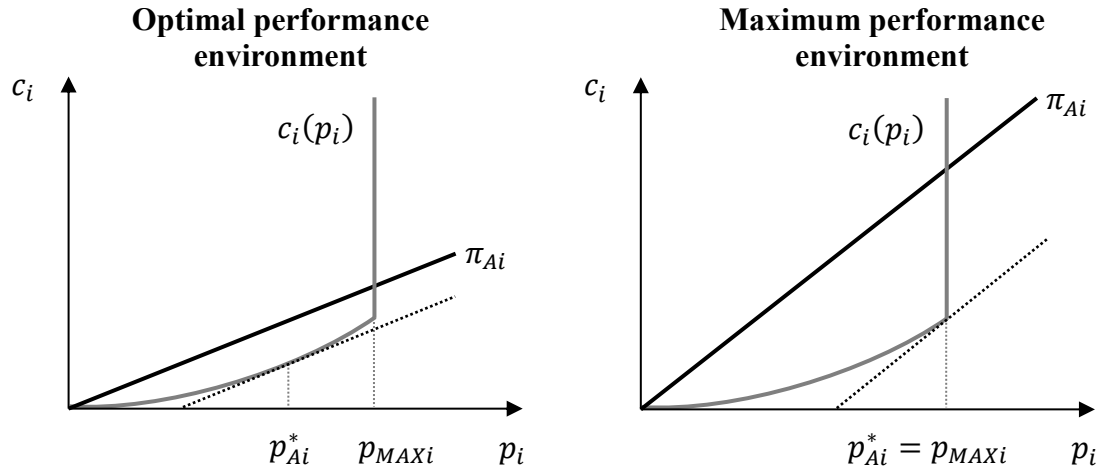
$$p_{Ai}^* = \arg\max\left(\delta_A \cdot p_{Ai} - c_i(p_{Ai})\right) \tag{3.1.4}$$

Particularly, individual *i* provides the maximum performance p_{MAXi} if the exogenous piece-rate δ_A is sufficiently high:

$$\delta_A \geq c_i'(p_{MAXi}) \tag{3.1.5}$$

In the following I refer to environment A as a *maximum performance environment*, if the optimal performance p_{Ai}^* equals the maximum feasible performance p_{MAXi} and as an *optimal performance environment* otherwise. Figure 3.1 illustrates individual *i*'s choice of performance for both cases.

Figure 3.1: Performance in non-competitive environments



3.2.2 Competitive environments

Deutsch (1949) proposed that a competitive environment is characterized by institutions where individuals' goals are not simultaneously achievable given the sets of possible strategies. Zero-sum games and winner-take-all situations represent examples of extremely competitive environments (Lazear, 1999). In competitive environments every attempt of individuals to get closer to their own goals makes it less likely for other individuals to achieve their goals (Deutsch, 1949; Lazear, 1999). That is, competition is part of the economic institutions that link performance to relevant outcomes. Following this definition I distinguish between competitive environments and non-competitive environments depending on how the performance of other individuals *j (with $j \neq i$)* influences individual *i's* payoff. In competitive environments individual *i*'s payment π_i depends negatively on a competitor *j*'s performance p_j[12]**.**

Competitive Environment: $\frac{\partial \pi_i}{\partial p_j} < 0$

Non-competitive Environment: $\frac{\partial \pi_i}{\partial p_j} \geq 0$

Please note that this definition of competitive environments does not require a negative effect of the individual's own performance p_i on the payoff π_j of others. Hence, competitive environments can be asymmetric in the sense that individual *j* creates a competitive environment for individual *i* $\left(\frac{\partial \pi_i}{\partial p_j} < 0\right)$, but individual *i* does not necessarily create a competitive environment for individual *j* $\left(\frac{\partial \pi_j}{\partial p_i} \geq 0\right)$.

As a first step I analyze a simple winner-take-all tournament as competitive environment. Winner-take-all tournaments are considered as extremely competitive environments (Lazear, 1999) and are frequently used as competitive payment schemes in experimental research on competitive preferences (e.g. Niederle & Vesterlund, 2007; Cárdenas et al., 2012; Shurchkov, 2012; Leibbrandt et al., 2013; Buser et al., 2014; 2017). In environment B, the winner-take-all tournament, individual *i* receives a pay-

[12] I continue to assume that the individual's payment π_i depends positively on the individuals own performance p_i, such that $\frac{\partial \pi_i}{\partial p_i} > 0$ for both competitive and non-competitive environments.

rate of δ_B only if individual *i* wins the tournament, i.e. if the performance of individual *i* is higher than the performance of all competitors *j*:

$$p_{Bi} > max(p_j) \tag{3.2.1}$$

Thus, the expected payment in environment B is given by equation 3.2.2:

$$E(\pi_B) = \delta_B \cdot \rho_i \cdot p_{Bi} + 0 \cdot (1 - \rho_i) \cdot p_{Bi} \tag{3.2.2}$$

where $\rho_i = PR\left(p_{Bi} > max(p_j)\right)$ denotes the probability that individual *i* wins the tournament[13]. Individual *i*'s probability to win increases with the individual's own performance p_{Bi}, but depends negatively on the competitors performances p_j. I assume the same performance cost function as in the non-competitive environment A discussed in Section 3.2.1. The utility U_{Bi} of individual *i* in environment B is assumed to be determined by the payment and the cost (equation 3.2.3) and a utility maximizing individual can be expected to perform up to the point, where the marginal value of the performance equals marginal performance cost (equation 3.2.4):

$$U_{Bi} = \delta_B \cdot \rho_i \cdot p_{Bi} - c_i(p_{Bi}) \tag{3.2.3}$$

$$\frac{\partial U_{Bi}}{\partial p_{Bi}} = \delta_B \cdot \rho_i + \delta_B \cdot \frac{\partial \rho_i}{\partial p_{Bi}} \cdot p_{Bi} - \frac{\partial c_i}{\partial p_{Bi}} = 0 \tag{3.2.4}$$

Hence, in the winner-take-all tournament B this yields the optimal performance p_{Bi}^*:

$$p_{Bi}^* = \arg\max\left(\delta_B \cdot \rho_i(p_{Bi},\, p_j) \cdot p_{Bi} - c_i(p_{Bi})\right) \tag{3.2.5}$$

If competitors choose their performances p_j irrespective of p_{Bi}, then their performances can be taken as given. In previous studies on competitive preferences individuals typically compete against past performances of their competitors (e.g. Niederle &

[13] I refer to ρ_i as the probability of winning. This denotes the subjective beliefs of individual *i* regarding the chance to win the tournament, which can be expected to shape the individual's decision making. This implies that individual *i* has to be able to form beliefs about chances of winning. I also assume that individual *i* forms beliefs about the effect of the own performance on the probability of winning. An individual *i* may not know the performances p_j of competing individuals, but assume that these performances are randomly drawn from a given distribution. In an economic experiment an individual might, for instance, compete against anonymous, randomly drawn competitors (e.g. Leibbrandt et al., 2013; Buser et al., 2014). How all these beliefs correspond to objective environmental conditions is irrelevant for my discussion.

Vesterlund, 2007), or against anonymous competitors (e.g. Leibbrandt et al., 2013). In both of these cases competitors cannot adjust their performances p_j depending on p_{Bi}. In this chapter I focus on these simplified cases, because they are commonly used in competitiveness research and provide a clear context to identify values of competing and winning. Thus, individual *i*'s probability to win can be considered a function of p_{Bi} for a given p_j and the individual's optimal performance p_{Bi}^* can be reduced to equation 3.2.6:

$$p_{Bi}^* = \arg\max\left(\delta_B \cdot \rho_i(p_{Bi}) \cdot p_{Bi} - c_i(p_{Bi})\right) \tag{3.2.6}$$

Particularly, individual *i* provides maximum feasible performance p_{MAXi} if the pay-rate δ_B and the probability of winning ρ_i are sufficiently high. Moreover, the increasing chance of winning provides an additional performance incentive as shown in equation 3.2.7:

$$\delta_B \cdot \rho_i(p_{MAXi}) + \delta_B \cdot \rho_i'(p_{MAXi}) \cdot p_{MAXi} \geq c_i'(p_{MAXi}) \tag{3.2.7}$$

3.2.3 Performance in competitive vs non-competitive environment

Following an experimental design introduced by Niederle and Vesterlund (2007) economic studies examining individual competitive preferences measure an individuals' revealed choices to self-select into either a competitive winner-take-all tournament or a non-competitive piece-rate payment scheme (e.g. Cárdenas et al., 2012; Shurchkov, 2012; Leibbrandt et al., 2013; Buser et al., 2014; 2017). To represent this kind of choice let individual *i* choose between the non-competitive piece-rate environment A and the competitive winner-take-all tournament B. For this purpose I first compare the performance provided in the tournament and the piece-rate. Without loss of generality I set δ_B equal to 1 and define the relative piece-rate:

$$\delta = \frac{\delta_A}{\delta_B} \tag{3.3.1}$$

This allows rewriting the utility for both environments:

$$U_A = \delta \cdot p_{Ai} - c_i(p_{Ai}) \tag{3.3.2}$$

$$U_B = 1 \cdot \rho_i \cdot p_{Bi} - c_i(p_{Bi}) \tag{3.3.3}$$

I assume $\delta_B > \delta_A$ such that $1 > \delta > 0$ holds. In the tournament the optimal performance increases with the probability of winning ρ_i. Hence, the optimal tournament performance p_{Bi}^* is higher than the optimal piece-rate performance p_{Ai}^* for sufficiently high winning probabilities.

$$p_{Bi}^* \geq p_{Ai}^* \quad \Leftrightarrow \quad \rho_i(p_{Bi}^*) + \rho_i'(p_{Bi}^*) \cdot p_{Bi}^* \geq \delta \tag{3.3.4}$$

As far as the probability of winning increases with an individual's ability, condition 3.3.4 is consistent with predictions from Moldovanu's and Sela's (2001) more sophisticated model of performance in competition. As shown by Boudreau, Lakhani, and Menietti (2016) the model predicts, that the highest-skilled contestants respond positively to additional competitors, whereas participants with lower ability respond negatively.

To better analyze the performance differences relevant for individuals' choices between competitive and non-competitive environments I apply the concept of a "piece-rate equivalent" introduced by Ifcher and Zarghamee (2016a). In my model the piece-rate equivalent of a competitive environment can be defined as the relative piece-rate for which individual *i* is indifferent between that relative piece-rate and the competitive environment. Let δ^* denote the piece-rate equivalent of environment B, so that $U_A = U_B$ if $\delta = \delta^*$ holds:

$$\delta^* \equiv \rho_i \cdot \frac{p_{Bi}}{p_{Ai}} + \frac{c_i(p_{Ai}) - c_i(p_{Bi})}{p_{Ai}} \tag{3.3.5}$$

In this benchmark model the piece-rate equivalent δ^* of environment B is determined by the individual's subjective winning probability ρ_i. This is consistent with the notion that self-selection into competition is driven by (over-)confidence in winning the tournament (Niederle & Vesterlund, 2007). Moreover, expected differences between piece-rate performance p_{Ai} and tournament performance p_{Bi} affect an individual's self-selection into either the piece-rate or tournament.

These expected performance differences are systematically linked with the payment schemes in both environments. More specifically, I proceed to show that when a positive relative piece-rate in an optimal performance environment A equals the piece-

rate equivalent then the optimal performance in environment B is larger than the optimal performance in environment A as long as the probability ρ_i of winning the tournament increases with a further increase in performance p_{Bi} in environment B.

Proposition 1: $\boldsymbol{\rho_i'(p_{Bi}) > 0 \quad \Leftrightarrow \quad p^*_{Bi} > p^*_{Ai} \qquad if \quad \delta = \delta^*}$

Proof:

Performance cost is increasing ($c_i'(p_i) > 0$) and convex ($c_i''(p_i) > 0$):

(I) $$p^*_{Bi} > p^*_{Ai} \;\Leftrightarrow\; c_i(p^*_{Bi}) > c_i(p^*_{Ai}) \;\Leftrightarrow\; c_i'(p^*_{Bi}) > c_i'(p^*_{Ai})$$

A convex function lies above all of its tangents:

(II) $$c_i(p^*_{Ai}) \geq c_i(p^*_{Bi}) + c_i'(p^*_{Bi}) \cdot (p^*_{Ai} - p^*_{Bi}) \;\Leftrightarrow$$

$$c_i'(p^*_{Bi}) \cdot p^*_{Bi} - c_i(p^*_{Bi}) \geq c_i'(p^*_{Bi}) \cdot p^*_{Ai} - c_i(p^*_{Ai})$$

I and II imply:

(III) $$p^*_{Bi} > p^*_{Ai} \;\Leftrightarrow\; c_i'(p^*_{Bi}) \cdot p^*_{Bi} - c_i(p^*_{Bi}) > c_i'(p^*_{Ai}) \cdot p^*_{Ai} - c_i(p^*_{Ai})$$

The conditions for optimal performance in both environments imply:

(IVA) $$\delta = c_i'(p^*_{Ai})$$

(IVB) $$\rho_i(p^*_{Bi}) + \rho_i'(p^*_{Bi}) \cdot p^*_{Bi} = c_i'(p^*_{Bi})$$

III and IV imply:

(V) $$p^*_{Bi} > p^*_{Ai} \;\Leftrightarrow\; \rho_i(p^*_{Bi}) \cdot p^*_{Bi} + \rho_i'(p^*_{Bi}) \cdot (p^*_{Bi})^2 - c_i(p^*_{Bi}) > \delta \cdot p^*_{Ai} - c_i(p^*_{Ai})$$

Individual *i* is indifferent between both environments, if piece-rate equivalent is paid:

(VI) $$\delta = \delta^* \;\Leftrightarrow\; \rho_i(p^*_{Bi}) \cdot p^*_{Bi} - c_i(p^*_{Bi}) = \delta \cdot p^*_{Ai} - c_i(p^*_{Ai})$$

V and VI imply:

(VII) $$p^*_{Bi} > p^*_{Ai} \;\Leftrightarrow\; \rho_i'(p^*_{Bi}) \cdot (p^*_{Bi})^2 > 0$$ ■

Proposition 1 shows that the optimal performance of an indifferent individual can be expected to be higher in competitive environments, if the chance of winning in the competitive environment increases with the individual's performance[14]. The performance effects of competition have been intensely studied from the perspective of tournament theory (Lazear & Rosen, 1981; see Connelly et al., 2014; Lazear, 2018 for reviews). The notion that competing with others for monetary rewards can have motivation effects has received empirical support in various economic settings (e.g., Bull, Schotter, & Weigelt, 1987; Knoeber & Thurman, 1994, Eriksson 1999, Falk et al., 2008; Casas-Arce & Martínez-Jerez 2009).

As shown by Proposition 1, individual *i*'s choice to enter the competitive environment is linked to performance effects of the competitive relative to the non-competitive environment as long as individual *i* can provide an optimal performance. As discussed in Chapter II an individual's tendency to select *into* competitive environments is conceptually distinct from the individual's behavior *within* competitive environments. However, Proposition 1 indicates that both phenomena are entangled as an individual's anticipated performance resulting from behavior within a competition, affects the individual's choice to enter that competition. This is not the case, if environment A is a maximum performance environment and, hence, individual *i* provides the maximum feasible performance in both the competitive and the non-competitive environment. This assumption of maximum performance allows disentangling the individual's selection into competitive environments from potential performance effects of these environments.

Systematic performance differences as indicated by proposition 1 require optimal performance environments, but do not occur in maximum performance environments, since the individual's maximum performance is independent of the payment scheme. If the individual provides maximum performance, the indifference condition from equation 3.3.5 can be simplified and individual *i* chooses environment A over environment B if and only if $\delta \geq \rho_i$ holds. Therefore, in maximum performance environments the piece-rate equivalent δ^{MAX} equals the winning probability:

[14] If the individual's chance of winning the tournament does not increase with a further increase in the individual's performance ($\rho_i'(p_{Bi}^*) = 0$), we can expect the optimal performance to be equal in environment A and environment B. This can be the case, for instance, if $\rho_i(p_{Ai}^*) = 1$, i.e. if an individual expects that the optimal performance of the non-competitive environment is sufficient to win the tournament.

$$\delta^{MAX} = \rho_i(p_{MAXi}) \quad if \quad p_{Ai} = p_{Bi} = p_{MAXi} \tag{3.3.6}$$

In previous research on individual competitiveness most studies employ a math task with time limits between 30 sec. and 10 min. (e.g. Niederle & Vesterlund, 2007)[15]. While it is plausible that participants have low cost of performance within these designs, it is unclear, whether the maximum performance assumption holds. Moreover, it has been shown that task performance in these math tasks tends to increase in tournaments as compared to piece-rate payments (Gneezy et al., 2003).

In contrast, in a recent study on competitiveness Ifcher and Zarghamee (2016b), apply a non-agency task where performance is determined by rolling (virtual) dice, the individual cannot provide any effort, but the performance is determined randomly. In these tasks the realized performance is, by design, the maximum feasible performance, i.e. the maximum performance assumption holds. Hence, these non-agency tasks allow studying self-selection into competitive environments irrespective of expected performance differences, and thereby disentangle performance effects from effects of competitive preferences. In the following I use the maximum performance assumption to provide a quantification of competitive preferences that does not require the elicitation of expected performance.

3.2.4 Competitive preferences and self-selection into competition

Now assume that individual *i* holds competitive preferences, i.e. individual *i* values competing as well as winning. While competitive preferences have only recently gained attention in economics, research on individual competitiveness has a tradition of more than 100 years in psychology (e.g., Deutsch, 1949; Triplett, 1898), where it is generally recognized as playing a significant role in interpersonal processes (Houston et al., 2002a). In previous research individual competitiveness denotes an individual's general tendency to select into competitive environments. In other words, competitive individuals are those individuals who favor competitive over non-competitive environments (Niederle & Vesterlund, 2011; Smither & Houston, 1992). Niederle and Vesterlund (2007) have argued that some individuals enjoy competing more than others. This is consistent with the "enjoyment of competition" measured as an individual

[15] An overview of experimental designs in this research is provided in Table 2.1 of Chapter II

characteristic in psychological research (Houston et al. 2002b). To formalize this notion let $\tilde{v}_c$ denote the value of competing that is 0 for any non-competitive environment[16]. In a competitive environment $\tilde{v}_c$ takes a positive value, if an individual likes competition, and a negative value, if an individual dislikes competition.

Furthermore, Delfgaauw and colleagues (2013) argue that previous economic experiments suggest a high symbolic value of winning a tournament. Such a value of winning is in line with psychological concepts describing competitiveness as a form of dominance (Newby & Klein, 2014), such as interpersonal competitiveness (Griffin-Pierson, 1990), hypercompetitiveness (Ryckman et al., 1990), and self-aggrandizement (Houston et al. 2002a), which refer to an individual's need to compete and win at any cost (Horney, 1937). Hence, let $\tilde{v}_w$ denote the non-monetary value of winning that is realized if individual i outperforms all other individuals $\left(p > max(p_j)\right)$ in a competitive setting[17]. Since $\tilde{v}_w$ is only realized, if individual *i* wins in the competitive environment, it describes the difference in utility between winning and losing. If an individual does not value winning, but realizes a utility loss in case of losing, the

[16] In order to simplify the notation, I drop the index *i* from all variables.

[17] While I focus on the identification of an individual's competitive preference in maximum performance environments, where all individuals provide their maximum feasible performance, in an optimal performance environment the value of winning might also have effects on an individual's optimal performance. Winning a competition requires an individual to do both: (1) to enter the competition, and (2) to provide high performance within the competition. Previous research has argued that higher performance in competitive environments is driven by a symbolic value of winning a tournament (Delfgaauw et al., 2013) and suggests heterogeneity in individuals' responses competition (Gneezy et al., 2003; Boudreau et al., 2016). Coffey and Maloney (2010) show that the *thrill of victory* has a positive effect on the speed of horse races as well as of dogs races. They argue that the thrill of victory is driven by the closeness of a competition, which is increasing with the probability of a rank change *"the heat of competition itself will draw forth extra effort. When competition is intense, participants will work harder than when the outcome is obvious."* (Coffey and Maloney, 2010, p.8)
When I include competitive preferences in my model the optimal performance in the non-competitive environment A and the competitive environment B are given by:

$$p_{Ai}^* = \arg\max\left(\delta \cdot p_A - c(p_A)\right) \qquad p_B^* = \arg\max\left(\rho(p_B) \cdot p_B + \tilde{v}_c + \rho(p_B) \cdot \tilde{v}_w - c(p_B)\right).$$

The optimal performance in the non-competitive environment p_A^* does not depend on competitive preferences. Moreover, the optimal performance in the tournament p_B^* is independent from the value of competing $\tilde{v}_c$. In contrast, the optimal performance increases with the value of winning $\tilde{v}_w$ as long as the probability of winning increases with performance. More specifically, the effect of the value of winning $\tilde{v}_w$ on the optimal tournament performance p_B^* is multiplied by the increase of the winning probability $\rho'(p_B)$ with respect to performance. Hence, if $\rho'(p_B) > 0$ the individual's optimal tournament performance p_B^* relative to the individual's piece-rate performance p_A^* is also increasing with the individual's value of winning $\tilde{v}_w$: $\frac{\partial(p_B^*)}{\partial \tilde{v}_w} > 0 \ \wedge \ \frac{\partial(p_A^*)}{\partial \tilde{v}_w} = 0 \ \Rightarrow \ \frac{\partial(p_B^* - p_A^*)}{\partial \tilde{v}_w} > 0$
The more intense a competition is – i.e. a small change in performance leads to a large change in the probability of winning – the more does the non-monetary value of winning increase the individual's optimal performance in that competition. Hence, in terms of effects on optimal performance my model yields the same conclusion as the model by Coffey and Maloney (2010).

positive difference between both cases is still reflected by $\tilde{v}_w$, while the lower utility base level in competitive environments would be accounted as a lower value of competing. In case an individual values winning and fears losing $\tilde{v}_w$ can be interpreted as the sum of both effects, while $\tilde{v}_c$ still describes the utility gained from competition in the case of losing.

Under the maximum performance assumption the performance is equal across all environments. Hence, I can define $v_c = \tilde{v}_c/p$ and $v_w = \tilde{v}_w/p$ for any given performance p. Including these preference terms yields the utility U_B for the competitive environment (equation 3.4.2), whereas the utility U_A is realized in the non-competitive environment (equation 3.4.1):

$$U_A = \delta \cdot p - c(p) \tag{3.4.1}$$

$$U_B = (\rho + v_c + \rho \cdot v_w) \cdot p - c(p) \tag{3.4.2}$$

Under the maximum performance assumption the performance costs are equal across all environments in the choice set and, hence, the cost term $c(p)$ can be considered irrelevant for the individual's choice between the competitive and the non-competitive environment independent of the performance level. Current decision theories usually assume that individuals discard components that are shared in all prospects during an editing phase, before evaluating their decision (Kahneman & Tversky, 2013). Following this approach I further simplify the utility functions:

$$U_A = \delta \cdot p \tag{3.4.3}$$

$$U_B = (\rho + v_c + \rho \cdot v_w) \cdot p \tag{3.4.4}$$

A utility maximizing individual is expected to choose environment A over environment B if and only if $\delta \geq \rho + v_c + \rho \cdot v_w$ holds[18]. Hence, the piece-rate equivalent of environment B is given by equation 3.4.5:

$$\delta^{EQ} \equiv \rho + v_c + \rho \cdot v_w \tag{3.4.5}$$

[18] Note that in the utility functions U_A and U_B I imply risk neutrality of individual *i*. While the assumption of risk neutrality helps to clarify the line of argumentation, I relax this assumption in the next section and provide a discussion of risk preferences.

In the previous section I have shown that in the absence of competitive preferences the piece-rate equivalent under maximum performance is given by $\delta^{MAX} = \rho$. Considering the individual deviation from this benchmark $y = \delta^{EQ} - \rho$ yields a simple measure for individual *i*'s competitive preferences:

$$y = v_c + \rho \cdot v_w \tag{3.4.6}$$

In order to separate v_c from v_w consider multiple decisions between competitive tournaments with different probabilities of winning. Let individual *i*'s probability to win tournament 1 be ρ_1 and let individual *i* have a higher probability ρ_2 to win tournament 2, where ρ_Δ denotes the difference in winning probabilities:

$$\rho_2 = \rho_1 + \rho_\Delta \tag{3.4.7}$$

The concept of piece-rate equivalents allows comparing multiple competitive environments by comparing their respective piece-rate equivalents. Let individual *i* be indifferent between a piece-rate equivalent δ_1^{EQ} and the tournament with a winning probability ρ_1 and let individual *i* ceteris paribus be indifferent between piece-rate δ_2^{EQ} and the tournament with a winning probability ρ_2. The parameter v_w is identified by subtraction of the indifference conditions:

$$v_w = \frac{\left(\delta_2^{EQ} - \delta_1^{EQ}\right) - \rho_\Delta}{\rho_\Delta} = \frac{y_2 - y_1}{\rho_\Delta} \tag{3.4.8}$$

The parameter v_c is then given by the individual's deviation from payoff maximization, which is independent from the probability of winning and hence, equal in both competitive environments:

$$v_c = \delta_1^{EQ} - \rho_1 - \rho_1 \cdot v_w = y_1 - \rho_1 \cdot v_w \tag{3.4.9}$$

$$v_c = \delta_2^{EQ} - \rho_2 - \rho_2 \cdot v_w = y_2 - \rho_2 \cdot v_w \tag{3.4.10}$$

3.2.5 Including risk-preferences

Gneezy, Niederle, and Rustichini (2003) highlight that a tournament payment differs from a piece-rate payment in two ways: (1) payment depends on the performance of others, which is the defining characteristic of a competitive environment, and (2) the payment is uncertain. In the model of competitive preferences presented above I use linear additive utility functions $U(\pi, v_c, v_w)$ with three attributes: the payment π, the value of competing v_c, and the value of winning v_w. Since not all of these outcomes need to be monetary, I consider multiattribute utility (Wakker, 2010) and in order to provide a simple analysis of risk preferences for multiple attributes I continue to assume an additive separable utility function:

$$U(x_1, \dots, x_n) = \sum_{k=1}^{n} u(x_k) \tag{3.5.1}$$

This functional form implies multivariate risk neutrality (Richard, 1975) as well as strong utility independence between the attributes (Keeney & Raiffa, 1976). For each attribute I use the common assumption of constant relative risk aversion (CRRA) and apply a von Neumann-Morgenstern like utility function $u(x) = \frac{x^{1-\eta}}{1-\eta}$ (von Neumann and Morgenstern, 1953). Hence, I assume the following utility functions:

$$U_A = \frac{(\delta \cdot p)^{1-\eta}}{1-\eta} \tag{3.5.2}$$

$$U_B = \rho \cdot \frac{(1 \cdot p)^{1-\eta}}{1-\eta} + \rho \cdot \frac{(v_w \cdot p)^{1-\eta}}{1-\eta} + \frac{(v_c \cdot p)^{1-\eta}}{1-\eta} \tag{3.5.3}$$

For any given level of performance an individual with a CRRA of η is expected to choose setting A over setting B if and only if $\delta^{1-\eta} \geq \rho + {v_c}^{1-\eta} + \rho \cdot {v_w}^{1-\eta}$ holds[19]. The parameters v_c and v_w are then given by:

[19] Both v_c and v_w may be negative. The term $v^{1-\eta}$ is not defined if η is no integer and v is negative. For these cases I assume that the absolute value $|v|^{1-\eta}$ is subtracted from the utility of the competitive setting. Such that an individual with $v_c < 0$ becomes indifferent between setting A and setting B if:

$$\delta^{1-\eta} \geq \rho_i - |v_c|^{1-\eta} + \rho_i \cdot {v_w}^{1-\eta}$$

$$v_w = \left(\frac{\left({\delta_2}^{1-\eta} - {\delta_1}^{1-\eta} \right) - \rho_\Delta}{\rho_\Delta} \right)^{\frac{1}{1-\eta}} \tag{3.5.4}$$

$$v_c = \left({\delta_1}^{1-\eta} - \rho_1 - \rho_1 \cdot {v_w}^{1-\eta} \right)^{\frac{1}{1-\eta}} \tag{3.5.5}$$

The values in equations 3.5.4 and 3.5.5 are adjusted for both the subjective chance of winning ρ and the individual risk taking preferences as reflected in the η parameter. These values form the theoretical foundation for my subsequent empirical analysis. In my experiment (that is described in detail in Section 3.3) individuals have multiple sets of choices between the non-competitive environment A and the competitive environment B. I exogenously induce a fix ρ_Δ between competitive environments and measure the piece-rate equivalent δ^{EQ} for each competitive environment as well as the risk aversion parameter η for each individual. Based on these measures I seek to quantify individual competitive preferences by calculating the value of winning v_w and value of competing v_c for each individual.

3.3 THE EXPERIMENT

In my experiment subjects completed a total 7 tasks. Each experimental session lasted approximately 80 min. and proceeded in the following way: (1) Subjects read and signed the informed consent and data security forms. (2) Subjects complete a tutorial to familiarize with the software and to ensure comprehension of the decision modes. (3) Subjects completed three tasks (tasks 1–3) in each of which they had 5 min. to solve summation problems. Task 1 was incentivized with a piece-rate, task 2 with a winner-take-all payment, and in task 3 subjects chose between piece-rate and winner-take-all payment. (4) Subjects completed a fourth task (task 4) in which they chose a payment scheme for their task 1 performance retrospectively. (5) Subjects completed a fifth task (task 5) in which they again performed summations for 5 min. Subjects chose their

A possible interpretation of this assumption is that the positive value of "not competing" $v_{nc} = -v_c$ enters the utility of a non-competitive setting. Analogously I assume that an individual with $v_w < 0$ becomes indifferent between setting A and setting B if: $\delta^{1-\eta} \geq \rho_i + {v_c}^{1-\eta} - \rho_i \cdot |v_w|^{1-\eta}$

payment (piece-rate or winner-take-all) for different conditions one of which was randomly drawn. (6) Subjects chose their payment in the same way as in task 5 for a non-agency task (task 6), which then was automatically run on their computer. (7) Subjects completed a risk preference task (task 7). (8) Subjects completed a questionnaire regarding demographic and other characteristics. (9) Subjects received their payment and exited the session. Subjects were guaranteed a minimum payment of €5.00 and received an average payment of €14.42. The experiment was conducted using z-Tree version 4.09 (Fischbacher, 2007).

3.3.1 Subjects

The experiment was conducted at the laboratory of the University of Wuppertal (Germany) in the summer of 2018. I recruited 56 students (33 male, 23 female) from undergraduate courses and postgraduate courses of all departments. Subjects, who participated in the experiment, were enrolled in Business and Economics (27), Engineering (7), Health economics (6), a teacher's program (5), Chemistry (3), Psychology (3), Politics (2), Philosophy (2), and History (1). Prospective subjects were told that participation in the experimental session would take about 90 min and that they would be paid with a minimum payment of €5.00 for their participation.

3.3.2 Tutorial

Before starting the experiment in each session subjects completed a non-incentivized tutorial in z-Tree (Fischbacher, 2007). The tutorial featured four exercises: (1) subjects typed and submitted numbers given on the screen; (2) Subjects submitted an estimation of the number of people in the lab; (3) Subjects submitted their choice between two hypothetical scenarios A and B. No further information was provided about the scenarios. (4) Subjects fixed their hypothetical maximum willingness to pay for chocolate and coffee, respectively. For each chocolate and coffee subjects decided whether to buy or not to buy at each price (€1.00, €2.00, €3.00, €4.00, €5.00). Choices were presented in a 5x2 matrix analogous to the 21x3 choice sets in task 5 and task 6 of the experiment. Subjects were informed that the tutorial was a tutorial and that choices

in the tutorial would have no consequences for their payoff or for the actual experiment. After subjects completed the tutorial, the experimenter rechecked with all subjects for comprehension issues and technical problems and ensured that those were solved before starting the experiment.

3.3.3 Tasks 1–4: A standard measure of competitiveness

The first four tasks of my experiment replicate the experiment by Niederle and Vesterlund (2007). In each of tasks 1-3 subjects performed summations within a time limit of 5 min. Each summation problem consisted of five randomly chosen, two-digit numbers displayed horizontally in the center of the computer screen. When subjects submitted an answer, the program presented a new summation problem. The number of correct and incorrect answers submitted during the task as well as the information, whether the last submitted answer was correct or false, were displayed at the top of the screen. Subjects received no information regarding the performance of other subjects. After the 5 min expired, the task ended automatically and subjects could not submit additional answers. Subjects were not allowed to use calculators, but were given a pen and scrap paper to use during the session.

Subjects were shown detailed information regarding the task and payment scheme before performing the respective task. In task 1 subjects received a piece-rate payment of €0.50 per correct answer. In task 2 each group of four subjects was paid according to a €2.00 winner-take-all payment scheme (tournament). Subjects were explicitly informed in the instructions that their group included the three other subjects sitting in the same row. Under the tournament scheme only the subject who submitted the most correct answers within each group received €2.00 per correct answer, while the other three group members received no payment. Ties were broken randomly. Seats were assigned by a random draw upon subjects' arrival in the lab. Subjects could observe the other subjects in their group and session.

In task 3 subjects chose their payment scheme between the €0.50 piece-rate (PR) used in task 1 and the €2.00 winner-take-all (WTA) payment used in task 2. Subjects were explicitly informed that if they choose the €2.00 WTA tournament, then their task

3 performance would be compared to the task 2 performances of the other group-members. Ties were broken randomly.

In task 4 subjects chose retrospectively between a €0.50 PR payment and a €2.00 WTA payment for their task 1 performance. Subjects knew how many summation problems they solved correctly in task 1, but received no information regarding other subjects' performance.

In the tasks 2-4 subjects were asked to rank their performance in the respective task, i.e. the number of summation problems they solved correctly, relative to the performance of the other group-members: 1st best, 2nd best, 3rd best, or 4th best (that is, worst). Before performing task 2 subjects ranked their own task 2 performance against the other group-mates' task 2 performances, before performing task 3 subjects were asked to rank their own task 3 performance against the other group-mates' task 2 performances, and in task 4 subjects retrospectively ranked their own task 1 performance against the other group-mates' task 1 performances. Subjects were informed that they would be paid an additional €1.00 for the respective task, if they ranked their performance correctly.

3.3.4 Task 5: Multiple competitor pools in a math task

In task 5 subjects performed the same summation task as in tasks 1–3, but applied the strategy method for the subjects' payment choice between PR and WTA. Subjects chose their preferred payment for each combination of 21 different piece-rates and three different cases of the winner-take-all tournament.

For the variation of the PR I used a refined payment scheme that was introduced by Ifcher and Zarghamee (2016a) in order to provide a more detailed measure of subjects' preferences between PR and WTA payments. Subjects were offered a series of choices between various PR payments, ranging from €0.00 to €1.00, and a €1.00 WTA payment. All choices were presented vertically in a single column. The first choice was between a €0.00 PR and €1.00 WTA payment. The next was between a €0.05 PR and €1.00 WTA payment. Thereafter, the PR payment increased in €0.05 increments until it reached €1.00. This measure identifies the strength of each subject's preference for a PR

payment relative to a WTA payment by observing her switch point: the minimum PR payment the subject prefers to a €1.00 WTA payment (extracted from Ifcher & Zarghamee, 2016a, p.647).

For the variation of the WTA payment I introduced a new treatment that manipulates the subjects' probability of winning. In the WTA tournament in task 5 the subject's score was not compared to the three group-mates' scores, but compared to the task 5 score of one unknown competitor. The competitor was determined as follows: First, from all previous task 5 performances ten scores were randomly drawn[20]. Second, from these ten randomly drawn scores three competitor pools were set up: (i) an original pool, (ii) an easy pool, and (iii) a hard pool. The original pool contained the ten scores without any modification. In the easy pool the highest of the ten scores was replaced by an all-time-low score of 0 correct answers, therefore each subject's probability to win increased by 1/10 as compared to the original pool. In the hard pool the lowest of the ten scores was replaced by an all-time-high score of 20 correct answers, therefore each subject's probability to win decreased by 1/10 as compared to the original pool. Subjects fixed their switch point between PR and WTA for each pool separately. All choices were presented on a single screen, where choices for the easy pool were shown in the left column; choices for the original pool in the middle column; and choices for the hard pool in the right column (see Figure A.1 in Appendix A for a screenshot). Subjects were explicitly informed about the respective changes in their winning probability in the easy and in the hard pool.

After all payment choices were fixed one of the piece-rates and one of the pools were randomly selected and the subject's competitor was drawn from the selected pool. Before performing the summation task the subject was informed about the drawn pool; the drawn PR-level; and whether the task would be performed under PR or WTA. The subject received no information about the competitor's score.

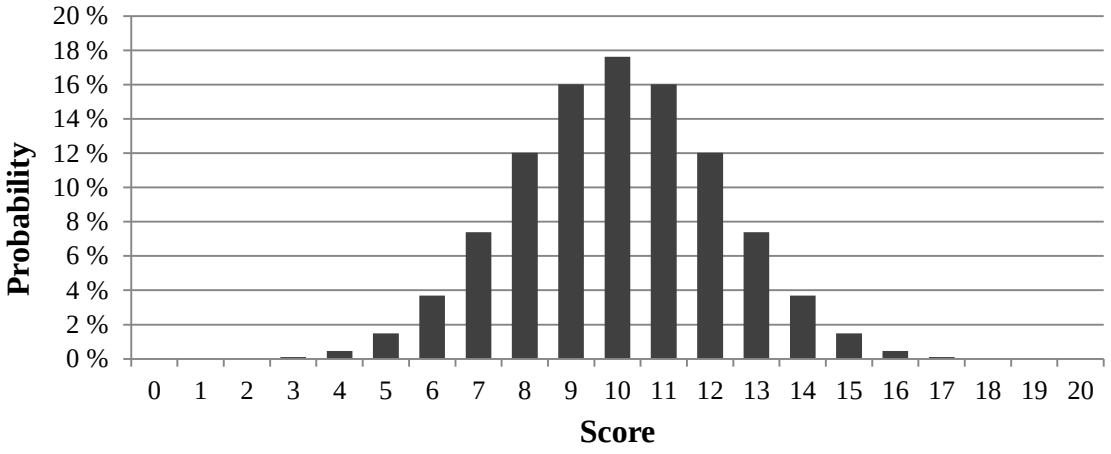
[20] For the first experimental session scores of the pilot were used.

3.3.5 Task 6: Multiple competitor pools in a non-agency task

Task 6 was designed to replicate task 5, except the summation task was replaced by a dice task similar to the task used by Ifcher and Zarghamee (2016b). In this task subjects had no agency (Ifcher and Zarghamee; 2016b). Subjects were informed that their computer would randomly roll a pair of virtual dice, each die having three white sides and three black sides; that their computer would roll the pair of virtual dice 10 times and display each roll (see Figure A.2 in Appendix A for a screenshot); that each roll was independent of all other rolls, so their rolls would not be the same as other subjects' rolls. Task 6 was entirely automated. Once the task had started, subjects could not control or alter the trajectory of the task in any way. There was no "continue," "pause," or "end" button. Thus, subjects could take no actions. Subjects were informed that the task would end automatically after 40 seconds.

Rolling a black side in the task without agency was equivalent to correctly answering a summation in the task with agency; subjects were not told this analogy. Subjects received no information regarding other subjects' rolls. Before starting the task subjects chose between each combination of a PR (ranging from €0.00 to €1.00) and a WTA (easy pool, original pool, hard pool) in the same way as in task 5. Scores in the competitor pools were randomly drawn from all previous task 6 scores. The probability of each score from 0 to 20 in task 6 was given by a binomial distribution (see Figure 3.2) and independent from the payment scheme.

Figure 3.2: Theoretical distribution of scores in the dice-task



3.3.6 Subjective probability of winning

Before subjects fixed their payment choices in tasks 5 and 6 respectively, I elicited subjects' beliefs regarding their subjective probability of winning in the WTA using an incentivized estimation question. Instead of guessing their rank as in tasks 2-4 subjects were asked in tasks 5 and 6 to guess how many out of the ten randomly drawn scores in the respective original pool were lower than their prospective own score in this task. Subjects were informed that they would be paid an additional €1.00 for the respective task, if they ranked themselves correctly.

Note that as each of the ten scores has the same chance (1/10) of being drawn from the original pool, this estimation directly implies the subjective probability of winning for all pools. Furthermore, the increase (decrease) of the winning probability that is induced by the easy (hard) pool treatment is independent of the subject's estimation[21].

3.3.7 Task 7: Measuring risk aversion

In task 7 subjects completed a standard risk-preference measure (Holt & Laury, 2002). Subjects made a series of ten choices between the paired lotteries presented in Table 3.1. The potential payoffs for the "safe" Option A (high = €4.00; low = €3.20) were less than the potential payoffs in the "risky" Option B (high = €7.70; low = €0.20). In the first decision the probability of the high payoff for both options was 1/10, so only an extreme risk seeker would choose Option B. In the second choice the probability of the high payoff for both options was 2/10 and so on up to a probability of 1 in the last choice. All choices were presented vertically on a single screen. As the right column of the table indicates, a risk-neutral individual can be expected to choose the safe Option A in the first four lines and switch to Option B in the fifth line. The ranges of an individual's relative risk aversion implied by each number of safe choices are identical to those in the original experiment by Holt and Laury (2002, table 3).

[21] This does not hold for subjects with an extreme belief. For those subjects believing that they can outperform all (none) of the ten others, the easy (hard) pool treatment has no effect. Subjects were informed about this exception.

Table 3.1: Payment choices in lottery task

Option A	Option B	Expected Payoff Difference
1/10 of €4.00; 9/10 of €3.20	1/10 of €7.70; 9/10 of €0.20	€2.33
2/10 of €4.00; 8/10 of €3.20	2/10 of €7.70; 8/10 of €0.20	€1.66
3/10 of €4.00; 7/10 of €3.20	3/10 of €7.70; 7/10 of €0.20	€0.99
4/10 of €4.00; 6/10 of €3.20	4/10 of €7.70; 6/10 of €0.20	€0.32
5/10 of €4.00; 5/10 of €3.20	5/10 of €7.70; 5/10 of €0.20	-€0.35
6/10 of €4.00; 4/10 of €3.20	6/10 of €7.70; 4/10 of €0.20	-€1.02
7/10 of €4.00; 3/10 of €3.20	7/10 of €7.70; 3/10 of €0.20	-€1.69
8/10 of €4.00; 2/10 of €3.20	8/10 of €7.70; 2/10 of €0.20	-€2.36
9/10 of €4.00; 1/10 of €3.20	9/10 of €7.70; 1/10 of €0.20	-€3.03
10/10 of €4.00; 0/10 of €3.20	10/10 of €7.70; 0/10 of €0.20	-€3.70

Note: *In task 7 subjects choose ten times between Option A and Option B. Chance of high Payoff increases by 0.1 each line. Right column shows expected payoff difference A-B.*

3.3.8 Questionnaire

After completing all seven tasks subjects completed an additional questionnaire including items regarding their demographic and other characteristics, for example, program (major), gender, year of birth, place of birth, and native language. In addition, subjects created a pseudonymous code that allows matching responses of the same subject across multiple experiments. Subjects were paid an additional €3.00, if their code matched a code in our database.

3.3.9 Payments

Subjects were paid a €5.00 fee for completing the 7 tasks. Moreover, subjects received a payment based on their performance in one of the 7 tasks. By paying only for one task, I diminish the chance that decisions in a given task may be used to hedge against outcomes in other tasks. For each subject the task to be paid was determined by a random draw after all subjects completed the questionnaire. If one of tasks 2-4 was drawn subjects received a €1.00 payment for correctly indicating their rank. If task 5 or 6 was drawn subjects received a €1.00 payment for correctly indicating the number of outperformed scores in the respective task. If task 7 was drawn one of the 10 probabilities for high payments was randomly drawn and the respective lottery was implemented. Before choosing their payment schemes for the tasks, subjects received detailed instructions regarding the calculation of their payment. Subjects were paid in

cash according to their seat number. The payment was given to each subject separately without other subjects observing the payment. Subjects exited the session after receiving their payment.

3.4 RESULTS

3.4.1 Replication of main findings of Niederle and Vesterlund (2007)

I replicate the main results of Niederle and Vesterlund (2007). In order to improve comparability I present this replication in the same way as the replication reported by Ifcher and Zarghamee (2016a, 2016b). I find no gender difference in performance in tasks 1–3, 5, and 6. In task 1 women, on average, solve 7.8 equations correctly, and the average of men is 8.1 equations ($p = 0.77$)[22]. For both genders I find subjects' performance in the summation tasks to be correlated (Spearman rank correlations range from a low of 0.586 for women between tasks 1 and 5 to a high of 0.834 for men between tasks 3 and 5). Performance of men improves significantly (but insignificantly for women) between tasks 1 and 2; performance does not increase between tasks 2 and 3; and performance of both genders increases significantly between tasks 3 and 5 (men: 8.1, 10.3, 10.2, and 11.4; women: 7.8, 8.6, 8.9, and 9.9, respectively).

In task 3 men are significantly more likely than women to favor the €2.00 WTA payment over the €0.50 PR payment (0.55 vs. 0.17, $p = 0.005$). I find no relationship between the task 3 choice and performance on tasks 1 and 2; neither for men, nor for women. Consistent with a previous replication those who choose the WTA payment do not perform significantly better in tasks 1 and 2 than do those who choose the PR payment (see Table 3.2; cf. Ifcher & Zarghamee, 2016a). For men, the improvement in performance between tasks 1 and 2 is not significantly different for those who choose the WTA versus PR payment in task 3 (2.39 vs. 1.93, $p = 0.71$). For women, however, those who choose the PR payment improve significantly more between tasks 1 and 2 than those who choose the WTA payment (1.37 vs. -1.75, $p = 0.03$). The four women who chose the WTA in task 3 reach on average even a lower score in task 2 than in task 1. This result diverges from both Niederle and Vesterlund (2007) and a recent

[22] All p-values reported in this chapter are two-sided.

replication by Ifcher and Zarghamee (2016a, 2016b). A probit regression shows that women are significantly less likely than men (marginal effect = -0.37; p = 0.002) to choose the WTA payment in task 3, controlling for the task 2 performance, the improvement in performance between tasks 1 and 2, and the payment choice in task 4.

Table 3.2: Task 1 and 2 performance
by gender and choice of task 3 payment scheme

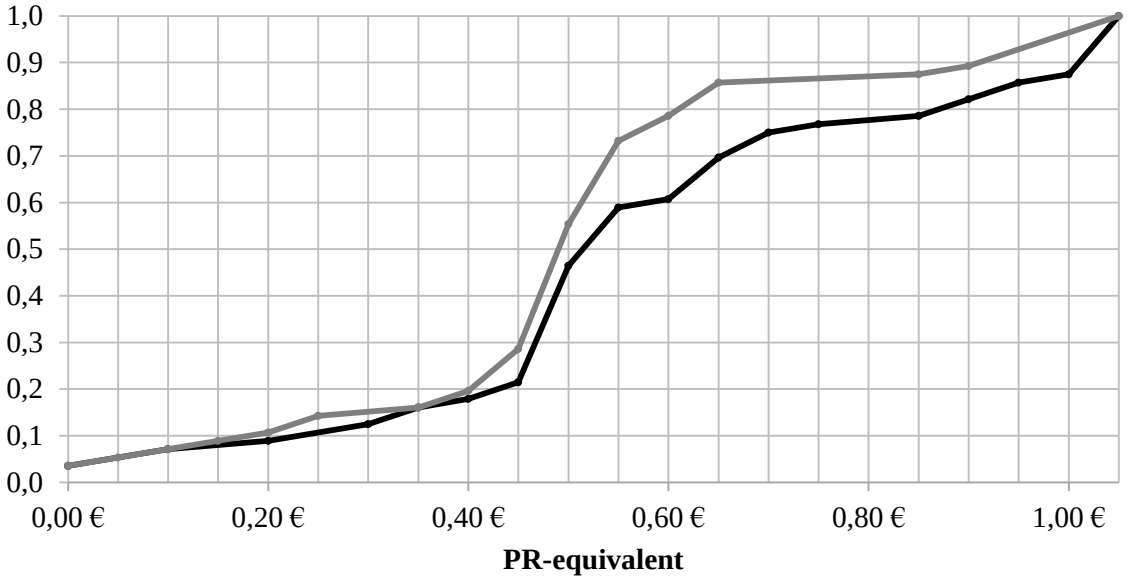
Gender	payment choice	Average performance			Obs.
	in task 3	Task 1	Task 2	Task 2 – Task 1	
Women	PR payment	7.47(2.99)	8.84(3.61)	1.37(2.59)	19
	WTA payment	9.25(2.87)	7.50(2.08)	-1.75(1.5)	4
	p value	0.29	0.49	0.03	
Men	PR payment	7.07(4.96)	9.00(4.99)	1.93(3.59)	15
	WTA payment	8.94(3.65)	11.33(4.10)	2.39(3.27)	18
	p value	0.22	0.15	0.71	

Note: *Standard errors reported in parentheses. The p values correspond to two-tailed tests of equal performance for those who chose PR versus WTA payment in task 3.*

3.4.2 Ifcher's and Zarghamee's (2016a) PR-equivalents

Ifcher and Zarghamee (2016a) suggested identifying the strength of each subject's preference for a PR payment by observing the PR payment equivalent of the WTA payment (PR-equivalent). I use a measure based on these PR-equivalents in task 5 (math task) and task 6 (dice task) of my experiment. Following Ifcher and Zarghamee (2016a) subjects who chose the WTA payment for all PR payments, including the €1.00 PR payment are coded as having a €1.05 PR-equivalent. Subjects who always chose the PR payment, even when it is €0.00 are coded as having a €0.00 PR-equivalent. Figure 3.3 shows the cumulative distribution of PR-equivalents for the WTA payment with the original competitor pool in both math task and dice task. I find neither a significance difference in mean values (math: 0.597; dice: 0.533; p=0.126), nor in median values (math: 0.55; dice: 0.5; p=0.450) between the two tasks. Fischer's exact test does not indicate a significant difference (p=0.748) between the cumulative distributions of both task's PR-equivalents.

Figure 3.3: PR-equivalents in math task and dice task



Note: *N=56. Cumulative distribution of PR-equivalents for original competitor pool in the math task (black) and the dice task (grey).*

I replicate some of the main findings presented in Ifcher's and Zarghamee's (2016a) study using the math task PR-equivalent I observe for the WTA payment with the original competitor pool. As in the original experiment I find the mean and median PR-equivalents in the math task to be significantly greater for men than women, €0.67 versus €0.49 ($p = 0.01$), and €0.65 versus €0.50 ($p = 0.006$), respectively. Subjects' task 3 choice of payment scheme (1 = WTA payment and 0 = PR payment) is highly correlated with their math-task PR-equivalent (Spearman rank correlation = 0.41, $p = 0.002$).

Analyzing relative payoffs Ifcher and Zarghamee (2016a) argue, that, compared to men, women require a 43 % premium, on average (or 37% premium when comparing median values), to choose the WTA payment in the math task. Calculating the same premium in my experiment I find that women required an average a 38.5% premium (or 30% premium when comparing median values) to choose the WTA payment in the math task. Both experiments consistently suggest that, all else equal, women require a larger payoff to compete.

I also replicate findings regarding PR-equivalents and performance indicating a positive effect of task 3 performance on the math task PR-equivalent (columns 2 & 3), but no significant effect of task 2 performance on the choice to enter the WTA

tournament in task 3 (column 4). I also find a negative effect of the self-estimated task 3 rank on the math task PR-equivalent (column 5) that turns insignificant when controlling for risk aversion (CRRA) and task 3 performance (column 6). As in the original study the gender difference remains (weakly) significant in all models, suggesting that gender differences cannot be completely explained by differences in performance, confidence, and risk aversion (Ifcher & Zarghamee, 2016a).

Table 3.3: Regression results for math task PR-equivalents

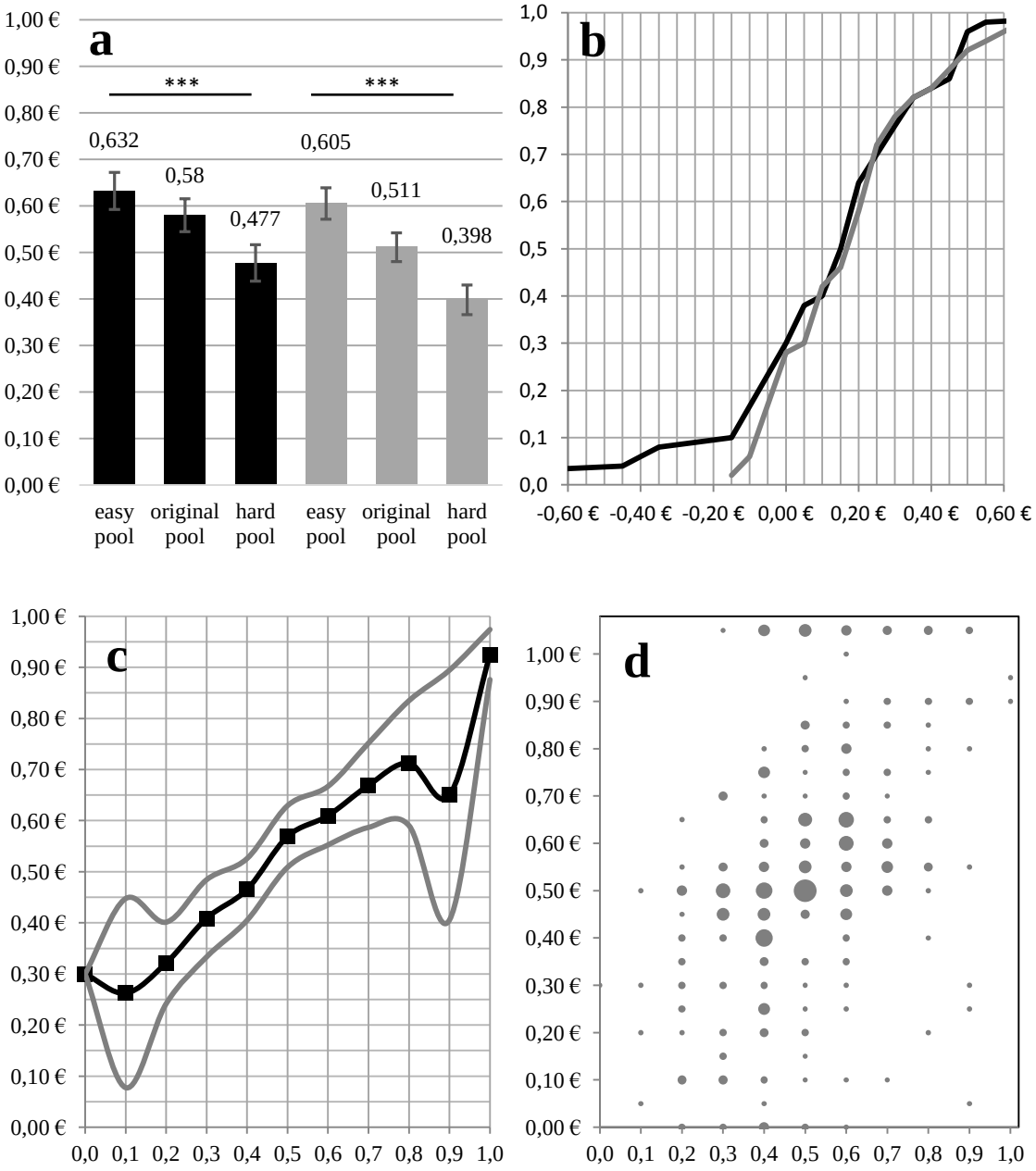
				WTA		
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.19**	-0.16*	-0.16*	-0.38**	-0.14+	-0.14+
	(0.07)	(0.07)	(0.07)	(0.12)	(0.07)	(0.07)
Task 2 performance				0.03		
				(0.02)		
Task 3 performance		0.02*	0.02*			0.01
		(0.01)	(0.01)			(0.01)
Improvement between tasks 1 and 2			-0.00	-0.03		
			(0.01)	(0.02)		
Improvement between tasks 2 and 3			-0.01			
			(0.01)			
Task 3 self rank					-0.08*	-0.05
					(0.04)	(0.05)
CRRA						-0.01
						(0.07)
Constant	0.67***	0.48***	0.46***		0.81***	0.63***
	(0.04)	(0.10)	(0.10)		(0.08)	(0.17)
Observations	56	56	56	56	56	56
R-squared	0.117	0.192	0.203		0.183	0.210

Note: *All columns but 4 report OLS estimates; the dependent variable is the math task PR-equivalent. Column 4 reports marginal effects from a probit regression; the dependent variable is an indicator variable that equals one if the subject choose the WTA payment in task 3 and zero otherwise. Standard errors reported in parentheses. ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

3.4.3 PR-equivalents and the subjective probability to win

I use an incentivized estimation to elicit subjective probability of winning in both the math task (task 5) and the dice task (task 6) for an original pool of ten potential competitors. I introduce a treatment that uses modified competitor pools to manipulate that subjective probability and compare each subject's PR-equivalents for the original pool, an easy pool (+10% winning probability), and a hard pool (-10% winning probability).

Figure 3.4: Effects of subjective winning probability on PR-equivalents



Note: ***Figure 3.4a*** *(upper left) shows average PR-equivalent of N=50 subjects by competitor pool in the math task (black bars) and the dice task (grey bars). Significance reported for difference between easy and hard pool. *** indicates statistical significance at the 0.001 level.* ***Figure 3.4b*** *(upper right) shows the cumulative distribution of the difference between hard and easy pool PR-equivalents ($PR_{easy} - PR_{hard}$) of N=50 subjects in the math task (black) and the dice task (grey).* ***Figure 3.4c*** *(lower left) shows average PR-equivalent (black) with 95% confidence interval (grey) conditional on the subjective winning probability for a total N=300 decisions.* ***Figure 3.4d*** *(lower right) shows the bivariate distribution of PR-equivalent and subjective winning probability for N=300 decisions. Size of the circles indicates number of observations.*

Six subjects indicated the belief they would outperform ten of the ten potential competitors, or none of them, respectively. By design the treatment does not fully affect

these participants. Therefore, they are excluded in further analyses. I analyze a total 300 PR-equivalent decisions by 50 individuals. Figure 3.4a shows the average PR-equivalents for all competitor pools in both tasks. I find the average PR-equivalent to be significantly higher for the easy competitor pool than for the hard competitor pool in both the math task (easy: 0.632; hard: 0.477; $p<0.001$) and the dice task (easy: 0.605; hard: 0.398; $p<0.001$). Repeating the analysis with median values yields the same result (Math: easy=0.65; hard=0.50; p=0.009; Dice: easy=0.60; hard=0.40; $p<0.001$).

Figure 3.4b shows the cumulative distribution of within-subject-differences in PR-equivalents between the easy pool and the hard pool for both tasks. Fisher's exact test does not indicate significant differences (p=0.439) between the cumulative distributions of the math task and the dice task, respectively. I further analyze all PR-equivalent decisions conditional on the estimated probability of winning, but irrespective of the task and the competitor pool. For decisions regarding the easy (hard) competitor pool, I code the subjective winning probability as the estimated winning probability plus (minus) 10%. Figure 3.4c shows the average PR-equivalent conditional on the subjective winning probability indicating a substantial positive correlation ($r=0.4256$; $p<0.001$)[23]. The bivariate distribution of PR-equivalent and subjective winning probability is shown in Figure 3.4d.

Table 3.4: Regression results for PR-equivalents

Dep. Var.: PR-equivalent	Pooled OLS regression		Individual fixed effects
	(1)	(2)	(3)
Probability of winning	0.73***	0.79***	0.84***
	(0.11)	(0.11)	(0.13)
Dice Task (contrast code)		-0.06+	-0.06+
		(0.03)	(0.03)
Probability of winning * Dice Task		0.11+	0.11+
		(0.07)	(0.07)
Constant	0.17**	0.15**	0.12*
	(0.05)	(0.06)	(0.06)
Observations (Subjects)	300 (50)	300 (50)	300 (50)
R^2 between / R^2 overall	0.108 / 0.181	0.112 / 0.187	0.112 / 0.187

Note: *Clustered standard errors reported in parentheses. ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

[23] Spearman Rank-Correlation ($\rho=0.4644$; $p<0.001$) yields the same result.

As reported in Table 3.4 subsequent regression analysis indicates a highly significant positive coefficient (0.73) of the subjective winning probability as well as a significantly positive constant (column 1). Both results are robust when controlling for the task allowing for interaction of task and winning probability (column 2) and when including individual fixed effects (column 3). These findings suggest that when the chance of winning is approximately zero, the WTA tournament is preferred to a PR lower than at least €0.12 to €0.17. When the chance of winning is approximately one, the WTA tournament is preferred to a PR lower than at least €0.90 to €0.96. Moreover, I find a weakly significant negative coefficient of the dice task (-0.06) and a weakly significant interaction effect (0.11). This suggests that the PR-equivalent for low (high) winning probabilities is higher in the math (dice) task.

3.4.4 Task performance and the maximum performance assumption

For each PR-equivalent subjects chose in my experiment the realized payment scheme was determined by a randomly drawn piece-rate. Only if the drawn piece-rate was at least as high as the PR-equivalent a subject chose for the respective competitor pool, subjects were paid according to the drawn piece-rate, otherwise the WTA tournament scheme was realized. Table 3.5 shows the realized payment schemes in the math task and the dice task.

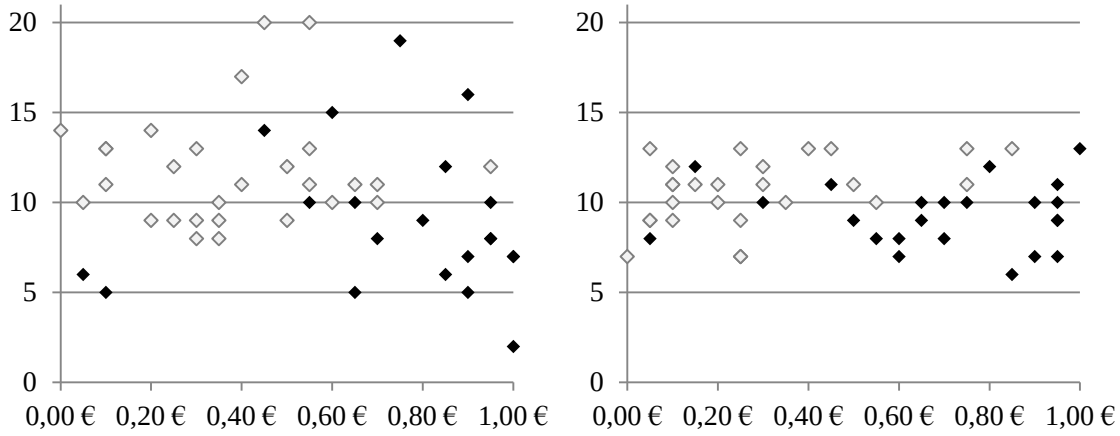
Table 3.5: Realized payment schemes

Realized Payment Scheme	Math Task		Dice Task	
	N	Av. PR draw	N	Av. PR draw
Piece-Rate	22	€ 0.73	24	€ 0.68
WTA Tournament	28	€ 0.38	26	€ 0.28
Total	50	€ 0.54	50	€ 0.48

The exogenous random piece-rate draw enables me to test the plausibility of the maximum performance assumption. As shown in Section 3.2.1, when the piece-rate payment scheme is realized, optimal performance increases with the piece-rate draw, but maximum performance does not. While it is guaranteed that the maximum performance assumption holds in the dice task, it is unclear for the math task.

In my sample 22 subjects performed the math task under the piece-rate scheme. The correlation between the realized piece-rate and the math performance of these subjects is close to zero (r = -0.0210). Figure 3.5 illustrates realized performance of subjects in tasks 5 and 6 for different levels of the randomly drawn piece-rate. This provides no indication of performance optimization, but is consistent with the assumption that individuals provide their maximum performance in the math task.

Figure 3.5: Exogenous random piece-rate draw and task performance



Note: *N=50. Math performance (left) and dice task score (right) under a piece-rate payment scheme (black) or a WTA tournament payment scheme (grey) by random piece-rate draw.*

3.4.5 Quantifying the value of competing and winning

The previous analysis indicates substantial effects of the subjective winning probability on PR-equivalents. However, such effects can be expected even in the absence of competitive preferences, since the relative expected payoff of the WTA tournament is driven by the probability of winning. In order to isolate competitive preferences and to quantify the values of competing and winning in my experiment, I adjust the observed PR-equivalents for revealed risk aversion as well as for the subjective winning probability, which includes overconfidence[24]. In order to quantify the total values rather than per-point-values I then multiply with the subject's task 5 performance. Table 3.6 shows summary statistics of the measures included.

[24] Quantifying the individual values of competing and winning does not imply that subjects themselves calculate such values during the experiment.

Table 3.6: Summary statistics

N = 50			Quantiles						
	mean	st.dev.	min	p10	p25	p50	p75	p90	max
PR-equivalent									
Math | easy pool	0.632	0.282	0.00	0.20	0.50	0.65	0.80	1.05	1.05
Math | original pool	0.580	0.250	0.00	0.30	0.50	0.55	0.70	1.05	1.05
Math | hard pool	0.477	0.277	0.00	0.10	0.30	0.50	0.65	0.88	1.05
Dice | easy pool	0.605	0.238	0.00	0.33	0.45	0.60	0.75	1.00	1.05
Dice | original pool	0.511	0.220	0.00	0.23	0.45	0.50	0.55	0.75	1.05
Dice | hard pool	0.398	0.225	0.00	0.10	0.25	0.40	0.50	0.65	1.05
Estimated winning Prob.									
Math	0.526	0.204	0.10	0.30	0.30	0.50	0.70	0.80	0.90
Dice	0.462	0.097	0.30	0.30	0.40	0.50	0.50	0.50	0.80
CRRA[25]	0.416	0.496	-0.49	-0.15	-0.15	0.41	0.68	0.97	1.37
Math-Performance	10.560	3.791	2.00	6.00	8.00	10.00	13.00	15.50	20.00

Since my previous analysis suggests, that the maximum performance assumption holds for the math task, I am able to pool responses from both tasks and increase the degrees of freedom substantially. For each of the six decisions *d* of each subject *i* I calculate the deviation y_{id} from the PR-equivalent that would maximize expected utility in the absence of competitive preferences.

$$y_{id} = PRequivalent_{id}^{(1-CRRA_i)} - WinningProbability_{id} \qquad (3.6.1)$$

I regress the deviation y_{id} on the subjective winning probability, derive individual coefficients β_{COMPi} and β_{WINi}, and calculate the individual value of winning (equation 3.6.3) as well as the individual value of competing (equation 3.6.4) for each subject:

$$y_{id} = \beta_{COMPi} + \beta_{WINi} * WinningProbability_{id} + \varepsilon_{id} \qquad (3.6.2)$$

$$value\ of\ winning = \beta_{WINi}^{\frac{1}{1-CRRA}} * Performance_i \qquad (3.6.3)$$

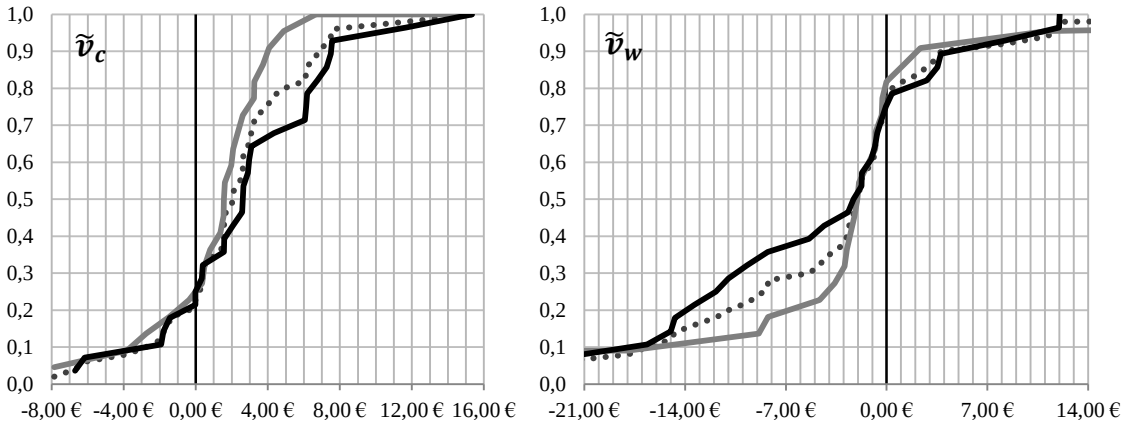
$$value\ of competing = \beta_{COMPi}^{\frac{1}{1-CRRA}} * Performance_i \qquad (3.6.4)$$

Figure 3.6 shows the cumulative distribution of the values of competing and winning. I find evidence for a positive (non-monetary) value of competing (mean=2.19, $p<0.001$) in my sample. Testing the median yields the same result

[25] The risk measure by Holt and Laury (2002) specifies an interval of the CRRA parameter for each individual. The reported results use the lower bound of these intervals, but using the interval midpoint or upper bound instead does not change my conclusion. Tables B.1 and B.2 are provided in Appendix B and report results for both alternative risk adjustments.

(median=2.07, p<0.001). On average subjects reveal a willingness to give up €2.19 (median=€2.07) of risk-adjusted expected payment in order to compete in a WTA tournament. I do not find evidence for a (non-monetary) value of winning (mean=-6.63, p=0.189) in my sample. Testing the median even yields a negative value of winning (median=-1.98, p<0.001).This suggests that in my experiment subjects are not willing to give up any risk-adjusted expected payment for the chance of winning a WTA tournament, but may even prefer a (harder) competition with a lower winning probability.

Figure 3.6: Non-monetary values of competing and winning



Note: *N=50. Cumulative distribution functions of the Value of competing (left) and the Value of winning (right). For both values the figure shows the distribution for males (black) and females (grey) as well as the overall distribution (dashed line).*

Moreover, I test for gender differences in both competitive preferences. While I observe a higher average value of competing for males than for females, this difference is not significant (Two-sample t test: diff=2.98-1.19=1.79>0, t=1.52, p<0.136). Testing for median differences (male: 2.62; female: 1.59; p=0.393) yields the same result. The average value of winning is negative for males and even lower for females, but this difference is insignificant (Two-sample t test: diff=-4.60+9.22=4.62>0, t=0.46, p<0.650) in my sample. Testing for median differences (male: -2.02; female: 1.98; p=0.776) yields the same result. This result is consistent with the study of van Veldhuizen (2017), who found that after controlling for overconfidence and risk preferences within a refined experimental design the gender difference in self-selection into competition did not imply a gender difference in competitive preferences.

3.4.6 Relating to other measures of competitiveness

Table 3.7 shows spearman correlations of the values of competing (*Vcomp*) and winning (*Vwin*) with the standard competitiveness measure of Niederle and Vesterlund (2007) and the PR-equivalents (Ifcher & Zarghamee, 2016a). *Vcomp* and *Vwin* are calculated based on the observed PR-equivalents of tasks 5 and task 6, therefore these measures are related by design. The resulting correlations are reported to illustrate these relations, but are not to be interpreted as a finding of my study. For both tasks *Vwin* is positively (negatively) correlated with the PR-equivalent of the easy (hard) competitor pool, but shows no substantial correlation with the original pool. Hence, *Vwin* reflects the difference subjects make between easy and hard competitions. *Vcomp* is most positively correlated with the PR-equivalents for the hard competitor pools. Hence, *Vcomp* is most reflective of subjects' decisions in hard and challenging competitions with lower a probability of winning.

Table 3.7: Spearman Correlations

N = 50			PR-equivalent						
	Vcomp	Vwin	Math easy pool	Math original pool	Math hard pool	Dice easy pool	Dice original pool	Dice hard pool	WTA round 3
Value of competing	1.000								
Value of winning	**-0.835*****	1.000							
PR-equivalent									
Math | easy	-0.134	**0.390****	1.000						
Math | original	0.142	0.037	**0.665*****	1.000					
Math | hard	**0.438****	**-0.280***	**0.435****	**0.611*****	1.000				
Dice | easy	-0.030	**0.247**+	**0.413****	**0.323***	**0.323***	1.000			
Dice | original	**0.258**+	0.022	**0.308***	**0.341***	**0.473*****	**0.588*****	1.000		
Dice | hard	**0.605*****	**-0.415****	0.183	**0.384****	**0.433****	**0.331***	**0.562*****	1.000	
Pref. for WTA (task 3)	**0.253**+	-0.204	**0.295***	**0.462*****	**0.484*****	0.119	0.141	0.218	1.000
CRRA	**0.237**+	-0.131	0.069	0.022	-0.002	-0.157	-0.035	0.140	-0.090
Overconfidence Math	-0.170	0.103	-0.043	0.082	**0.253**+	-0.007	0.094	-0.027	0.174
Overconfidence Dice	0.023	-0.024	-0.090	-0.094	-0.029	-0.100	-0.087	-0.141	0.088
Math-Performance	**0.302***	-0.115	**0.403****	**0.325***	0.216	0.194	0.149	0.166	**0.351***
Pref. for WTA (task 4)	0.064	-0.059	0.169	0.042	0.172	-0.122	-0.022	-0.144	0.151

Note: *Spearman rank correlations. Vcomp and Vwin are calculated based on the observed PR-equivalents of task 5 and task 6, therefore these measures are related by design. ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

The binary choice between piece-rate payment and winner-take-all tournament (task 3) is the standard measure of competitiveness introduced by Niederle and Vesterlund (2007) and widely used in behavioral studies (e.g. Buser et al., 2014; 2017).

I observe a positive correlation between the value of competing (*Vcomp*) and the task 3 payment choice, while the value of winning (*Vwin*) is not significantly correlated with this standard measure of Niederle and Vesterlund (2007).

Niederle and Vesterlund (2007) argued that the preference to enter the WTA tournament reflects an individual's enjoyment of competition, but that each individual's decision to enter the WTA (or choose the PR) can be driven by this preference as well as other factors such as overconfidence or risk aversion. In their analysis Niederle and Vesterlund (2007) controlled for the confounding factors and attributed the residual gender gap to the preference for competition without having to identify the individual utility or valuation of competition.

Table 3.8: Regression Results

	(1)	(2)	(3)	(4)	(5)
Dep. Var.:	WTA task 3	WTA task 3	WTA task 3	PR-equivalent	PR-equivalent
	OLS	OLS	probit mfx	pooled OLS	pooled OLS
Value of competing	0.03(0.02)+	0.04(0.02)*	0.05(0.03)+	0.01(0.01)+	0.01(0.01)+
Value of winning	0.00(0.00)	0.00(0.00)	0.00(0.01)	0.00(0.00)**	0.00(0.00)**
Dice Task (contrast code)					-0.04(0.03)
Value of competing * Dice					0.00(0.01)
Value of winning * Dice					-0.00(0.00)
Overconfidence Math		0.04(0.02)+	0.05(0.03)+	0.01(0.01)	0.01(0.01)
Overconfidence Dice		0.01(0.02)	0.01(0.02)	-0.01(0.01)	-0.01(0.01)
CRRA		-0.16(0.15)	-0.19(0.16)	-0.02(0.07)	-0.02(0.07)
Constant	0.32(0.08)***	0.31(0.10)**		0.53(0.05)***	0.53(0.05)***
Observations (subjects)	50(50)	50(50)	50(50)	100(50)	100(50)
R^2 between / R^2 overall	-- / 0.066	-- / 0.148		0.141/ 0.097	0.141/ 0.122

Note: *Columns 1and 2 report coefficients of linear probability models. Column 3 reports marginal effects (mfx) from probit regression. Columns 4 and 5report coefficients of pooled OLS for PR-equivalents in both tasks and original competitor pools. Standard errors reported in parentheses. Columns 4 and 5 report clustered standard errors (clustered on subject level). ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

I use *Vcomp* and *Vwin* to decompose the individual decision to enter the WTA tournament (task 3) into the effects of enjoying the competition, seeking to win the competition, and the effects of other factors like risk preferences and overconfidence. Table 3.8 columns 1 – 3 consistently show a (weakly) significant positive effect of *Vcomp*, while *Vwin* has no significant effect. My results suggest that an additional €1.00 in the Value of competing increases the probability of self-selecting into the tournament

by 5 percentage points. Given the observed distribution of *Vcomp* the subject at the 3rd quartile (€4.06) is about 19 percentage points more likely to enter the WTA tournament than the subject at the 1st quartile (€0.33). Moreover, I find a positive effect of overconfidence in the math task, suggesting that overestimating the chance of winning by 10 percentage points increases the probability of self-selecting into the tournament by 5 percentage points. Columns 4 and 5 illustrate the relation between *Vcomp* and *Vwin* and the PR-equivalent for the original competitor pool in both math task (task 5) and dice task (task 6). After adjusting for the subjective winning probability, risk preferences, and performance expectations, both values are still positively related to the PR-equivalent (column 4). This relation does not depend on the type of task (column 5).

3.5 DISCUSSION

3.5.1 Summary of results

In this chapter I introduce a simple utility model describing indifference conditions for an individual's choice between competitive tournaments and non-competitive environments. In the benchmark model without competitive preferences the subjective probability of winning determines the piece-rate equivalent of the competitive tournament. I distinguish maximum performance environments, where individuals provide their maximum feasible performance, from optimal performance environments, where they do not. For both types of environments I show the relation between performance expectations and the piece-rate equivalent. Under the maximum performance assumption I demonstrate how the introduction of two distinct competitive preferences – (1) a non-monetary value of competing, and (2) a non-monetary value of winning the competition – changes the indifference condition, i.e. the piece-rate equivalent.

In my experimental treatment I manipulate the probability of winning a competitive winner-take-all tournament and identify a causal effect of the treatment on subjects' choice of a PR-equivalent. This effect does not differ between a math task, where performance depends on ability and effort, and a dice task, where performance is the result of pure luck. Moreover, my results suggest that subjects provide their maximum performance in the math task. In order to identify competitive preferences I

calculate the deviation from the quantitative prediction of the benchmark model and separate it into an individual value of competing and an individual value of winning. My experiment provides evidence for a positive average non-monetary value of competing among my subjects. Moreover, the individual value of competing is shown to increase the likelihood of entering the tournament in a classical competitiveness experiment (Niederle & Vesterlund 2007) substantially. This result confirms the conjecture of previous research that self-selection into competitive environments is driven by an enjoyment of competition (Niederle & Vesterlund, 2007; Bönte, Procher, Urbig, & Voracek, 2017b). I am not able to identify a non-monetary value of winning. The average value of winning does not differ significantly from zero. The estimated individual value of winning does not have an effect on the likelihood of entering the tournament in a classical competitiveness experiment.

3.5.2 Limitations

My conclusions are limited to the scope of the theoretical model. I analyze an individual's choice between competitive winner-take-all tournaments and their respective piece-rate equivalents. It is unclear, if and how my results are generalizable to other competitive and non-competitive environments. I include a value of competing and a value of winning and analyze their effects on the piece-rate equivalent of the competitive environment under the maximum performance assumption. Hence, my results apply only to environments, where individuals provide their maximum feasible performance. Moreover, I include risk preferences in a very simple way and assume constant relative risk aversion. A more detailed emphasis on risk preferences, which for instance includes skewness preferences (e.g. Brunnermeier, Gollier, and Parker, 2007) is likely to provide valuable additional insights.

My measure of competitive preferences is based on subjects' deviation from the benchmark model of utility maximizing without competitive preferences. Whenever such a deviation from more "rational" decision making is measured, the results are prone to reflect imperfectly random irrationality (including a lack of comprehension) rather than meaningful behavioral tendencies. I tried to increase comprehension levels of my subjects by presenting a tutorial in each session before running the actual experiment. Moreover, I demonstrate the relation of the observed value of competing to

established measures competitiveness (cf. Niederle & Vesterlund, 2007). The relation shown by comparison of these two behavioral measures is, unlike the effect of my experimental treatment, not to be interpreted causally.

Moreover, as I apply a within-subject design the uniqueness of my subject pool may induce biased results. While I cannot completely rule out this problem, I am able to replicate main findings of previous studies by Niederle and Vesterlund (2007) as well as Ifcher and Zarghamee (2016a), which supports the assumption that my subject pool and experimental setting are consistent with those examined in previous research.

3.5.3 Implications

1. Different environments to study competitiveness

Despite these limitations my study presented in this chapter has important implications for future research. In my model I have distinguished between optimal performance environments and maximum performance environments, where individuals provide their maximum feasible performance, e.g. because they can only provide a restricted amount of effort. My model suggests, that self-selection into competition and behavior within competition are not only conceptually distinct, but do also require different environments to be studied most effectively. An investigation of effort behavior and performance within competition may be most insightful, when all individuals optimize their performance without such restrictions. If some, or all individuals face a performance restriction, performance effects are likely to be only imperfectly observable.

My model suggests that self-selection into competition and performance within competition are interlinked in optimal performance environments. I show that the optimal performance in the competitive tournament is higher than under the non-competitive piece-rate equivalent as long as the chance of winning increases with higher performance and that these anticipated performance differences affect an individual's choice between a competitive and a non-competitive environment. In environments where individuals provide maximum performance self-selection into competition can be disentangled from performance effects and competitive preferences can be identified without the elicitation of the performance distribution anticipated by each individual for

each environment. Hence, these environments are likely best suited for studies of competitive preferences and their effects on self-selection into competition.

In most real world situations, such as workplace environments, we cannot expect the maximum performance assumption to hold. Often in these environments competition is implemented with the very purpose of increasing performance (Lazear & Rosen, 1981; Connelly et al., 2014). This highlights the importance of controlled laboratory environments for the study of individual competitive preferences. However, in the math tasks frequently used in economic experiments measuring competitiveness (e.g. Niederle & Vesterlund, 2007; Buser et al., 2014; Wozniak et al., 2014) we do not know, whether the maximum performance assumption holds. Non-agency tasks (Ifcher & Zarghamee, 2016b) can ensure, that by design the maximum performance assumption holds, and therefore, might be considered as an alternative for future experiments. If researchers seek to isolate competitive preferences, but prefer math tasks for other reasons, the maximum performance assumption can be tested, for instance, by comparing performance under different piece-rate levels.

2. Individuals value competing

I provide a utility-based benchmark model that predicts the piece-rate equivalent of a competitive tournament and accounts for an individual's (over-)confidence and risk preferences. Consistent with my model individuals in my study adjust their piece-rate to a manipulation of the chance of winning, but observed piece-rate equivalents deviate from the benchmark model in a systematic way. My results imply that individuals value competing. Hence, competitive preferences are shown to be a distinct phenomenon, which is not fully explained by other factors such as risk preferences and (over-)confidence. Further theoretical and experimental examination of these preferences is therefore a promising field for behavioral economists. The identification of quantifiable individual values of competing and winning shown in this study provides a refined measurement method for future research. Individuals deviate from payoff maximization giving up a quantifiable amount of money for their valuation for competition. This amount is rather independent of individual chances of winning and hence reflects a value of competing itself rather than a value of winning the competition.

3. Individuals do not value winning?

While the piece-rate equivalents observed in my study provide empirical evidence, that individuals value competing, I am not able to identify a non-monetary value of winning. For the majority of subjects my calculation yields negative values. A negative value of winning indicates that subjects prefer competitive settings with lower chances of winning. One possible explanation for such a preference to enter harder competitions might be some sort of seeking competitive challenges. In this case the value of winning is likely underestimated. However, it might also be necessary for contests to include an element of status (Moldovanu, Sela, & Shi, 2007) in order to generate the symbolic value of winning (Delfgaauw et al., 2013). In this case the value of winning in itself would not be a distinct preference. Additional research is required to understand the role of winning for self-selection and performance in competitive environments.

4. Competitive preferences independent from gender differences

Previous research has often used gender comparisons as identification for heterogeneity in competitive preferences (see Croson & Gneezy, 2009; Niederle 2017 for reviews). In recent work van Veldhuizen (2017) re-examines the gender difference in competitiveness and questions the relevance of competitive preferences in the absence of such a gender difference. The value of competing presented in my study allows an investigation of individual competitive preferences, which is conceptually and empirically independent from the identification of gender differences in such preferences. Consistent with the study of van Veldhuizen (2017) I observe gender differences in self-selection into the competitive environment, but I do not observe significant gender differences in the value of competing. However, this does not suggest the irrelevance of competitive preferences itself. As discussed above I provide empirical evidence that individuals value competing and that this can be considered a distinct preference. My design allows comparing individual decisions to a benchmark model, and hence, investigating individual heterogeneity in competitive preferences without relying on group differences, such as a gender gap.

Chapter IV

Entrepreneurs embrace Competition: Evidence from a lab-in-field study

"I am asserting that entrepreneurship and competition are two sides of the same coin: that entrepreneurial activity is always competitive and that competitive activity is always entrepreneurial" (Kirzner 1973, p. 94)

4.1 INTRODUCTION

Israel M. Kirzner's above-quoted assertion tightly links entrepreneurship to competition suggesting that individuals who embrace competition might be those who are attracted to entrepreneurship. Consistently, Joseph A. Schumpeter describes entrepreneurs as being driven by "the will to conquer; the impulse to fight, to prove oneself superior to others" (Schumpeter, 1934, p. 93). Despite Kirzner's and Schumpeter's well-known disagreement on the economic function of the entrepreneur[26], these two distinguished theoreticians seem to agree that entrepreneurial activity is inherently competitive and that entrepreneurs tend to embrace competition.

While Kirzner (1973) and Schumpeter (1934) have notably influenced current entrepreneurship research in many ways, their observation that entrepreneurship is linked to competition implying that becoming an entrepreneur means selecting into a

[26] Kirzner (1973) suggests that entrepreneurial activities tend to drive markets towards equilibrium, while Schumpeter (1934) suggests that that these activities are the driving force behind market disequilibria. Recently, Acs, Åstebro, Audretsch, and Robinson (2016, p.37-38) summarize these two perspectives as Kirzner referring to entrepreneurship as "competition in the market" and Schumpeter referring to "competition for the market".

particularly competitive environment has been almost completely ignored in entrepreneurship research. Reviewing the recent extensive literature on the personality of entrepreneurs, Kerr et al. (2018) highlight several personality traits, but individuals' attitudes towards competition, such as those described by Schumpeter (1934), are not emphasized. Competition only indirectly enters the review through entrepreneurs' optimistic beliefs about their abilities relative to others. Furthermore, Rauch and Frese (2007) introduce, based on a survey among expert researchers, entrepreneurs' personality characteristics that can be matched to specific tasks of entrepreneurs. While Kirzner (1973) describes the entrepreneurial task as inherently competitive, individuals' attitudes towards competition are not considered by Rauch und Frese (2007) as one of the personality characteristics of entrepreneurs that match with the specific demands of entrepreneurial environments.

Outside the context of entrepreneurship empirical studies suggest that individual competitiveness measured by economic experiments is related to selection into more competitive educational and occupational environments (e.g. Buser et al., 2014, 2017; Reuben et al., 2015; Almås, Cappelen, Salvanes, Sorensen, & Tungodden, 2016). Entrepreneurship as an environment particularly attractive for competitive individuals, however, has received just as little attention in economic research as in recent entrepreneurship research (see Bönte & Piegeler, 2013, and Holm, Opper, & Nee, 2013, as exceptions).

In Chapter IV we address the relationship between entrepreneurship and individual competitiveness. In order to improve our understanding of this link, we apply the general framework of individual competitiveness introduced in Chapter I highlighting three different motives to self-select into competitive environments. We link each of these motives to entrepreneurship and hereby connect entrepreneurship research to psychological research, which has identified these different motives to enter competitive environments, i.e. a desire to win, personal development and mastery of tasks, and enjoyment of competition (e.g. Ryckman et al., 1990, 1996; Newby & Klein, 2014, Houston et al., 2002b). While individual competitiveness has rarely been explicitly addressed in entrepreneurship literature, two of the three motives of competitiveness are at least indirectly linked to constructs discussed in entrepreneurship research. First, a strong desire to win can result in higher efforts to win a competition but may also lead to aggressive or even unethical behavior (Ryckman et al., 1990;

Houston et al., 2002a; Newby & Klein, 2014). A positive association between such behaviors and entrepreneurship has already been demonstrated in the literature (e.g., Berge, Bjorvatn, Pires, & Tungodden, 2015; Utsch, Rauch, Rothfuß, & Frese, 1999; Hmieleski & Lerner, 2016; Levine & Rubinstein, 2017). Second, striving for personal development and mastery of tasks may also affect individuals' decision to enter competitions (Ryckmann et al., 1996, Newby & Klein, 2014). This facet of competition is closely related to achievement motivation, which is often viewed as one of the most prominent characteristics of entrepreneurs (e.g. McClelland, 1965, Rauch & Frese, 2007).

The relationship between entrepreneurship and enjoyment of competition, however, has not been investigated in entrepreneurship research. Our previous analysis in Chapters II and III suggests, that individuals' decisions to self-select into competitive environments in incentivized economic experiments are driven by their enjoyment of competition and that such an enjoyment of competition reflects a non-monetary value individuals gain by competing. In Chapter IV we examine the relevance of individuals' enjoyment of competition for career choices. We hypothesize that entrepreneurs decide to enter a competition for the sake of competition itself, independent of the prospect of winning the competition or personal development and mastering the tasks in the competition. If entrepreneurs had a stronger general tendency to favor competitive over non-competitive environments than non-entrepreneurs and if this tendency was driven at least partially by enjoyment of competition, this could have relevant practical implications. For instance, among the three facets of individual competitiveness, especially the enjoyment of competition might provide an additional explanation for potentially excessive market entry by entrepreneurs and perseverance in face of low odds of success and in face of a lack of controllability, e.g. due to the influence of pure chance, beyond the well-known factors such as overconfidence (cf., Camerer & Lovallo, 1999) and high willingness to take risks[27] (e.g., Caliendo, Fossen, & Kritikos, 2009, Wu & Knott, 2006).

[27] Given that there is substantial work demonstrating a lack of relevance of risk preferences (e.g., Busenitz & Barney, 1997; Miner & Raju, 2004; Palich & Bagby, 1995; Wu & Knott, 2006) and, in particular, Holm et al. (2013) report that general risk preferences are not distinguishing entrepreneurs from others, but only preferences related to risks in strategic interaction, including competitions, enjoyment of competition might even be more important and explain some of the seeming risk taking of entrepreneurs.

Following recent economic literature that relates individuals' self-selection into competitive environments in incentivized economic experiments to career choices (e.g. Almås et al., 2016, Buser et al., 2017; Buser et al., 2014; Reuben et al., 2015), we adapt the experimental design introduced by Niederle and Vesterlund (2007), where participants perform well-defined tasks and choose between two performance-related payment schemes. Participants can choose between a non-competitive piece-rate payment scheme and a competitive winner-take-all tournament payment scheme. Conducting a "lab-in-the-field" study with 224 visitors at a shopping mall in a large German city we demonstrate that entrepreneurs—both revealed entrepreneurs (individuals who are or have been entrepreneurs) and potential entrepreneurs (who consider entrepreneurship a possible future option)—are more likely to select into competition than non-entrepreneurial individuals (who have no intention at all to start a business)[28].

We employ an experimental design that allows us to examine the extent to which entrepreneurs' tendency to select into competitive environments is driven by enjoyment of competition rather than driven by a desire to win or achievement motives. We isolate enjoyment of competition from a desire to win by showing that this effect does not depend on entrepreneurs' levels of confidence in winning the competition. If individuals' enter competitions despite believing that they are unlikely to win, their preferences for competition are not solely driven by their desire to win.[29] Moreover, we isolate enjoyment of competition from achievement motivations by showing that the effect holds for both a skill-related task, i.e. verifying simple single-digit equations (Mayr et al., 2012), and a skill-independent task, i.e. rolling dice (Ifcher & Zarghamee, 2016b). In contrast to the math-based competition, the outcomes of the dice task are determined by chance only. Individuals' selection into this dice-based competition does

[28] For the sake of this chapter, we follow Blanchflower and Oswald (1998) and use the terms entrepreneurship and self-employment interchangeably by employing a conceptualization of entrepreneurship of a medium scope; that is, beyond individuals starting their own business with the intention to grow and employ other people, we also include individuals who run their own business without employees or without the intention to grow. However, we exclude people who act entrepreneurially in an employment position, such as managers or any sort of corporate entrepreneurs or employees who manage corporate spin-offs without actually owning that spin-off. A more differentiated analysis of revealed entrepreneurs distinguishing between start-up founders and other forms of self-employment is provided in Chapter V.

[29] If individuals enter competitions despite believing that they will not win, their preferences for competition are not solely driven by their desire to win. As discussed above, if individuals have a strong desire to win and do not believe that they can win, then it will be less likely that they enter competitive environments.

not tend to be driven by skill-related considerations such as individuals' striving for personal development or achievement motivations, which include mastery of tasks and the demonstration of skills.

We test the association of entrepreneurship and enjoyment of competition for both revealed entrepreneurs, who have experience in entrepreneurship, and potential entrepreneurs, who have no entrepreneurial experience but are considering starting their own businesses in the future. Thereby we tentatively examine whether individuals' behavior in economic experiments is related to selection into entrepreneurship.

In the remainder of this chapter we discuss the respective conceptual relations between the three distinct motives of individual competitiveness and entrepreneurship in Section 4.2. We focus on their critical contingencies, which need to be distinguished to isolate enjoyment of competition. Building on this discussion Section 4.3 then outlines our empirical approach. Following a report of our results and a large set of robustness checks in Section 4.4, Section 4.5 discusses how our findings contribute to entrepreneurship and economics research.

4.2 CONCEPTUAL BACKGROUND

In psychological, economic, and entrepreneurship research the notion of competitiveness has various meanings. In order to clarify our conceptualization of individual competitiveness, we separate our conceptualization that focuses on individuals' selection into competitive environments from other conceptualizations that focus on the ability to win in competitions or on behavior within competitive environments. We then highlight three facets of individual competitiveness, namely enjoyment of competition, desire to win and personal development, and discuss how these facets can be linked to entrepreneurship research. We thereby document that enjoyment of competition is the one of the three facets that has not yet been convincingly linked to entrepreneurship.

4.2.1 Individual competitiveness

As discussed in the general framework in Chapter I we follow previous psychological and economic research that focuses on *individual competitiveness* defined as individuals' general tendency to favor competitive over non-competitive environments. This reflects a competitive preference which is distinct from risk preferences and overconfidence. As any competition implies a chance of winning and a risk of losing, both risk preferences and overconfidence may make competitive environments more attractive, but they both do not relate to a unique preference for competitive versus non-competitive environments (Niederle, 2017; Niederle & Vesterlund, 2007). Competitive environments are characterized by institutions where individuals' goals are not simultaneously achievable given the sets of possible behaviors. Hence, in competitive environments every attempt of individuals to get closer to their own goals makes it less likely for other individuals to achieve their goals (Deutsch, 1949; Lazear, 1999). This negative relationship of individuals' goals can be established, for instance, by "the perceived presence of a rival or a group of competitors who serve as performance standards for the individual" (Smither & Houston 1992, p. 408). This very general definition of competitive environments also comprises environments where the performances of individuals are not under their control or where the performances are neither affected by efforts of individuals, nor by their abilities and skills. According to this conceptualization of individual competitiveness, competitive individuals select into competitive environments, because they have preferences over particular institutions linking individuals' performances to their rewards, but not because they have preferences over particular tasks they are competing in.

Our conceptualization differs from two other conceptualizations of competitive individuals that have been used in previous research, but relate to completely different settings and mechanisms. First, competitiveness is sometimes defined as individual ability to win competitions or to perform better than others (e.g., Manning & Taylor, 2001; Hönekopp et al., 2006). While the ability to win a competition may indirectly affect individuals' decisions to select into competitions, a high probability of winning does not imply that an individual has a unique preference for competitive over non-competitive environments (Niederle & Vesterlund, 2007). A general tendency to favor

competitive environments, as suggested here, implies that an individual tends to select into competitions, irrespective of the own ability to win.

Second, following economic research (Croson & Gneezy, 2009), we separate the tendency to enter competitive environments from individuals' behavior within competitive environments. Alfred Marshall (1920), for instance, asserts that "a manufacturer or a trader is often stimulated much more by the hope of victory over his rivals than by the desire to add something to his fortune" (p.19) and, hence, accepts lower profits within a competition for the sake of winning. Aggressive behavior in competitive environments does not necessarily imply, however, that individuals generally like situations in which they compete with others. For instance, individuals who dislike competitions may be forced to enter competitive environments and may respond to this by competing aggressively. While aggressive behavior in competitions has already been associated with entrepreneurs (e.g., Utsch et al., 1999; Hmieleski & Lerner, 2016), such behavioral tendencies within competitive environments are distinct from preferences to enter competitions.[30] Relatedly, individuals maximizing own rewards relative to others' rewards have also been considered to be competitive individuals (e.g., van Lange et al., 1997; Fehr and Schmidt, 1999) and these distributional preferences have been linked to selection into entrepreneurship (e.g., Weitzel, Urbig, Desai, Acs, & Sanders, 2010). While significant correlations between such distributional preferences and individual competitiveness have been reported (Bartling et al., 2009), distributional preferences also differ from our conceptualization of individual competitiveness, because they relate to behavior in contexts where individuals' rewards are mutually dependent on one another, that is, to behavior within competitive environments, but not to preferences to select into such environments. In sum, the two presented alternative conceptualizations of competitiveness refer to individuals' behaviors and performances within competition, but do not focus on selection into competitive environments, which is the focus of our research.

[30] In psychological research the individual competitiveness as a preference for competition and behavior within competitions are sometimes viewed as one construct. For instance, hypercompetitiveness as "an indiscriminate need by individuals to compete and win (and to avoid losing) at any cost" (Ryckman et al. 1990, p. 630) and the competitiveness dimension in the work and family orientation questionnaire defined as "enjoyment of interpersonal competition and the desire to win and be better than others" (Spence & Helmreich, 1983, p. 41) clearly mix preferences to compete with preferences for specific behaviors within competitions. Depending on the particular research question, such a combination can reduce the ability to sufficiently differentiate mechanisms affecting individuals' behaviors related to selection into and behavior in competitions.

4.2.2 Enjoyment of competition as a facet of individual competitiveness

Individuals may voluntarily select into competitive environments for different reasons. Psychological research has identified different facets of individual competitiveness, each of which relates to a distinct motive making competitive environments attractive for individuals (Helmreich & Spence, 1978; Houston et al., 2002a, 2002b; Newby & Klein, 2014). Three facets emerge as the most important ones: *the desire to win, personal development, and enjoyment of competition* (Ryckman et al., 1990, 1996; Newby & Klein, 2014). While entrepreneurs' desires to win and their need for achievement and personal development have already been indirectly addressed in entrepreneurship research (e.g. Utsch et al., 1999; Levine & Rubinstein, 2017; McClelland, 1965; Rauch & Frese, 2007), enjoyment of competition has neither directly nor indirectly been investigated. We therefore focus on enjoyment of competition, reflecting the non-monetary benefits associated with competing against others. These intrinsic benefits are related to the institution of competition itself and do not depend on the outcome of a competition, i.e. whether a competition has been lost or won. Moreover, these benefits arising from competing with other individuals are independent of the particular tasks carried out in the competition. This implies that enjoyment of competition results from competing irrespective of performing a particular task, irrespective of demonstrating superior skills, and irrespective of winning a competition.

Enjoyment of competition can be distinguished from individuals' willingness to win (Newby and Klein, 2014; Ryckman et al., 1990). Individuals with a desire to win may feel that they need to win and avoid losing at any cost (Ryckman et al., 1990) and compete for the sake of winning itself, independent of associated rewards. These individuals are likely to invest more effort and accept higher costs to leverage odds of winning than individuals not having such a desire. More importantly, in order to have a chance of winning a competition, it is inevitable to enter a competition. Hence, the desire to win can be an important motivation to enter competitive rather than non-competitive environments. This, however, does not imply that individuals having a strong desire to win do also have a *general* tendency to favor competitive over non-competitive environments. On the contrary, individuals with a strong desire to win might even shy away from competitions they believe that they are not able to win (Connelly et al., 2014; Coffey & Maloney, 2010). Hence, the desire to win may affect the likelihood that individuals select into competitive environments, but this effect is—

in contrast to the effect of enjoyment of competition—conditioned on individuals' expectations of winning the competition. Through this inherent interaction between confidence in winning a competition as a belief, and the desire to win as a preference, we are able to empirically discriminate between a desire to win as an expectancy-dependent facet and other facets of individual competitiveness, including the enjoyment of competition.

Enjoyment of competition can also be distinguished from a third facet of individual competitiveness that is driven by personal development motives (Newby and Klein, 2014; Ryckman et al., 1996) and related achievement motivations (Nicholls, 1984; Elliot & McGregor, 1999). Individuals competing to satisfy personal development goals, do not focus on winning a competition, but rather seek mastery of a given task (Ryckman et al., 1996). Similarly, achievement motivations drive individuals to strive for accomplishments and the mastering of skills and, hence, relate to tasks that require individuals' skills or allow individuals to display their skills (Nicholls, 1984; Elliot & McGregor, 1999).[31] Hence, personal development and achievement motivations can be expected to be especially relevant for selection into competition based on tasks that require and challenge individuals' skills and competencies. In contrast, such personal development motives are likely to be irrelevant if competition relies on luck and, thus, does not offer opportunities to develop or demonstrate mastery of skills. Varying the degree to which a competition depends on individuals' skills, therefore, provides a way to indirectly identify the potential influence of personal development motives and achievement motivation on individuals' tendencies to enter competitions.

Being able to conceptually distinguish different motivations for entering competition does not imply that such a distinction is meaningful with respect to predicting individuals' economic behavior, i.e., that there is some external validity and practical relevance of these distinctions. However, in Chapter II we demonstrate that competitiveness resulting from personal development motives displays substantially different associations with basic personality dimensions (Big Five) compared to competitiveness not resulting from personal development motives. In fact, for

[31] Since some researchers equate competitiveness with achievement motivation, it is important to note that the here discussed differences imply that both are distinct constructs. Competitiveness only matters for competitive environments, but need for achievement may also affect engagement in tasks performed in non-competitive environments. Hence, "[n]eed for achievement and competitiveness may occur in the same individual, but competitiveness need not be present in a highly achieving person" (Smither & Houston, 1992, p. 409).

neuroticism, we even find opposite signs of the associations with these two facets of competition. Furthermore, in Chapter II we show that these two different motives of competitiveness relate differently to participants' interest in a managerial career. Hence, distinguishing between different motivations to enter competitions is valid and potentially relevant for individuals' occupational choices.

4.2.3 Entrepreneurs' enjoyment of competition

We have claimed that enjoyment of competition is distinct from the desire to win and, thus, independent of confidence in winning, and from personal development motives and, thus, independent of whether a given task depends on one's skills and competencies or on pure chance. We now argue that particularly entrepreneurs may display enjoyment of competition, leading to selection into entrepreneurship as a competitive environment (Kirzner, 1973). Entrepreneurs tend to face market competition more directly than wage-earning employees, as illustrated by Bartling and colleagues (2009, p.93): "a self-employed lawyer is in constant competition for clients, whereas a lawyer working as a civil servant in a public authority is not". Both desire to win and achievement motivations may make entrepreneurial individuals more likely to enter competitive environments. Whether entrepreneurs also demonstrate higher levels in the third facet of individual competitiveness has yet to be investigated. We argue that entrepreneurs' higher enjoyment of competition, independent of potential differences in desires to win and desires to master tasks and demonstrate skills, might be another mechanism to explain why entrepreneurs have been observed to start businesses despite low odds of success (Koellinger, Minniti, & Schade, 2007). Given that success as an entrepreneur depends not only on skills and competencies but also on chance (Monsen & Urbig, 2009), enjoyment of competition might be a particularly interesting explanation, because it does not require that individuals believe to be in full control of their performances.

Evidence on whether entrepreneurs are more or less likely to enter competition is scarce and evidence, especially on whether or not they enjoy competition itself rather than the desire to win or the related mastery of tasks, is absent. Following psychological research (e.g. Helmreich & Spence, 1978; Newby & Klein, 2014), Bönte and Piegeler

(2013) use cross-sectional and self-reported[32] data obtained from a large-scale multi-country survey to demonstrate that individuals who prefer self-employment over paid employment and those who are currently taking the first steps towards starting new ventures also tend to report that they like situations in which they compete with others. Bönte and Piegeler's (2013) study provides no indication regarding the extent to which their measurement of individual competitiveness might be driven by individuals' desires to win and achievement motivations. In fact, examining the relationship between both psychometric self-reported and economic behavioral measurements in Chapter II, we find that self-reported measures of individual competitiveness can reflect multiple motives for favoring competition and, in particular, are likely to reflect personal development motives. This is consistent with findings that self-reported attitudes towards competition significantly relate to achievement motivations (Elliot, Jury, & Murayama, 2018). Furthermore, Bönte and Piegeler (2013) do not control for individuals' desire to win or the heterogeneity in individuals' expectations to win in competitions. Hence, they cannot rule out the possibility that entrepreneurs like competition because they exaggerate their chances of winning these competitions or because of personal development and achievement motives.

Using an economic experiment, Holm and colleagues (2013) provide some evidence that CEOs of Chinese firms, including owner managers and founding managers, are more likely to select a competitive over a non-competitive payment scheme than a control group of non-CEOs. In their empirical analyses, Holm and colleagues (2013) do not control for risk preferences and perceived odds of winning, which, however, is needed to isolate individual competitiveness from risk preferences and overconfidence (Niederle & Vesterlund, 2007). Furthermore, since Holm and colleagues (2013) employ a quiz-task implying that performance is based on individuals' knowledge, the effect might still be driven by CEOs' need for achievement, the need to demonstrate to be better than others. In sum, both Bönte's and Piegeler's (2013) and Holm's and colleagues' (2013) studies provide only limited evidence with respect to entrepreneurs' enjoyment of competition, because both studies do not control for important confounding effects, such as risk preferences and confidence in winning (Holm et al., 2013), or for alternative motives and, in particular, for achievement

[32] Self-reported measures are sometimes regarded with suspicion in economic research, and behavioral measures of individual competitiveness obtained from incentivized economic experiments are often preferred (e.g., Niederle, 2017; Buser et al., 2014).

motivations (Holm et al., 2013, Bönte & Piegeler, 2013). Given that achievement motivation is one of the characteristics most robustly associated with entrepreneurs (Rauch & Frese, 2007; Kerr et al., 2018), this could explain both Bönte's and Piegeler's (2013) and Holm's and colleagues' (2013) findings.

When discussing the differences between entrepreneurs and non-entrepreneurial individuals, we can distinguish two important reasons for the emergence of such differences. On the one hand, entrepreneurs may be more likely to enjoy competition because they are exposed to competition all the time and become accustomed to it. Accordingly, a higher level of enjoyment of competition would be the result of being socialized in entrepreneurship[33]. On the other hand, individuals who intend to start new ventures may expect that they will be exposed to competition and, therefore, those who enjoy competing may be more likely to become entrepreneurs. Consequently, a higher level of enjoyment of competition would then be a reason for selecting into entrepreneurship in the first place rather than a consequence of being an entrepreneur.

We suggest that enjoyment of competition makes entrepreneurship more attractive for individuals and, hence, makes them more likely to become entrepreneurs. If, however, individuals enjoy competitions only after having been an entrepreneur, then individuals who find entrepreneurship attractive and may once start but have not yet started own businesses would not be found to enjoy competition as much as revealed entrepreneurs. Hence, comparing revealed entrepreneurs with potential entrepreneurs, i.e. individuals who consider entrepreneurship as a possible future option, is informative with respect to excluding explanations for the association between being an entrepreneur and the likelihood of selecting into more competitive environments that are based on reverse causality. Since we suggest that enjoyment of competition affects selection into entrepreneurship, we expect that both revealed entrepreneurs and potential entrepreneurs are more likely to enjoy competitive environments than non-entrepreneurial individuals. The following two hypotheses summarize our discussion.

[33] Evidence for related effects has been reported for risk-taking behavior (e.g., Brachert, Hyll, & Titze, 2017).

Hypothesis 1: *Revealed entrepreneurs are more likely to select into competition than non-entrepreneurial individuals, independent of confidence in winning and independent of whether performing a task that depends on skills or on chance only.*

Hypothesis 2: *Potential entrepreneurs are more likely to select into competition than non-entrepreneurial individuals, independent of confidence in winning and independent of whether performing a task that depends on skills or on chance only.*

4.3 STUDY DESIGN

4.3.1 Identification of enjoyment of competition[34]

We examine differences between individual competitiveness of entrepreneurs (revealed and potential) and non-entrepreneurial individuals based on a behavioral measure of individual competitiveness. This behavioral measure is obtained from an artificially created environment, which ensures comparability of responses even between individuals with highly heterogeneous experiences and personal backgrounds. Participants anonymously choose whether they want to be paid for their performance in a task according to either a competitive or a non-competitive payment scheme (Niederle & Vesterlund, 2007). In order to relate our study to existing experimental studies on individual competitiveness, we follow previous research and employ a simple math task (Niederle & Vesterlund, 2010).

Our theoretical considerations suggest, however, that a participant's decision to enter a competition may not only depend on enjoyment of competition but also on the two other facets of competition, namely development motives and the desire to win. In order to exclude the possibility that potential differences in individual competitiveness between entrepreneurs and non-entrepreneurial individuals can be explained by these two facets, we slightly adjust an often used behavioral measure of individual

[34] The identification of enjoyment of competition in this study differs from the more elaborated identification of the value of competing shown in Chapter III. In this study we use a simplified design that does not allow the quantification of an individual value of competing. This is due to practical constraints. The identification of the value of competing in Chapter III builds on an experimental design that requires a laboratory setting, but was not suitable for our lab-in-field studies of Chapters IV and V.

competitiveness and conduct regression analyses in order to control for relevant confounds.

First, we introduce an alternative task where participants' performances are not influenced by their efforts, skills, and abilities. To take out the potential influence of individual considerations related to efforts, skills and abilities as well as related desires and needs, we employ rolling dice as a task (cf., Ifcher & Zarghamee, 2016b).[35] By definition, individuals' performances in dice competition are determined by chance only.[36] Consequently, it can be expected that the decision to enter a dice competition is not influenced by personal development and achievement motivations.

Second, we indirectly control for the desire to win as a motive for selection into competition. Since winning requires competing, the desire to win can create an incentive to enter a competition, which, however, is conditioned on an individual's expectation to win. Individuals with a strong desire to win may be more likely to enter a competition if they expect to win the competition, but expecting to lose would deter their entry into a competition. Revealed and potential entrepreneurs may therefore be more likely to enter a competition than non-entrepreneurial individuals because they have a stronger desire to win and expect to win the competition. This would imply that the effect of entrepreneurship on selection into the math or the dice competition was moderated by the expected probability of winning and vice versa. In order to control for unobserved differences in the desire to win, we therefore take this into account by not only including in our regressions the individual confidence to win but also its interaction with being an entrepreneur. If entrepreneurs are more likely to enter a competition than non-entrepreneurial individuals because of a stronger desire to win, the estimated effect of this interaction will be positive and statistically significant.

[35] Ifcher and Zarghamee (2016b) demonstrate that a dice competition is sufficient to generate gender-variant preferences for competition, even when controlling for risk preferences.

[36] One might be tempted to conclude that competing based on rolling dice might remove any element of competition and, hence, attitudes towards competition may not be relevant anymore but only risk preferences (cf., Große & Riener, 2010). However, the situation is still interactive in the sense that outcomes for one individual depend on outcomes of other individuals, such that one loses when the other wins. Based on a perspective that individuals maximize their own expected payoffs only, this situation clearly is equivalent to a complex lottery. Enjoyment of competition, however, as defined above (cf., Deutsch, 1949; Lazear, 1999, Smither & Houston, 1992), deviates from such a perspective, such that individuals derive a utility from the particular structure of the institutional regime that they are embedded in as well as from the fact that outcomes of individuals they are interacting with are negatively related to their own outcomes. See Ifcher and Zarghamee (2016b) for an alternative discussion of why competition based on rolling dice is not the same as a lottery.

4.3.2 Sample and procedures

We conducted a "lab-in-the-field" experiment in a shopping mall in a large German city over the course of five days in June and October 2014. To provide low barriers to participation, we conducted the experiment using a paper-and-pencil approach. The experimental design focused on measuring individuals' tendencies to select into competition under various conditions. Mall visitors were approached and asked whether they would like to participate in an experiment on "decision-making behavior of adults" lasting 10–15 minutes, where they could earn between at least €5.00 and at maximum €15.50. In total, 224 adults participated; 113 men and 111 women. We started with a brief survey to collect data on each participant's socio-economic background, e.g., age, education, and occupation as well as self-reported propensity to take risks, which serve as control variables.

After completing the brief survey, which familiarized participants with the interview situation, they played two rounds of an incentivized competition game, where they chose between a competitive winner-take-all tournament payment scheme and a non-competitive piece-rate payment scheme.[37] In each round, individuals had to perform a different task, such that their decisions to select or avoid competition are based on a skill-dependent task (involving math) or a skill-independent task (rolling dice). Participants were informed that at the end of the experiment only one of the two rounds would be randomly drawn and paid for in cash. The order of tasks was randomized. Following Mayr et al. (2012), participants in the *math task* verified up to 20 simple equations within 30 seconds. Each equation consisted of four single digits added or subtracted and a positive result of one or two digits (e.g., "7+2+3–6=5. Is the result true or false?"). The sets of 20 equations were randomly composed and randomly assigned. Equations were equally difficult mathematically. One out of every two equations was wrong, but these odds were not revealed to participants. A correctly

[37] One might suspect that asking for the job and entrepreneurial intentions before the experiment might through priming affect behavior in the experiment. Asking for gender, which even lay people associated with differences in competitive behavior, before playing competitions, however, has been found to not affect competitive behavior in economic experiments (Boschini, Dreber, von Essen, Muren, & Ranehill, 2018). Arguably, both the fact that the artificial experiment involving a competition based on math tasks or rolling-dice (not involving any investments, creative performance, or any business decisions) is sufficiently different from entrepreneurial environments as well as the incentives for the experiment should reduce potential priming effects. Furthermore, asking for entrepreneurial intentions after the incentivized experiment would, due to having no incentives on the measurement of entrepreneurial intentions, be even more susceptible to related priming effects.

verified equation added one point to the participant's score, while an incorrect verification subtracted one point[38]. No performance feedback was provided before the end of the experiment. In the *dice task* participants rolled five times a pair of fair six-sided dice (with three white sides and three black sides), earning one point for each die that displays a black side (cf., Ifcher & Zarghamee, 2016b).

At the beginning of each round, participants were shown a task description, which included examples. Participants then had to choose between a non-competitive payment scheme, i.e. a piece-rate of €0.25 per point, and a competitive payment scheme, i.e. €0.50 per point if their own overall score was higher than the score of a randomly selected anonymous participant, and €0.00 otherwise. The results achieved by previous participants were noted on cards. Each competitor's score was randomly drawn from a pool of 10 previous participants' scorecards and not shown to participants before the end of the experiment.[39] Subsequently participants performed the respective task.

4.3.3 Variables

Selecting into a competitive environment

An individual's tendency to select into competitive environments was measured based on the above-introduced incentivized economic experiment (c.f., Buser et al., 2014). We used a dummy variable indicating whether participants chose the competitive payment (1) or the non-competitive piece-rate payment scheme (0).

While participants had to choose between a competitive winner-take-all and a piece-rate payment scheme, forced choices of indifferent participants are less informative and may attenuate the effects. To separate clear-cut preferences from possibly random choices in cases of indifference, we asked participants to indicate on a scale running from 0 (indifference) to 10 (alternative would not even be considered) the extent to which they actually preferred the chosen payment scheme. We classified

[38] Participants were told that if they reached a negative score, their score would be set to 0 points.

[39] One might argue that enjoyment of competition might be different if competing individuals would see one another. Since competition in business is often indirect through customers and market interaction, however, we consider this appropriate when measuring enjoyment of competition as relevant for entrepreneurial and business-related settings.

decisions where individuals indicated that it was equally likely they would have selected the alternative payment scheme as *indifference decisions*.

As the competitive payment scheme was characterized by a wider spread of possible payoffs and the probability of receiving the payoff additionally depended on others' performances, the self-selection into the more competitive payment scheme might reflect not only individual differences in enjoyment of competition, but also individual differences regarding both risk preferences and confidence in performing better than others, which reflect characteristics that have also been associated with entrepreneurs (cf., Camerer & Lovallo, 1999; Wu & Knott, 2006). To control for these potentially confounding effects, we follow standard practice (e.g. Niederle & Vesterlund, 2007) and statistically control for both effects as described below.

Revealed and potential entrepreneurs versus non-entrepreneurs

To identify *revealed entrepreneurs*, we asked participants to indicate whether they were currently self-employed or had ever been self-employed before.

Within the group that denied both, we separated *potential entrepreneurs* from unambiguously *non-entrepreneurial individuals*. We included a three-item measure of entrepreneurial intentions that refers to the potential of future entrepreneurship. We took two items from Thompson (2009): "I intend to set up a company in the future" and "I spend time learning about starting a firm". As a third item we included "I frequently think about starting my own business." Participants responded on a 7-point scale ranging from 'does not apply at all' (1) to 'fully applies' (7); responses were averaged (Cronbach's α=0.84). We classified those who had not been entrepreneurs and displayed the lowest possible score on each of the three items as non-entrepreneurial individuals. These individuals unambiguously reject entrepreneurship as an option for the future, they are not at all intending, not at all preparing themselves, and are clearly not thinking about starting an own business. Despite this very strong criterion, about 30 percent of all participants fall into this category. Individuals, who indicated for at least one of these items that they do not clearly reject it, might, in fact, see a chance to

engage in entrepreneurship in one way or another.[40] These individuals are classified as potential entrepreneurs. The 224 participants were partitioned correspondingly into three groups: non-entrepreneurial individuals (67), potential entrepreneurs (100),[41] and revealed entrepreneurs (57).

As a robustness check we furthermore explore heterogeneity within the groups of potential entrepreneurs and revealed entrepreneurs and test whether the effects differ for relevant subgroups. To explore if the effect differs within the group of potential entrepreneurs depending on their specific level of the entrepreneurial intent, we split the group of potential entrepreneurs into two subgroups of low entrepreneurial intentions (N = 51 with average intention = 1.91) versus high entrepreneurial intentions (N = 49 with average intention = 4.41). The split is based on the median by assigning those with an entrepreneurial intention less or equal to the median to the subgroup with low intentions and the others to the group with high intentions. Furthermore, we split the group of revealed entrepreneurs into two subgroups of those who are still with their own business (25) and those who have given up running their own business (32).

Control variables

To measure individuals' *confidence* in terms of beliefs about the winning probabilities we asked them to estimate the number of individuals out of ten potential competitors who, compared with themselves, had an equal or lower score. If participants guessed the number correctly, they received an additional €0.50 at the end of the experiment.

Risk preferences were elicited through a self-reported measure, which has often been used and demonstrated to be valid (e.g., Caliendo et al., 2009; Dohmen et al. 2011). On a 7-point scale ranging from 'does not apply at all' to 'fully applies', participants evaluated the following statement: "In general, I am willing to take risks". As context-specific risk preferences might be more relevant than a general risk

[40] Among the 100 potential entrepreneurs, 89 indicated that they do not fully disagree when being asked about intending to set up a company in the future. Among the other 11 potential entrepreneurs, 9 did not fully reject that they think about starting a firm, and the remaining 2 currently spend time on learning how to start a firm.

[41] For those who consider entrepreneurship a potential future career option, i.e. potential entrepreneurs, this is not necessarily the most preferred option and, thus, many of these individuals will not start businesses. However, that is why this group is only referred to as potential entrepreneurs.

preference (Bönte, Procher, & Urbig, 2015; Caliendo et al., 2009), in a robustness check we controlled for risk-taking that is more specifically related to one's career development and financial issues, respectively, with the following two statements: "For financial investments, I am willing to take risks", and "Within my professional career, I am willing to take risks".

Additionally, we controlled for variables that relate to the specific setup of our behavioral measurement of individual competitiveness. For example, we controlled for whether the dice task or the math task was presented first (order of treatments), the day of data collection, and whether the experimenter was male or female. As demographic control variables we include dummies for participants' age (classes: below 26, 26–35, 36–45, 46–55, above 55), gender (male vs. female), and the highest level of secondary school education attained, a dummy for having a vocational degree, and a dummy for having a university degree. With respect to secondary schooling, we differentiate between the following types: "less than Hauptschule" (no secondary schooling diploma), "Hauptschule" (grades 5–9, the least demanding level of secondary school), Realschule (grades 5–10), "Fachabitur" (grades 5–11 or 5–12, depending on the federal state), Abitur (the highest-level secondary school diploma, grades 5–12 or 5–13, depending on the federal state), and a dummy indicating when educational information is missing.

4.4 RESULTS

4.4.1 Sample statistics

Table 4.1 reports summary statistics for revealed and potential entrepreneurs as well as for non-entrepreneurial individuals. Potential entrepreneurs are substantially younger than revealed entrepreneurs (while 41 percent of the potential entrepreneurs are below 26 years old, the share is only 4 percent among the revealed entrepreneurs), which is consistent with the idea that potential entrepreneurs may, over time, discover suitable opportunities, start businesses and, hence, with advancing age move into the group of revealed entrepreneurs. Moreover, the share of males is higher among revealed (54%) and potential (57%) entrepreneurs than among non-entrepreneurial individuals (37%), which is consistent with the gender gap in entrepreneurship reported by previous studies (e.g. Bönte & Piegeler, 2013).

Table 4.1: Summary statistics

	Non-entrepreneurs	Potential entrepreneurs	Revealed entrepreneurs
Observations	67	100	57
Demographics			
Gender: male	37%	57%	54%
Age: less than 26	19%	41%	4%
Age: 26-35	13%	28%	30%
Age: 36-45	24%	9%	26%
Age: 46-55	24%	14%	21%
Age: above 55	19%	8%	19%
Education: School – less than Hauptschule	4%	2%	4%
Education: School – Hauptschule	16%	10%	7%
Education: School – Realschule	18%	15%	21%
Education: School – Fachabitur	12%	16%	11%
Education: School – Abitur	45%	54%	53%
Education: University degree	37%	26%	39%
Education: Vocational degree	48%	30%	58%
Education: Education missing	4%	3%	5%
Risk preference: General (1-7)	4.30 (SD=1.46)	4.89 (SD=1.37)	5.18 (SD=1.39)
Risk preference: Financial (1-7)	2.12 (SD=1.34)	3.03 (SD=1.55)	3.18 (SD=1.79)
Risk preference: Career (1-7)	3.84 (SD=1.60)	4.63 (SD=1.54)	5.02 (SD=1.70)
Entrepreneurial intent (1-7)	1.00 (SD=0.00)	3.13 (SD=1.50)	-
Experimental conditions			
Day: 1	22%	28%	26%
Day: 2	46%	49%	44%
Day: 3	31%	23%	30%
Male experimenter	69%	71%	72%
Math competition second	51%	50%	47%
Participants' responses			
Performance in math task (0-20)	5.42 (SD=2.73)	5.62 (SD=2.63)	5.84 (SD=1.83)
Performance in dice task (0-20)	5.48 (SD=1.43)	4.83 (SD=1.58)	4.91 (SD=1.38)
Confidence for math task (0-10)	5.37 (SD=1.83)	5.46 (SD=1.68)	5.40 (SD=1.78)
Confidence for dice task (0-10)	5.10 (SD=1.24)	5.18 (SD=1.16)	5.05 (SD=1.16)
Choose competitive payment for math task	43%	57%	58%
Choose competitive payment for dice task	43%	64%	65%

Notes: *SD = standard deviation*

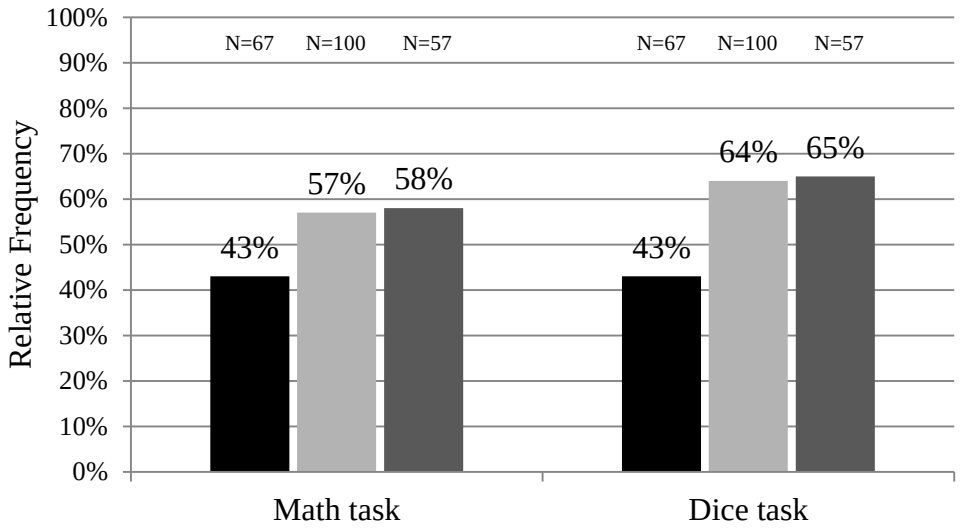
Consistent with findings reported in previous research we also observe higher preferences for general, financial, and career-related risks among revealed and potential entrepreneurs than among non-entrepreneurs (cf. Caliendo et al., 2009; Bönte et al., 2015). We do not observe, however, statistically significant differences between entrepreneurs and non-entrepreneurial individuals with respect to confidence in winning the math and dice tasks. We also observe no substantial differences across the three

groups of revealed and potential entrepreneurs and non-entrepreneurial individuals with respect to performances in these tasks.[42]

4.4.2 Group and treatment comparisons

Figure 4.1 illustrates the shares of participants, who chose the competitive payment scheme, across the categories of non-entrepreneurial individuals, potential entrepreneurs, and revealed entrepreneurs. Comparing non-entrepreneurial individuals with the combined group of potential and revealed entrepreneurs, we observe a significantly lower portion choosing the competitive payment scheme for both the math task (two-sample test of proportions: 43% vs. 57%, z=1.93, p=0.05) and the dice task (two-sample test of proportions: 43% vs. 64%, z=2.92, p=0.004).

Figure 4.1: Shares of revealed, potential, and non-entrepreneurs choosing a competitive payment



Notes: *Shares of non-entrepreneurs (black) potential entrepreneurs (light grey), and revealed entrepreneurs (dark grey) choosing the competitive tournament payment.*

[42] A repeated-measure analysis of variance reveals that the difference between performances in math versus dice tasks seems to slightly differ between the three groups of people (MS=10.89, F=2.45, p=0.089). As can be seen from table 4.1 and by post-hoc task-specific analyses of variance, indeed the groups' average performances differ slightly in the dice task (MS=9.08, F=4.14, p=0.017) but not in the math task (MS=4.36, F=0.66, p=0.516). The overall significance level, which accounts for repeated tests, of p=0.089, and observing that the effect is related to the dice task and, furthermore, very small, suggests that we face a purely random artifact.

While providing initial insights, these tests cannot account for the fact that differences in observed choices may result from differences in risk attitudes or confidence (and the related desire to win) rather than from differences in enjoyment of competition.

4.4.3 Regression analyses

Table 4.2 reports the results of our regression analyses, which include relevant control variables. Having measured each individual's competitiveness with respect to both the math task and the dice task, we employ random effects logistic regression analyses and include interaction terms to check whether the measures can be pooled. We report coefficients and related standard errors of seven logistic regression models. For the focal effects, i.e. the difference between potential or revealed entrepreneurs and non-entrepreneurial individuals, we additionally report the average marginal effects and robust standard errors. Model 1 indicates that, despite controlling for general risk preferences and confidence, both potential and revealed entrepreneurs select into competition more often than non-entrepreneurial individuals (i.e., 16.1 and 19.5 percentage points, respectively).

Model 2 tests whether the effects differ within the group of potential entrepreneurs depending on their level of entrepreneurial intentions and within the group of revealed entrepreneurs depending on whether they still are entrepreneurs or have already given up their own business. We introduce a contrast code that is -1 for low intentions and +1 for high intentions and zero for those who are not potential entrepreneurs. Similarly, we introduce a contract code that is -1 for past entrepreneurs and +1 for current entrepreneurs and zero for those who are not revealed entrepreneurs. With this coding, the main effects of potential and revealed entrepreneurs are the averages of the effects of the corresponding two subgroups and the estimated coefficients of the contrast codes show how the corresponding two subgroups differ from the related average effects. We do not observe any statistically significant differences within the two groups and the effect sizes are small. Hence, the distinction between those who do not consider entrepreneurship a potential option versus those who consider it or have already acted upon and thereby revealed their intentions is what drives the difference in behavior.

Table 4.2: Regression analyses for the selection of a competitive payment scheme

Dependent variable = "Choose competitive payment scheme"	Model 1: Base model		Model 2: heterogeneous subgroups		Model 3: Dice vs. math task		Model 4: More vs. less confident	
Potential entrepreneurs	1.037	(0.430)*	1.023	(0.429)*	1.032	(0.430)*	1.057	(0.437)*
Average marginal effect	0.161	(0.064)*	0.159	(0.064)*	0.160	(0.064)*	0.161	(0.064)*
Revealed entrepreneurs	1.266	(0.445)**	1.271	(0.443)**	1.259	(0.444)**	1.258	(0.458)**
Average marginal effect	0.195	(0.064)**	0.196	(0.064)**	0.194	(0.064)**	0.197	(0.064)**
Pot. entrepr.: High vs. low intent			-0.101	(0.238)				
Diff. in average marginal effects			-0.015	(0.036)				
Rev. entrepr.: Current vs. past			0.148	(0.271)				
Diff. in average marginal effects			0.022	(0.041)				
Pot. entrepr. x Dice vs. math task					0.179	(0.282)		
Rev. entrepr. x Dice vs. math task					0.193	(0.338)		
Pot. entrepr. x Confidence							-0.077	(0.244)
Rev. entrepr. x Confidence							0.280	(0.272)
Dice vs. math task	0.233	(0.125)+	0.233	(0.125)+	0.104	(0.214)	0.231	(0.125)+
Confidence	0.551	(0.118)***	0.548	(0.118)***	0.549	(0.117)***	0.523	(0.183)**
Risk-taking: General	0.103	(0.117)	0.109	(0.119)	0.104	(0.117)	0.099	(0.117)
Gender: Male	0.420	(0.325)	0.414	(0.322)	0.422	(0.325)	0.415	(0.327)
Age: 26-35	-1.384	(0.534)**	-1.368	(0.529)**	-1.382	(0.534)**	-1.375	(0.533)**
Age: 36-45	-1.966	(0.590)***	-1.982	(0.589)***	-1.966	(0.590)***	-2.052	(0.602)***
Age: 46-55	-0.969	(0.614)	-0.983	(0.610)	-0.968	(0.615)	-0.984	(0.611)
Age: above 55	0.541	(0.657)	0.499	(0.652)	0.542	(0.658)	0.562	(0.662)
Education: School – Hauptschule	-0.873	(1.471)	-0.908	(1.470)	-0.867	(1.469)	-0.797	(1.495)
Education: School – Realschule	-0.758	(1.409)	-0.795	(1.407)	-0.751	(1.406)	-0.677	(1.435)
Education: School – Fachabitur	-0.819	(1.430)	-0.868	(1.426)	-0.813	(1.428)	-0.798	(1.458)
Education: School – Abitur	-1.010	(1.376)	-1.046	(1.371)	-0.999	(1.373)	-0.970	(1.401)
Education: University degree	1.070	(0.496)*	1.070	(0.492)*	1.068	(0.496)*	1.089	(0.498)*
Education: Vocational degree	0.709	(0.506)	0.722	(0.502)	0.711	(0.507)	0.720	(0.508)
Education: Education missing	-19.838	(8.461)*	-19.977	(8.367)*	-19.829	(8.469)*	-20.094	(8.509)*
Math competition second	0.234	(0.326)	0.225	(0.326)	0.233	(0.326)	0.257	(0.332)
Day: 2	0.092	(0.425)	0.093	(0.424)	0.095	(0.425)	0.071	(0.426)
Day: 3	0.061	(0.463)	0.067	(0.459)	0.061	(0.463)	0.050	(0.465)
Male experimenter	-0.140	(0.358)	-0.153	(0.360)	-0.134	(0.358)	-0.131	(0.363)
Constant	-0.268	(1.663)	-0.234	(1.661)	-0.283	(1.661)	-0.292	(1.681)
lnsig2u	0.630	(0.468)	0.619	(0.469)	0.634	(0.467)	0.653	(0.466)
Observations (individuals)	448	(224)	448	(224)	448	(224)	448	(224)
Log-Pseudo Liklihood (χ^2)	-256.47	(44.31)**	-256.27	(45.18)**	-256.23	(44.67)**	-255.49	(43.59)**

Notes: *Robust standard errors are shown in parentheses. Non-entrepreneurs are the base group for the effects of potential and revealed entrepreneurs. Base groups of controls are Age: less than 26; Education: School - less than Hauptschule; Day: 1. Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.1*

Model 3 includes terms for interactions between potential entrepreneurs and revealed entrepreneurs with the experimental treatment (dice vs. math). We observe that the differences between entrepreneurs (potential and revealed) and non-entrepreneurial individuals do not depend on whether competitiveness was measured based on a math task or a dice task.

By controlling for individuals' confidence in winning we avoided attributing entrepreneurs' possible optimism about winning to their enjoyment of competition. This tactic does not, however, enable us to test whether entrepreneurs' individual competitiveness operated independently of their confidence in winning. That is, we cannot exclude the alternative explanation that the willingness to win drives our findings instead of enjoyment of competition. To demonstrate that entrepreneurs enjoy competition independently of their desire to win, Model 4 allows the effects of revealed and potential entrepreneurs to be moderated by confidence in winning. Through the interaction with the confidence in winning, we can identify whether the observed effect is driven by the desire to win (cf., Coffey & Maloney, 2010). We observe that the estimated coefficients of interaction terms are not statistically significant. Consequently, the estimated effects of entrepreneurship are not conditioned on confidence and, hence, the observed effects can be considered independent of individuals' confidence and their responses to confidence and, by implication, independent of their potential desire to win.

4.4.4 Robustness checks

In order to explore the robustness of our main results, we have run a set of additional robustness checks reported in Table 4.3. First, regarding payment-scheme decisions, for 11 percent, that is 51 out of 448 decisions, participants reported that they were in fact indifferent and could as well have taken the alternative payment scheme. Excluding these decisions removes an additional random component from the analyses, which may have led to slightly attenuated effects in our main analysis. Consistent with this intuition, in Model 5 we observe slightly stronger effects for both potential and revealed entrepreneurs (i.e., 18.2 and 22.5 percentage points).

Second, while we already controlled for dichotomous differences between potential entrepreneurs with high versus low entrepreneurial intentions, we could also control for the continuous variation in entrepreneurial intent among potential entrepreneurs. In Model 6, we include these entrepreneurial intentions for potential entrepreneurs. We center this variable within the group of potential entrepreneurs, such that the effect of potential entrepreneurs still reflects the effect of the overall group averaged over the subgroups (Cohen, Cohen, West, & Aiken, 2003). Supporting the analysis based on the dichotomous measure, we also do not observe any effect of the level of entrepreneurial intent for the continuous measure and the focal group differences remain robust (i.e., differences of 16.1 and 19.4 percentage points).

Third, while we controlled for general risk preferences, more specific forms of risk-taking may actually affect entrepreneurial intentions, specifically financial and career-related risk-taking (Bönte et al., 2015; Caliendo et al., 2009). If the related, more specific risk attitudes also affect behavior involved in the behavioral measure of individual competitiveness—e.g. financial risk-taking would be relevant for both entrepreneurship and behavior in financially incentivized experiments—then general risk-taking might be a weak control variable. In a robustness check (Model 7), we therefore additionally included measures of these more specific risk preferences related to financial and career-related risks. We observe that financial risk-taking indeed is statistically significant and the previously positive but statistically insignificant effect of general risk-taking fully disappears when controlling for financial and career-related risk-taking. With respect to our main variables, we observe that the estimated effects of being a potential or of being a revealed entrepreneur decrease slightly when controlling for additional variables. The marginal effect for revealed entrepreneurs declines by 2.5 percentage points (compare Models 2 and 4), leaving 16.9 percent as a statistically significant effect.

In sum, our results are robust to alternative explanations based on desires to win or achievement motivations as well as robust to several variations in model specification.

Table 4.3: Additional robustness checks

Dependent variable = "Choose competitive payment scheme"	Model 5: Excluding decisions under indifferences		Model 6: Continuous entre-preneurial intent		Model 7: Including context-specific risk-taking	
Potential entrepreneurs	1.320	(0.550)*	1.033	(0.430)*	0.794	(0.424)+
Average marginal effect	0.182	(0.072)*	0.160	(0.064)*	0.122	(0.065)+
Revealed entrepreneurs	1.640	(0.566)**	1.258	(0.444)**	1.107	(0.436)*
Average marginal effect	0.225	(0.071)**	0.194	(0.064)**	0.169	(0.064)*
Pot. entrepr.: Entrepreneurial intention			-0.048	(0.155)		
Dice vs. math task	0.170	(0.143)	0.233	(0.125)+	0.222	(0.125)+
Confidence	0.641	(0.143)***	0.551	(0.118)***	0.520	(0.116)***
Risk-taking: General	0.131	(0.143)	0.112	(0.118)	-0.009	(0.147)
Risk-taking: Financial					0.311	(0.109)**
Risk-taking: Career					-0.003	(0.130)
Gender: Male	0.262	(0.396)	0.419	(0.324)	0.353	(0.322)
Age: 26-35	-1.547	(0.648)*	-1.396	(0.534)**	-1.590	(0.542)**
Age: 36-45	-2.093	(0.732)**	-1.970	(0.590)***	-1.987	(0.594)***
Age: 46-55	-1.152	(0.789)	-0.981	(0.614)	-1.114	(0.619)+
Age: above 55	0.791	(0.827)	0.514	(0.663)	0.333	(0.647)
Education: School – Hauptschule	-0.698	(1.710)	-0.871	(1.466)	-0.826	(1.522)
Education: School – Realschule	-0.823	(1.587)	-0.767	(1.403)	-0.781	(1.475)
Education: School – Fachabitur	-0.909	(1.614)	-0.834	(1.426)	-0.821	(1.483)
Education: School – Abitur	-1.009	(1.550)	-1.015	(1.370)	-1.076	(1.437)
Education: University degree	1.326	(0.604)*	1.075	(0.495)*	1.046	(0.485)*
Education: Vocational degree	0.710	(0.615)	0.721	(0.504)	0.638	(0.510)
Education: Education missing	-21.914	(10.216)*	-19.952	(8.430)*	-18.918	(8.444)*
Math competition second	0.191	(0.394)	0.234	(0.326)	0.217	(0.326)
Day: 2	0.307	(0.492)	0.095	(0.425)	-0.026	(0.417)
Day: 3	0.182	(0.554)	0.075	(0.462)	-0.096	(0.458)
Male experimenter	-0.112	(0.444)	-0.144	(0.358)	-0.173	(0.362)
Constant	-0.703	(1.904)	-0.301	(1.654)	-0.067	(1.690)
lnsig2u	1.095	(0.450)*	0.627	(0.468)	0.544	(0.484)
Observations (individuals)	397	(211)	448	(224)	448	(224)
Log-Pseudo Liklihood (χ^2)	-221.31	(35.80)*	-256.43	(44.50)**	-252.71	(47.12)**

Notes: *Robust standard errors are shown in parentheses. Non-entrepreneurs are the base group for the effects of potential and revealed entrepreneurs. Base groups for control variables are Age: less than 26, Education: School - less than Hauptschule, and Day: 1. In Model 5 we excluded decisions under indifference, which relates to choices for which individuals reported having been indifferent. In Model 6, entrepreneurial intention of potential entrepreneurs is centered within the group of potential entrepreneurs, such that the effect of the group of potential entrepreneurs still reflects the average effect of all group members. Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.1*

4.5 DISCUSSION AND CONCLUSION

4.5.1 Summary of findings

The results obtained from our lab-in-the field study suggest that entrepreneurs, both revealed and potential, are more likely than non-entrepreneurial individuals to choose competitive payment schemes in experimental settings, irrespective of their confidence in winning and irrespective of whether the task in which they compete relates to their skills or to chance alone. This suggests that entrepreneurs' selection into competitive situations is driven by their enjoyment of competition, which is independent of their confidence in winning and whether the competition is based on skills or dice. Employing a behavioral measurement approach based on well-defined environments, i.e. the artificially created experiment, adds significantly to our understanding of the nature of the link between individual competitiveness and the emergence of entrepreneurship. Our focus on real behavior in a laboratory-like setting helps us to exclude alternative explanations.

The marginal effects of enjoyment of competition we observe after controlling for gender, risk-taking, and confidence (see table 4.2), which are between 12 and 18 percentage points for potential entrepreneurs and between 16 and 23 percentage points for revealed entrepreneurs, indicate a substantial relationship between enjoyment of competition and entrepreneurship. These effect sizes are comparable to levels that are observed for other variables considered as relevant, such as gender differences in competitiveness (e.g., Apicella, Demiral, & Mollerstrom, 2017).

4.5.2 Limitations

Although we make relevant contributions to entrepreneurship research and research on occupational choices in general, this study also faces potential limitations. Most importantly, our study is based on cross-sectional data. Hence, it should be interpreted cautiously with respect to causality. Nevertheless, observing similar effects for potential and revealed entrepreneurs provides some evidence that enjoyment of competition might affect selection into entrepreneurship. Future research could further examine the causal link between selection into entrepreneurship and individual competi-

tiveness, e.g., through the use of panel data or the identification of potential instrumental variables.

While we explore some heterogeneity within the groups of potential and revealed entrepreneurs, there might be more relevant unobserved heterogeneity. For instance, in our empirical analysis we identified revealed entrepreneurs based on whether they are or have been involved in running their own business. This may include self-employed people as well as entrepreneurs engaged in growth-oriented start-ups. The degree of competitiveness might be more prevalent among those growth-oriented start-ups than among the self-employed individuals. Furthermore, the revealed entrepreneurial behavior might also result from what is referred to as necessity entrepreneurship, that is, individuals, who do not find employed positions and consequently must engage in independent and often self-employed work (Block & Koellinger, 2009). As the lack of alternatives has driven these individuals into entrepreneurship, their selection is likely to not be driven by their enjoyment of competition and, hence, they should not display higher levels of enjoyment of competition. Both kinds of heterogeneity most likely attenuate the effects that we observe for the group of revealed entrepreneurs, such that our study is even conservative regarding the true influence of the enjoyment of competition. Future research might be able to explore such heterogeneity in more detail.

Furthermore, our study explicitly focuses on the link between entrepreneurship and individuals' selection into competition but does not aim at examining the link between entrepreneurship and individuals' behavior in competitive environments. Some work already links selection into competition in economic experiments to entrepreneurs' behavior, their way of managing businesses, and their performance (e.g. Berge et al., 2015), but experimental measures of behavior within competitions, such as being motivated to invest more effort or even cheat in competitions, have not yet been linked to entrepreneurship or individuals' occupational choices, in general. Since selection into competition might be a weak proxy for behavior within competitions, future research may go beyond our as well as Berge's and colleagues' (2015) studies and explore how experimental measures of behavior *within* competition are associated with selection into entrepreneurship and other occupations. Over time we might then be able to actually capture the full complexity of Schumpeter's (1934) description of entrepreneurs' behaviors as driven by "the will to conquer; the impulse to fight, to prove

oneself superior to others", which we suggest is linked to three distinct characteristics, that is, entrepreneurs' desire to win, their achievement motivations, and as demonstrated in this study, their enjoyment of competition.

4.5.3 Contributions and implications

1. Enjoyment of competition and market entry

We examine the link between entrepreneurship and individual competitiveness and we contribute to the body of research that investigates entrepreneurs' responses to competition by conceptually distinguishing between different facets of competitiveness and by providing empirical evidence that entrepreneurs are more likely to select into competitive environments than non-entrepreneurs because of their enjoyment of competition, a facet of competitiveness for which there has not been reliable evidence as yet. This study complements previous research examining behavior of entrepreneurs in competition and suggesting that entrepreneurs tend to be more aggressive and possibly even ruthless in competitions (Utsch et al., 1999; Hmieleski & Lerner, 2016; Levine & Rubinstein, 2017), having a high need for achievement motivation (McClelland, 1965; Rauch & Frese, 2007), and might be generally more likely to favor competitive over non-competitive environments (Bönte & Piegeler, 2013; Holm et al., 2013).

Entrepreneurs enjoy competition irrespective of whether they expect to win, which rules out the desire to win as a motivation for entry into competition, and irrespective of the degree to which a task depends on skills, which rules out mastery-related motives and, more generally, achievement motivations as a reason for entering competition. Thus, possibly excessive market entry by entrepreneurs might not only be explained by possibly unrealistically optimistic beliefs about winning (cf., Camerer & Lovallo, 1999), less risk aversion (e.g., Caliendo et al., 2009, Wu & Knott, 2006), but might also be explained by intrinsic benefits from competing, that is, enjoyment of competition. Considering an intrinsic value from competing itself in addition to corresponding benefits of winning, e.g., in terms of status and prestige, might also explain why entrepreneurs do not give up so easily, once winning becomes less likely,

but continue competing. Hence, the enjoyment of competition may help us to better understand why entrepreneurs may persist in seemingly unfavorable conditions.

2. Enjoyment of competition and occupational choice

Our second contribution is that our analysis of revealed and potential entrepreneurs tentatively suggests that individuals' behavior in economic experiments is related to selection into entrepreneurship. As discussed above, the alternative explanation that selection into competition is driven by entrepreneurial experience cannot explain why we find similar effects for potential entrepreneurs, who have not yet worked as entrepreneurs. Our study thereby contributes to research linking competitive behavior in economic experiments to selection into more competitive careers, such as managerial positions (Gneezy et al., 2003; Niederle & Vesterlund, 2007), careers in financial industries (Reuben et al., 2015), and selection into prestigious academic tracks (Buser et al., 2014). When studying the link between competitiveness and selection into particular industries, for example, future research might additionally control for whether a career will be pursued as an entrepreneur or in paid employment; the relationships may differ substantially.

Observing that entrepreneurship is attractive for competitive individuals does not imply that we suggest that these entrepreneurs are always competing. To improve the chances of winning within the market, entrepreneurs often start their business as highly cooperative teams and may even cooperate with competitors within markets. Hence, while entrepreneurship seemingly offers opportunities to satisfy needs derived from participating in competitions, it does not imply that entrepreneurs are unwilling to cooperate.

Chapter V

Entrepreneurship, Individual Competitiveness, and Individuals' Perceptions of Intensity of Competition

5.1 INTRODUCTION

Recent experimental studies suggest that individuals may be deterred by competitive workplaces. Flory, Leibbrandt, and List (2015) find that a competitive compensation scheme causes differential job entry where women disproportionately shy away from competitive work settings. Their findings complement a larger and more general stream of literature suggesting that individuals' willingness to self-select into competitive environments shapes their educational and occupational choices (Buser et al., 2014, 2017; Reuben et al., 2015; Almås et al., 2016). Environments that are found to be more attractive to competitive than to non-competitive individuals include industries such as finance and professional services (Reuben et al., 2015), or prestigious academic tracks such as science and mathematics (Buser et al., 2014).

Our findings presented in Chapter IV complement this research. Consistent with Schumpeter's (1934, p. 93) conjecture that entrepreneurs are driven by "*the will to conquer; the impulse to fight*" and Kirzner's (1973, p. 94) assertion "*that entrepreneurial activity is always competitive and that competitive activity is always entrepreneurial*" as well as with empirical findings by Bönte and Piegeler (2013), who report that individuals assessing themselves as individuals enjoying competitive situations are more likely to start new businesses, we find that entrepreneurs embrace competitive environments. In Chapter IV we demonstrate that both revealed and

potential entrepreneurs are more likely to self-select into competitive environments within an incentivized experiment than non-entrepreneurial individuals and we show that their self-selection is driven by an enjoyment of competition rather than by desires to win, or by personal development motives. While previous findings highlight the practical relevance of individual competitiveness for important economic decisions, we have not yet provided comprehensive evidence *why* enjoying competition makes some environments more attractive than others. Moreover, based on existing literature we can hardly derive systematic predictions which occupations are most attractive to competitive individuals.

In Chapter V we focus on the mechanism relating enjoyment of competition to career choices and investigate why some careers and occupations are more attractive for competitive individuals than others. Definitions of individual competitiveness refer to individuals favoring competitive environments over non-competitive environments (Niederle & Vesterlund, 2011; Smither & Houston, 1992) and the general framework introduced in Chapter I suggests that the influence of an individual's enjoyment of competition on the individual's self-selection into one of two environments can be expected to be conditioned on the individual's belief that one environment is more competitive than the alternative environment. Hence, the difference between competitive environments and non-competitive environments is integral for the concept of individual competitiveness. While existing literature tends to assume – implicitly or explicitly – that certain environments are more competitive than others, e.g. top-level executive and managerial positions (Gneezy et al., 2003; Niederle & Vesterlund, 2007), industries such as finance and professional services (Reuben et al., 2015), or entrepreneurship (Schumpeter, 1934; Bönte & Piegeler, 2013), we empirically investigate individuals' perceptions of competitive intensity in occupational environments.

In addition to individual heterogeneity in competitive preferences, we argue that potential heterogeneity in individuals' perceptions of competition associated with different occupations creates moderating effects on the relation between individual competitiveness and career choices. While heterogeneity in individuals' perceptions is largely unexplored in the literature on competitiveness, its relevance has already been highlighted in the literature on risk-taking, where empirical results suggest that individuals' behaviors and choices are influenced even more by heterogeneity in their

perceptions of risk associated with certain environments than by heterogeneity in their willingness to take risks (Weber, Blais, & Betz, 2002).

We empirically examine individual and systematic differences in perceptions of competitive intensity in 27 different occupations. We focus on a comparison between entrepreneurship versus paid employment and further distinguish these groups with respect to business founders versus other self-employment as well as managerial employment versus non-managerial employment. Our empirical analysis is based on two complementary studies with 429 participants with 8,553 judgments of competitive intensity of particular occupations; the first study with 227 students includes 10 forms of entrepreneurship and 17 forms of paid employment and uses self-reported measures of both competitive preferences and the individuals' intentions to enter particular occupations. The second study with 202 people from the general population includes reduced sets of 6 forms for each of these categories and employs incentivized behavioral measures of competitiveness from a lab-in-the field experiment and revealed occupational choices.

In the remainder of this chapter we conceptualize the relevance of individual heterogeneity in perceptions of competitive intensity for individual competitiveness and entrepreneurship in Section 5.2. Section 5.3 describes the datasets, study designs, and variables of both studies, as well as the econometric approach. Section 5.4 presents the results including validations and multiple robustness checks. Finally, Section 5.5 discusses how our findings contribute to entrepreneurship and economics research.

5.2 CONCEPTUAL BACKGROUND AND RELATED WORK

5.2.1 Entrepreneurs embrace competitive environments

Schumpeter (1934) already claimed that founders' entry decisions are driven by their willingness to compete and that founders are, hence, more competitive. It can be argued that competition is less intense in paid employment as compared to self-employment, since entrepreneurs tend to face market competition more directly than do paid employees. Bartling et al. (2009, p.93), for instance, state that "a self-employed lawyer is in constant competition for clients, whereas a lawyer working as a civil servant in a public authority is not". Studies by Holm and colleagues (2013) and Bönte

and Piegeler (2013) provide first empirical evidence for a link between individual competitiveness and selection into entrepreneurship. Using an economic experiment, Holm and colleagues (2013) investigate specific risk preferences and provide some evidence that CEOs of Chinese firms, including owner-managers and founding managers, are more likely to select competitive over non-competitive payment schemes than a control group of non-CEOs. Since their empirical analyses focus on specific risk taking rather than competitiveness, Holm and colleagues (2013) do not control for risk preferences and perceived odds of winning, which, however, is needed to isolate individual competitiveness from risk preferences and (over-)confidence (Niederle & Vesterlund, 2007). Using data obtained from a large-scale survey conducted in 36 countries, Bönte and Piegeler (2013) find that individuals who like situations in which they compete with others are more likely to prefer self-employment over paid employment (latent entrepreneurs) and they are also more likely to actually start new ventures (nascent entrepreneurs). Moreover, their results confirm the finding of laboratory experiments that women are less competitively inclined than men[43] and Bönte and Piegeler (2013) report that this gender difference in competitiveness contributes significantly to the gender gap in entrepreneurship. In contrast to experimental studies, however, Bönte and Piegeler (2013) employ an approach that is typically used by psychologists to measure an individual's competitiveness, i.e. they make use of a self-reported psychometric measure reflecting enjoyment of competition. Hence, existing research provides some evidence that in general entrepreneurs are also more likely to select into competitive environments.

The study presented in Chapter IV provides additional evidence that individuals, who already revealed their entrepreneurial spirit by entering entrepreneurship are more likely to opt for a competitive tournament incentive scheme in an incentivized economic experiment than other individuals. Moreover, we distinguish different motives of competitiveness and provide empirical evidence that entrepreneurs are more likely to select into competitive environments than non-entrepreneurs because of their enjoyment of competition itself, rather than other motives. Entrepreneurs enjoy competition irrespective of whether they expect to win, which rules out the desire to win as a motivation for entry into competition, and irrespective of the degree to which a task

[43] Bönte (2015) reports that this gender difference in competitiveness persists even when controlling for a number of potentially relevant variables and that it is hardly affected by the stage of life cycle.

depends on skills, which rules out mastery-related motives and, more generally, achievement motivations as a reason for entering competition (see Chapter IV).

However, observing that revealed entrepreneurs are more likely to select into competition in an experimental setting, does not necessarily imply that these revealed entrepreneurs became entrepreneurs because they were highly competitive in the first place. An alternative explanation for such a finding could be that experience or occupation-specific socialization effect related to intense competition in entrepreneurial environments may make individuals more competitive over time. In order to examine whether entrepreneurs are more competitive before starting a business in Chapter IV we compare the individual competitiveness of potential entrepreneurs–individuals who are likely to start a business in the future but did not do so in the past–with the competitiveness of non-entrepreneurial individuals[44]. We find that potential entrepreneurs are more likely to opt for competitive payment schemes and enjoy competing more than non-entrepreneurial individuals. The alternative explanation that selection into competition is driven by entrepreneurial experience cannot explain why we find similar effects for potential entrepreneurs, who have not yet worked as entrepreneurs (see Chapter IV).

5.2.2 Perceptions of competitive intensity

While our findings in Chapter IV are a first step towards a causal link between competitiveness and selection into entrepreneurship, it is still not clear, whether competitive individuals enter entrepreneurship *because* intensity of competition is high in entrepreneurship. In order to examine whether competitive intensity of work environments affects job-entry decisions into paid employment, Flory, Leibbrandt, and List (2015) run a natural field experiment by posting employment advertisements to an internet job-board in sixteen major US cities. Job-seekers are randomized into different compensation regimes for the same job and employment advertisements are experimentally manipulated by varying the role that interpersonal competition plays in setting the wage. Flory, Leibbrandt, and List (2015) find that a competitive

[44] Compelling evidence suggests that entrepreneurial intention precedes individual's actual founding of a new firm (Busenitz & Barney, 1997; Thompson, 2009), and, consequently, potential entrepreneurs can be characterized as individuals having the intention to start a business, whereas non-entrepreneurial individuals are individuals having no entrepreneurial intention at all.

compensation scheme causes differential job entry where women disproportionately shy away from competitive work settings. Together with the well-established finding that within lab experiments men are more competitive than women (e.g. Niederle & Vesterlund, 2007), their results suggest a causal effect of individual competitiveness on the selection into more competitive employment positions.

Of course, manipulating the intensity of competition within entrepreneurship with the method of Flory, Leibbrandt, and List (2015) is not feasible. In particular, there are no employment advertisements for entrepreneurs. In other words, the missing link for a causal effect of competitiveness on selection into entrepreneurship is the *unobserved* intensity of competition in entrepreneurship. In this chapter we provide an attempt to identify this link by analyzing the individuals' *perceived* intensity of competition in entrepreneurship.

Subjective perceptions are highly important for individuals' occupational choices and particularly the selection into entrepreneurship. Related research, for instance, shows that entry decisions of nascent entrepreneurs rely on subjective perceptions rather than on objective expectations of success (Arenius & Minniti, 2005). Fauchart and Gruber (2011) distinguish three ideal types of founder identities and suggest that founders perceive as opportunities only those situations that are consistent with their respective identity type. With respect to competition they highlight that one ideal type tends to perceive competitors as their primary frame of reference, while the other types rather tend to perceive competitors as less relevant and focus on society and social groups instead (Fauchart & Gruber, 2011, p.942). Moreover, perception has been demonstrated to be an important driver of choices under risk and there is a substantial literature on the concept of risk perception (e.g. Arrow, 1982; Slovic, 1987, 2000; Weber et al., 2002). Weber and Milliman (1997) highlight that situational differences in risky choices are likely to be driven by differences in individuals' perception of risk rather than differences in individuals' willingness to take risks.

We argue that in the same way self-selection into certain competitive environments can be driven by differences in individuals' perception of competitive intensity in addition to differences in individuals' competitive preferences. According to psychological competitiveness research the interpersonal nature of individual competitiveness implies that the construct is inextricably tied to an individual's actual or

perceived social environment and competitiveness requires the perceived presence of a rival or a group of competitors (Smither & Houston, 1992). Individuals can only form beliefs about intensity of competition associated with certain environments based on their respective individual experience and socialization. Every individual tends to know and remember a unique set of particular instantiations of entrepreneurs as well as of any occupation. As far as individual perceptions of competitive intensity in an occupation are constructed from the set of particular instantiations that the individual experienced the heterogeneity of these particular instantiations should be reflected as individual-level heterogeneity in perceptions of competition. This individual-level heterogeneity is not necessarily induced by any kind of perception bias, but results from the idiosyncrasy of individual experience. Hence, individuals may not only be heterogeneous with respect to individual competitive preferences, but also with respect to their subjective perception of intensity of competition associated with certain occupations.

We argue that the relationship between individual competitiveness and selection into occupations is moderated by individual perceptions of intensity of competition in the respective work environment. More (less) competitive individuals are expected to prefer occupations that they perceive as more (less) competitive. Hence, we expect that individual perceptions of competition moderate the effects of individual competitiveness on self-selection into entrepreneurship, which leads to our first hypothesis:

Hypothesis 1: *The effect of individual competitiveness on selection into entrepreneurship is moderated by perceived intensity of competition.*

5.2.3 Idiosyncratic and systematic perceptions of competitive intensity

According to Hypothesis 1, individual heterogeneity in perceptions of competitive intensity might to some extent account for differences in selection into entrepreneurship. To illustrate this by an extreme example, suppose a case where all individuals are reluctant to enter competitive situations, but some individuals perceive entrepreneurship as highly competitive, whereas other people believe that competitive intensity in entrepreneurship is low. In this case, only those individuals perceiving competitive intensity as low will be willing to self-select into entrepreneurship.

However, this simple example neglects the individual's choice between entrepreneurship and other occupations. If there was a causal effect of individual competitiveness on selection into entrepreneurship, a perceived high *relative* competitive intensity in entrepreneurship would be a necessary condition for this effect. That is, competitive individuals should be more likely to select into entrepreneurship, only to the extent to which they perceive entrepreneurship to be more competitively intense than other occupations.

If individual perceptions of competition are non-systematic and idiosyncratic, perceived intensity of competition in entrepreneurship will, on average, not differ from perceived intensity of competition in paid employment. In this case differences in the perception of competitive intensity could not explain the findings of previous research that entrepreneurs are more likely to select into competitive environments (see Bönte & Piegeler, 2013; Holm et al., 2013; see also Chapter IV). In contrast, if there is a commonly shared view on intensity of competition in entrepreneurship and in paid employment, there will be systematic differences in perceptions. Based on Kirzner's (1973) assertion that entrepreneurial activity is always competitive and that competitive activity is always entrepreneurial, we expect that individuals tend to perceive entrepreneurship to be more competitively intense than paid employment. This leads to our second hypothesis:

Hypothesis 2: *Entrepreneurship is on average perceived (rated) as more competitive than paid employment jobs.*

Furthermore, there is substantial heterogeneity between different occupations within both groups. Entrepreneurship may comprise various activities ranging from working as an IT freelancer over owning a restaurant to starting a new venture in a high-tech industry and this heterogeneity has evoked controversial discussion within entrepreneurship literature. While, for instance, Spencer, Kirchhoff, and White (2008, p.9) suggest to *"focus more on entrepreneurs that form and operate independent new firms",* Acs, Åstebro, Audretsch, and Robinson (2016, p. 41) state that "*the typical ''entrepreneur'' is a sole proprietor with no other employees and who is working in a relatively mature and competitive industry such as the trades (e.g., construction), small-*

scale services, or who owns a restaurant or a retail business. While most of this discussion is well beyond the scope of this work, the heterogeneity of entrepreneurship might be reflected in perceived competitive intensity. The notions of competition faced by entrepreneurs are as heterogeneous as the entrepreneurial opportunities itself. Innovative entrepreneurs may create new combinations by challenging conventional wisdom to overcome social resistance and skepticism (Schumpeter, 1934), exploit market failures and destroy monopoly positions (Dean & McMullen, 2002), and engage in rivalrous competition with other entrepreneurs for profitable market opportunities (Kirzner, 1997). Yet most entrepreneurs may rather enter into highly contested markets, with products and services that are typically already offered, and where there is already a large supply present (Acs et al., 2016). In his general theory of entrepreneurship Shane (2003) distinguishes *self-employment* from *founding of new businesses* as the two operational definitions of entrepreneurship typically used in empirical research[45]. We follow this distinction between self-employment and founding new businesses and explore the perceived intensity of competition associated with both kinds of environments.

Not only entrepreneurship, but also paid employment tends to be heterogeneous with respect to perceived competitive intensity. Particularly top-level executives and managerial positions may be viewed as extremely competitive (Gneezy et al., 2003; Niederle & Vesterlund, 2007). On the one hand managers are more in touch with the market competition their organizations face than other paid employees; on the other hand managers and particularly executives have to face substantial intra-organizational competition. Especially within large organizations becoming a top level manager might require competing and winning in promotion tournaments (Lazear & Rosen, 1981).

In order to provide a more fine grained analysis, we further distinguish between four different occupational categories: Within entrepreneurial occupations we distinguish between business founders, and other self-employed occupations. Within paid employment we distinguish between managers and non-managerial employment. We explore the perceived competitive intensity within these four occupational categories.

[45] Shane and Venkataraman (2000) define entrepreneurship as the identification, evaluation, and exploitation of opportunities. Shane (2012) criticizes the distinction between this conceptual definition and other operational definitions of entrepreneurship (e.g. firm formation) in entrepreneurship research.

5.3 METHOD

To empirically investigate the role of the perceived intensity of competition in the context of the relationship between individual competitiveness and career choices, we analyze data from two separate empirical studies, which are based on a sample consisting of 227 undergraduate university students (Sample 1) and a general population sample consisting of 202 visitors of a shopping mall (Sample 2). For Sample 1, we make use of self-reported measures of competitive preferences focusing on enjoyment of competition and use job intentions as a measure of career choice. For Sample 2, we build on revealed behavior for both the measure of competitive preference and the job preference. Specifically, we employ an incentivized "lab-in-field" experiment to elicit participants' competitive preference (and control for related measures of risk preferences and confidence) and look at revealed job choices.

Using a general population sample with revealed entrepreneurs and non-entrepreneurs allows investigating whether competitiveness is related to actual job choice. However, as discussed in Chapter IV having experience as an entrepreneur may affect perception of competitiveness as well as individual competitive preferences. Moreover, participation in a "lab-in-field" experiment is voluntary and participants are likely to have high opportunity costs of participating. Within the student sample, these problems are smaller, because the intent is directed towards future behavior and due to the early stage in their professional development they are less likely to be affected by job-specific experiences, such that "student samples provide a good balance between threats of reverse causality and sample selection biases" (Bönte et al., 2015, p.9). Especially in classroom surveys participants are likely to have very low opportunity cost of participation, which likely reduces the selection bias stemming from voluntary participation and allows implementing more detailed and complex measures.

5.3.1 Study designs and sample descriptions

Sample 1

In 2016 we conducted a survey examining the perception of competitiveness of occupations among 2nd year undergraduate students at a large German university. At the beginning of the survey, students were informed that participation was voluntary and

that their identities were not recorded to ensure confidentiality. Participants were not informed about the specific research question. A total 237 respondents provided full information regarding all specific occupations. For the within-subject comparison of four different occupational environments, we have a total sample of 887 sufficient information sets provided by 227 respondents. Respondents are on average 23 years old and all achieved the same education level required to access a university in Germany. Descriptive statistics for these participants are provided in table 5.4 and table 5.6.

Sample 2

For three days in November 2017 we conducted a "lab-in-field" experiment in a shopping mall in a large German city. Given time-constraints and in order to provide low barriers for participation, we conducted the experiment using a paper-and-pencil approach. Mall visitors were approached and asked whether they would like to participate in a 15-20 minutes experiment on "decision-making behavior of adults" in return for earnings between at least €5.00 and at maximum €16.00. At the beginning, participants were informed that participation was voluntary and that their identities were not recorded to ensure confidentiality. Participants were not informed about the specific research question. We continued with a brief survey on participant's socio economic background, including gender, age, education, occupation. Subsequently, participants played two rounds of incentivized games.

In the first round participants were exposed to one of two task treatments: math-based competition (MC) or dice-based competition (DC). In the math-based competition treatment (MC), participants collected points by performing a math task that is similar to those implemented by Mayr et al. (2012). For 30 seconds, participants verified up to 20 simple single-digit equations (e.g. "7+2+3–6=5. Is the result true or false?"). The sets of 20 equations were each randomly composed and randomly assigned. Equations were mathematically equally difficult. One out of two equations was false, but participants were not informed about this share. A correctly verified equation added one point and an incorrect verification subtracted to the participants score. The task description presented to participants included three representative examples, which participants solved without incentives. In the dice-based competition treatment (DC),

participants collected points by rolling two fair six-sided dice (each with 3 white sides and 3 black sides) five times, earning one point for each die that displays a black side.

Independent of the task treatment participants were presented three payment schemes: (1) A piece-rate scheme (€0.25 for each point), (2) a risky piece-rate scheme (rolling a fair dice determines whether participant receives €0.50 per point, or, €0.00 otherwise) and (3) a competitive payment scheme (€0.50 per point if the participant's overall score was higher than the score of a randomly selected previous anonymous participant, and €0.00 otherwise). Participants make a set of three conditioned choices selecting their preferred payment scheme for each possible combination of two payment schemes. The choice between piece-rate versus competition reflects the classic choice from typical competitiveness experiments (e.g. Niederle & Vesterlund, 2007). The choice between risky piece-rate and piece-rate allows us to proxy individuals' risk preferences without losing the feature that the risky outcome also depends on the own abilities. The third choice of competition versus risky piece-rate was introduced to identify participants' transitivity of choices. We exclude participants who display intransitive choices, because the factors of their choices are most likely not decomposable into the different parts of competition, risk, and confidence, which is needed to correctly interpret the results of the competitiveness measurement. The payment for this first round is determined by these choices and a previously drawn (sealed) card indicating one of the three payment scheme combinations to be the one that eventually determines the relevant choice set. After making these choices, participants were asked to estimate how many out of the ten other participants reached a lower score than they themselves will prospectively reach. Participants received €1.00 for a correct estimation.

In the second round we adopted the Eckel-Grossman task as an incentivized measure of risk preferences (Eckel & Grossman, 2008), which has been argued to be particularly useful for participants with low mathematical skills (Dave, Eckel, Johnson, & Rojas, 2010). Participants choose one out of six 50/50 lotteries. In lottery #1 participants received an expected payment of €2.80 and an absolute risk of €0.00. In lotteries #2 to #5 the expected payment increases in steps of €0.20, while absolute risk increases in steps of 0.60€. Lottery #6 (€0.20; €7.00) has the same expected payoff as lottery #5, but higher absolute risk.

After the second round, participants answered additional survey items regarding their current and previous occupation, their perception of competitive intensity in 12 different jobs, and the occupation of their parents. At the end of the experiment, we randomly determined, using a die, which of the two played rounds would be paid.

From the overall 331 participants, we excluded 90 students and 6 participants, who were older than 66 years or older, because these individuals' job choices are most likely not only between the different occupational categories, but also the non-participation alternative is likely very dominant. Furthermore, 13 participants were excluded because of missing responses. We also excluded 20 participants due to their intransitive choices in the experiment as previously described. Hence, our final sample includes 202 valid and reliable responses. Descriptive statistics for these participants are provided in Table 5.5 and Table 5.7.

5.3.2 Model variables

Perceived competitive intensity of job categories

Our measurements of perceived competitive intensities of the four occupational categories are based on related judgments of examples of these categories. We adapted the single-item measure of job competitiveness from the O*NET database[46]. Based on the description that competitive workplaces "require the worker to compete or to be aware of competitive pressure" respondents rate occupations on 7-point scales (1 = not competitive at all; 7 = extremely competitive).

We initially started, in Sample 1, with examining the perceived competitiveness of 27 specific occupations derived from the general job categories described by the International Standard Classification of Occupations ISCO-08 (ILO, 2012) and specific jobs linked to these categories by the O*NET database. We aimed at two general categories of job activities: entrepreneurship and paid employment, which each is

[46] The Occupational Information Network (O*NET) is developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration and is a primary source of occupational information for the U.S. The O*NET database contains a large set of standardized and occupation-specific descriptors on more than 900 occupations covering the entire U.S. economy. The database is publicly available and continually updated from input by workers in each occupation (cf. National Center for O*NET Development, 2019 https://www.onetcenter.org/overview.html).

divided into two sub-categories: *Start-up founder*, (other) *Self-employment*[47], *Management*, and (non-managerial) *Employment* without management role. We included 9 job descriptions from O*NET assigned to occupations from the ISCO-08 subgroups of "Major Group 1 – Managers". Furthermore, we included 8 other O*NET job descriptions assigned to the other major groups of the ISCO-08.

As O*NET data only cover paid employment and do not have explicit categories for entrepreneurship, we additionally created 10 descriptions of entrepreneurial jobs including different kinds of entrepreneurship ranging from founding a growth-oriented start-up to owning and managing a family firm or working as a self-employed specialist.

To derive robust indicators for perceptions of competitive intensity in these four job categories we run an exploratory factor analysis with Promax rotation (see Table 5.1). Extracting the conceptually expected number of four factors, we observe that each of the extracted factors can be clearly and unambiguously matched with one of the conceptually expected factors. There are a few unexpected loadings and cross loadings. The founder of a service firm loads on both the start-up founder factor and the other self-employment factor. The clinician and the employed architect both load on the factor reflecting the managerial employments, though with rather small loadings. In both cases, we believe that to some extent managerial duties could be part of these jobs. To simplify measurements for Sample 2 we selected three jobs that best represent each factor; the highest loading ones with also low cross loading (marked in bold in Table 5.1).

Running a confirmatory factor analysis for Sample 1 (N=237, $\chi^2(48)= 130.466$, $p<0.001$, RMSEA=0.085, SRMR=0.079, CFI=0.899), which should be interpreted with care because the original exploratory analysis was run on this sample, and Sample 2 (N=202, $\chi2(48)=89.984$, $p<0.001$, RMSEA=0.066, SRMR=0.065, CFI=0.942), which is a true confirmatory test, both indicate a good fit, particularly for Sample 2. Table 5.2 reports Cronbach's alpha and composite reliability for the respective three selected jobs of all four job categories in both samples.

[47] The distinction between founders and self-employment is of course not a perfectly disjunctive classification, but acknowledges the heterogeneity of entrepreneurship.

Table 5.1: Exploratory factor analysis for perceptions of competitive intensity for 27 jobs

	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
Single founder of a high-tech start-up *			**0.7558**		0.3606
Team founder of a high-tech start-up *			**0.7627**		0.3993
Founder of a growth-oriented start-up *			**0.5974**		0.3787
Founder of a Service-Business	0.3370		0.3441		0.5793
Architect with own Architect's Office *	**0.8129**				0.3435
Kiosk Owner	0.4546				0.6924
Dentist with own Dental Surgery *	**0.7752**				0.4469
Hairdresser with own shop *	**0.5776**				0.6278
Owner-Manager of a family firm	0.4501				0.5890
Self-employed IT-specialist	0.5253				0.5622
Sales manager		0.4807			0.7527
Marketing manager		0.5097			0.6856
Human resource manager *		**0.5485**			0.6408
Supply chain manager		0.4788			0.6157
Emp. chief executive of a family firm		0.3474			0.7864
Computer or information system manager *		**0.5820**			0.5793
Top Manager of a large corporation *		**0.6612**			0.5177
Construction Manager		0.4257			0.6253
Investment Fond Manager		0.5038			0.7203
Clinician		0.4350			0.7653
Architect - employed in an Architect's Office		0.3653			0.7739
Employed Child Care Worker *				**0.7284**	0.4769
Retail Salesperson				0.4581	0.7923
Police Patrol Officer				0.3239	0.8352
Legal Secretary				0.5162	0.6171
Public Sector Clerk *				**0.5935**	0.6233
Busdriver *				**0.6556**	0.6154

Notes: *Blanks represent factor loadings below 0.3. Jobs selected for the brief measurement instrument, i.e. the highest loading ones, are marked by a star*.

Table 5.2: Cronbach's alpha and composite reliability for 4x3 item measure of perceptions of competitive intensity

Perception of Competitive Intensity	**Study 1**		**Study 2**	
	Cronbach's α	**Composite Rel.**	**Cronbach's α**	**Composite Rel.**
Employment	0.6843	0.6869787	0.7598	0.7681859
Manager	0.6328	0.6522628	0.6609	0.6733331
Self-Employment	0.7475	0.7587271	0.4638	0.4618238
Founder	0.8055	0.8060962	0.8538	0.8534977
Average	0.717525	0.7260162	0.684575	0.68921013

Self-reported individual competitiveness (Sample 1)

In Sample 1, we measured individual competitive preferences using three items of the self-reported competitiveness scale introduced in Chapter II that focus on the enjoyment of competition: *"I like situations in which I compete with others"; "I enjoy competing against others"; "I prefer competing with others when pursuing a goal over pursuing the goal alone".* All items are rated on a 7-point Likert scale (1 = completely disagree; 7 = completely agree). The centered average score of these three items forms the variable indicating individual competitive preferences (α=0.822); hence, zero represents the sample mean.

Revealed individual competitiveness (Sample 2)

In Sample 2, we use the choice between the "tournament" and the "piece-rate" as an incentivized behavioral measure of revealed competitive preferences; the dummy variable is zero for participants choosing the non-competitive piece-rate and one for participants choosing the competitive tournament. Because competitive preferences are by definition distinct from risk preferences and expectations of winning (Niederle & Vesterlund, 2007) we include variables measuring risk preferences and expectation of winning within the competitiveness measurement as statistical controls, such that the employed measure of individual competitiveness is, in fact, the residual independent of the risk preference and the expectations of winning. We use the choice between the "risky payment" and the "piece-rate" as an incentivized behavioral measure of *revealed risk preferences*; the dummy variable is zero for participants choosing the piece-rate and one for participants choosing the risky payment. *Expectations of winning* are measured by the response to the incentivized estimation of how many of ten other participants will display a lower performance.

Job preferences as self-reported intentions (Sample 1)

In Sample 1, for each occupational environment we include a three-item scale. The first item is a generalized version of the Thompson (2009) item used in study 1 (*"I intend to [set up a company, be self-employed, work in a management position, work as*

an employee] in the future.") [48]. The second item is a reversed version of the third item of study 1 (*"I have never thought about [setting up a company, working as a self-employed, working as a manager, working as an employee]" (R))*. Moreover, we include a very general item (*"I would like to [set up a company, be self-employed, work in a management position, work as an employee]").* Each item is rated on a 7-point Likert scale (1=completely disagree; 7=completely agree). We use the average score of these three items as measure for the attractiveness of each occupation.

Job preferences as revealed previous job engagement (Sample 2)

In sample 2, for each occupational environment we include the respondent's previous job engagement. We ask participants, whether they have "ever founded a business before", "ever been self-employed", "ever been employed in management position", and "ever worked as an employee without a management role". To measure respondents' revealed job preferences for each occupational environment we use dummy variables, which take the value one, if the respondent reveals previous engagement in that environment, and zero otherwise.

5.3.3 Additional control variables

In both samples we included the following individual level control variables. Gender (contrast code), age, two dummies for whether mother or father were self-employed. Sample 1 is, compared to Sample 2, rather homogeneous with respect to education; they all possess the minimum requirement to enter university programs, i.e. the A level (Abitur). We included the grade of this degree to control for different levels of educational attainment. In Sample 2, we included dummies for different levels of educational attainments (Hauptschule, Realschule, Fachabitur, Abitur, vocational training, university degree). Sample 1 also included a measure of the number of siblings, which might be related to individual competitiveness. Besides the above-mentioned control variables, risk preferences and confidence related to the behavioral measurement of individual competitiveness, analyses of Sample 2 also included

[48] The other item from Thompson 2009 we used in study 1 ("I spend time learning about starting a firm") is hardly applicable to the more general occupational categories, e.g. to employment.

dummies for the specific day of the experiment and whether or not participants were native speakers of German.

In Sample 1, we included two additional job-specific control variables. First, individuals may be more familiar with some occupations than with others and therefore have more informed evaluations of these more familiar occupations. We control for such differences by including a measure of **familiarity**, i.e. the response to the single item (*"In my personal environment there are [Managers, Founders, Self-Employed; Employees]")* rated on a 7-point Likert scale (1 = completely disagree; 7 = completely agree). Furthermore, people may choose a seemingly more competitive environment because they believe to be more successful. To account for such heterogeneity, we include a measure of **confidence** for each occupation using the average response to a two-item scale with one item indicating to what extent individuals believe they are able to successfully work in each occupation (*"I will likely be able to [set up a company, be self-employed, work in a management position, work as an employee]")* and the other item indicating whether individuals believe they would be among the best in each occupation (*"If I worked as a [Manager, Founder, Self-Employed; Employee], I would be among of the best of them.").* Both items were rated on a 7-point Likert scale (1 = completely disagree; 7 = completely agree).

5.3.4 Vignettes: Experimental Scenarios

As an additional plausibility check we investigate the perception of competition in abstract scenarios among our student sample. In this section of the survey we present four different scenarios, which were designed to resemble the payment schemes used in typical economic competitiveness experiments (e.g Gneezy et al., 2003, Niederle & Vesterlund, 2007). Each scenario is presented to the participants as a short vignette. In Scenario A we describe a typical piece-rate condition. In scenario B we add an element of risk to it. These scenarios are considered to represent non-competitive settings. In Scenarios C and D we describe a competitive tournament condition. In Scenario D we emphasize a tournament condition of competing while performing different tasks, which again includes an element of chance and reduces the impact of individual ability beliefs. Moreover, this may reflect a feature of competition in various occupations (e.g. between start-up firms with different production technologies or managers working on different

projects). Table 5.3 presents the German original text and English translation of each scenario.

Including these scenarios reflecting typical experimental conditions has advantages for the comparison of competitive perceptions. First, it allows to distinguish between the perception of different institutions and different perceptions of (the same) institutions. While different instantiations of the same occupation may still include heterogeneous sets of institutions, using standardized scenarios helps to isolate the effect of perceiving identical institutions differently from the effect of facing different institutions. Second, for these standardized scenarios we have clear theoretical predictions that the tournaments (Scenarios C and D) represent competitive settings and should be perceived as highly competitive, while the piece-rates (Scenario A and B) represent non-competitive setting and should not be perceived as competitive.

Perceived competitive intensity of abstract scenarios

Our measurements of perceived competitive intensities of the four scenarios are based on the single-item measure we adapted from the single-item measure of job competitiveness from the O*NET database. Respondents rate each scenario on a 7-point scale (1 = not competitive at all; 7 = extremely competitive).

Self-reported scenario preferences

Our measurements of participants' preference for each of the four scenarios are based on simple single-item measures: "In Scenario [A, B, C, D] I would like to participate". Each item is rated on a 7-point Likert scale (1=completely disagree; 7=completely agree).

Table 5.3: Vignette texts

Szenario A *Mehrere Personen lösen unabhängig voneinander für Geld die gleichen Aufgaben. Eine Person erhält für jede von ihr richtig gelöste Aufgabe einen Punkt. Am Ende der Bearbeitungszeit bekommt diese Person ihrer Gesamtpunktzahl entsprechend 1 € pro Punkt ausgezahlt. Die Person erfährt nur ihre eigene Gesamtpunktzahl, nicht jedoch die Punktzahlen der anderen Personen.*	***Scenario A*** *Multiple persons are paid for independently solving the same tasks. A person receives one point for every task he/she solves correctly. At the end of the working period the person is paid €1 per point according to his/her total score. The person is informed solely about his/her own total score, but not about scores of the other persons.*
Szenario B *Mehrere Personen lösen unabhängig voneinander für Geld die gleichen Aufgaben. Eine Person erhält für jede von ihr richtig gelöste Aufgabe einen Punkt. Am Ende der Bearbeitungszeit wird die Bezahlung der Person ausgelost. Mit einer 50% Chance bekommt die Person ihrer Gesamtpunktzahl entsprechend 2 € pro Punkt ausgezahlt. Mit der gleichen Wahrscheinlichkeit erhält die Person 0 €. Die Person erfährt nur ihre eigene Gesamtpunktzahl, nicht jedoch die Punktzahlen der anderen Personen.*	***Scenario B*** *Multiple persons are paid for independently solving the same tasks. A person receives one point for every task he/she solves correctly. At the end of the working period the person's payment is determined by a lottery. With a probability of 50% the person is paid €2 per point according to his/her total score. With the same probability the person receives €0. The person is informed solely about his/her own total score, but not about scores of the other persons.*
Szenario C *Mehrere Personen lösen unabhängig voneinander für Geld die gleichen Aufgaben. Eine Person erhält für jede von ihr richtig gelöste Aufgabe einen Punkt. Am Ende der Bearbeitungszeit wird die Gesamtpunktzahl dieser Person mit der Gesamtpunktzahl von 3 zufälligen anderen Personen verglichen. Ist die Punktzahl der Person höher, als die Punktzahlen aller 3 anderen Personen, erhält sie ihrer Gesamtpunktzahl entsprechend 4 € pro Punkt ausgezahlt. Ansonsten erhält die Person 0 €. Die Person erfährt nur ihre eigene Gesamtpunktzahl, nicht jedoch die Punktzahlen der Anderen.*	***Scenario C*** *Multiple persons are paid for independently solving the same tasks. A person receives one point for every task he/she solves correctly. At the end of the working period the person's total score is compared to the total scores of 3 other randomly chosen persons. If the person's total score is higher than the total scores of all 3 other persons, the person is paid €4 per point according to his/her total score. Otherwise the person receives €0. The person is informed solely about his/her own total score, but not about scores of the other persons.*
Szenario D *Mehrere Personen bearbeiten unabhängig voneinander für Geld* ***unterschiedliche Aufgaben, die auch einen unterschiedlichen Schwierigkeitsgrad haben können****. Für jede Person wird eine Gesamtpunktzahl ermittelt. Am Ende der Bearbeitungszeit wird die Gesamtpunktzahl einer Person mit der Gesamtpunktzahl von 3 zufälligen anderen Personen verglichen. Ist die Punktzahl der Person höher, als die Punktzahlen aller 3 anderen Personen, erhält sie ihrer Gesamtpunktzahl entsprechend 4 € pro Punkt ausgezahlt. Ansonsten erhält die Person 0 €. Die Person erfährt nur ihre eigene Gesamtpunktzahl, nicht jedoch die Punktzahlen der Anderen.*	***Scenario D*** *Multiple persons are paid for independently solving* ***different tasks, which may have different difficulty levels.*** *A person receives one point for every task he/she solves correctly. At the end of the working period the person's total score is compared to the total scores of 3 other randomly chosen persons. If the person's total score is higher than the total scores of all 3 other persons, the person is paid €4 per point according to his/her total score. Otherwise the person receives €0. The person is informed solely about his/her own total score, but not about scores of the other persons.*

Table 5.4: Descriptive statistics for study I (individual level variables)

Variable	Mean	s. d.	Min	Max
Competitive Preferences	3.971	1.351	1	7
Gender (Female=1)	0.498	0.501	0	1
Age	22.555	3.067	17	36
Mother self-employed	0.211	0.409	0	1
Father self-employed	0.066	0.249	0	1
Abitur degree	2.371	0.534	1	3.7
No. of siblings	1.348	1.140	0	7

Notes: *N=227. Competitive preferences before centering the score.*

Table 5.5: Descriptive statistics for study II (individual level variables)

Variable	Mean	s. d.	Min	Max
Competitive Preferences	0.490	0.501	0	1
Risk: Risky Payment	0.594	0.492	0	1
Risk: CRRA	1.078	1.218	0	3.46
Gender (Female=1)	0.473	0.500	0	1
Age	39.946	11.833	18	65
Mother self-employed	0.317	0.466	0	1
Father self-employed	0.178	0.384	0	1
Education: Hauptschule	0.119	0.324	0	1
Education: Realschule	0.297	0.458	0	1
Education: Fachabitur	0.153	0.361	0	1
Education: Abitur	0.347	0.477	0	1
University Graduation	0.396	0.490	0	1
Professional Job Training	0.386	0.488	0	1
Education: Other	0.084	0.278	0	1
German natives	0.782	0.414	0	1
Day2	0.361	0.481	0	1
Day3	0.356	0.479	0	1

Notes: *N=202*

Table 5.6: Descriptive statistics for study I (domain-specific variables)

		Total			Employment			Management			Self-Employment			Founder		
		N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
1	Perception of Comp	887	4.489	1.769	225	2.21	0.933	221	4.893	1.074	219	5.154	1.306	222	5.739	1.170
2	Attractiveness of Occ.	887	4.205	1.733	225	3.449	1.350	221	5.152	1.638	219	4.061	1.707	222	4.170	1.773
3	Confidence	887	4.457	1.529	225	5.056	1.364	221	4.774	1.398	219	4.034	1.466	222	3.953	1.589
4	Familiarity	887	4.818	2.262	225	5.893	1.502	221	3.991	2.363	219	5.374	1.974	222	4.005	2.447

Table 5.7: Descriptive statistics for study II (domain-specific variables)

		Total			Employment			Management			Self-Employment			Founder		
		N	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.
1	Perception of Comp	808	4.693	1.736	202	2.657	1.355	202	5.015	1.249	202	5.325	1.119	202	5.776	1.265
2	Previous job engagement	808	0.425	0.495	202	0.822	0.384	202	0.292	0.456	202	0.386	0.488	202	0.198	0.399

Table 5.8: Correlations conditioned on job categories

	Sample 1	**Employment**		**Manager**		**Self-Empl.**		**Founder**	
		PoC	*AoO*	*PoC*	*AoO*	*PoC*	*AoO*	*PoC*	*AoO*
1	Perception of Comp	1	0.056	1	-0.014	1	-0.012	1	-0.009
2	Confidence	-0.063	0.271***	-0.032	0.695***	-0.030	0.656***	0.029	0.680***
3	Familiarity	-0.231***	0.105	0.095	0.249***	-0.020	0.286***	-0.026	0.171*
4	Competitive Preferences	0.159*	-0.150*	0.190**	0.204**	0.047	0.131+	-0.014	0.159*
5	Gender (Female=1)	-0.005	0.101	0.012	-0.108	0.039	-0.280***	0.121+	-0.371***
6	Age	-0.069	0.079	-0.086	-0.267***	-0.050	0.127+	0.096	0.052
7	Mother self-employed	-0.026	-0.071	-0.027	0.109	0.051	0.228***	0.013	0.150*
8	Father self-employed	0.106	-0.023	0.049	-0.106	0.025	0.063	0.076	-0.050
9	Abitur degree	-0.047	0.115+	0.045	-0.104	0.015	0.042	0.028	0.041
10	No. of siblings	0.126+	-0.050	0.077	-0.117+	-0.068	-0.127+	0.037	-0.103
	Sample 2	**Employment**		**Manager**		**Self-Empl.**		**Founder**	
		PoC	*JobEver*	*PoC*	*JobEver*	*PoC*	*JobEver*	*PoC*	*JobEver*
1	Perception of Comp	1	-0.163*	1	-0.057	1	0.009	1	0.065
2	Competitive Preferences	0.122+	0.017	0.010	0.067	-0.141*	0.138+	-0.095	0.234***
3	Risk: Risky Payment	0.076	-0.016	0.118+	-0.045	-0.066	0.055	-0.035	0.082
4	Risk: CRRA	0.064	0.014	-0.083	-0.006	0.054	0.061	-0.034	-0.044
5	Gender (Female=1)	-0.004	-0.104	0.178*	-0.273***	0.316***	-0.193**	0.120+	-0.247***
6	Age	0.170*	0.120+	0.020	0.306***	0.059	0.143*	-0.039	0.261***
7	Mother entrepreneur	-0.079	0.039	-0.022	-0.110	-0.043	-0.016	0.057	0.009
8	Father entrepreneur	0.010	-0.121+	0.102	0.014	0.007	0.003	0.028	0.093
9	Education: Hauptschule	0.218**	-0.109	0.024	-0.000	-0.121+	0.086	-0.137+	0.048
10	Education: Realschule	0.072	-0.235***	0.033	-0.084	0.066	-0.137+	-0.122+	0.030
11	Education: Fachabitur	0.084	0.055	0.017	0.059	-0.071	0.057	-0.135+	0.099
12	Education: Abitur	-0.292***	0.176*	-0.014	-0.010	0.136+	-0.022	0.237***	-0.101
13	University Graduation	-0.214**	0.113	-0.039	0.059	0.063	0.085	0.227**	-0.022
14	Professional Job Training	0.008	0.130+	-0.018	-0.085	0.009	0.060	0.034	0.091
15	Education: Other	-0.042	0.001	0.044	0.080	-0.051	0.126+	-0.003	0.118+
16	German natives	-0.131+	0.130+	-0.106	0.181*	0.121+	-0.025	0.150*	0.112
17	Day2	0.117+	-0.054	0.041	-0.143*	-0.164*	-0.089	-0.147*	-0.089
18	Day3	-0.071	0.050	-0.067	0.204**	0.151*	-0.017	0.059	0.019

Notes: *Domain-specific correlations of all variables in study 1 with perception of competition (PoC) and attractiveness of occupation (AoO) as well as of all variables in study 2 with PoC and previous job engagement (JobEver). Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

5.3.5 Econometric approach

For our econometric analyses of individuals' perceptions of competitive intensity we employ fixed effects regression analyses. Our econometric specification has its foundation in a random utility model describing individual preferences for J different environments and can be seen as an adaptation of McFadden's (1974) choice model. The model includes two sets of independent variables for each individual i. First, the $J \times p$ matrix X_i denotes p alternative-specific variables that vary among alternatives and individuals. Second, the $1 \times q$ vector z_i denotes q individual-specific variables that vary only among individuals. Moreover, we include both individual-fixed and job-fixed effects. The $J \times 1$ vector w reflects the vector of alternative-specific fixed effects, which might include tendencies that for some reasons, e.g. social norms, all individuals report lower attractiveness of, e.g., non-managerial employments. The scalar v_i reflects the individual-specific fixed effect, which for instance might include individuals' tendencies to generally find all alternatives more attractive. A random-utility model can then be expressed as

$$u_i = X_i\beta + (z_i A)' + w + v_i + \epsilon_i \qquad (5.3.1)$$

with β being a $p \times 1$ vector of alternative-specific regression coefficients and $A = (\alpha_1, \ldots, \alpha_J)$ being a $q \times J$ matrix of alternative-specific regression coefficients, i.e. α_j is a $p \times 1$ vector with coefficients specific for alternative j versus a base alternative. For the base alternative we set $\alpha_1 = 0$. The elements of the $J \times 1$ vector ϵ_i are independent random variables with the usual properties (mean equals zero, uncorrelated with itself, uncorrelated with X_i, uncorrelated with v_i, and homoskedastic). In sum, including the fixed effects implies that $X_i\beta + (z_i A)'$ only describes individual differences in relative utilities both between jobs and between individuals.

In Section 5.4.1 we first investigate self-reported individual preferences for four artificial scenarios indexed by $j = 1, \ldots, 4$ (referring to 1 as Scenario A, 2 as Scenario B, 3 as Scenario C, and 4 as Scenario D) in Sample 1. Scenario A serves as the base category. In our main analysis in Section 5.4.2 we then investigate individual preferences for occupational categories (henceforth referred to as *jobs*) as dependent variables. We have a set of four unordered alternatives, i.e. jobs, indexed by $j = 1, \ldots, 4$ (referring to 1 as non-managerial employment, 2 as managerial employment, 3 as self-employment, and 4 as start-up founder). Non-managerial employment serves as the

base category. The measurement of job preferences varies between our samples. In Sample 1 individual job preferences are elicited as self-reported intentions for each job. These measures are assumed to be directly linked to probabilities to enter these jobs in the future. In Sample 2 we elicit whether an individual has previously been engaged in a job. We do not model an exclusive choice between these jobs, but individuals may reveal to engage (or have been engaged) in more than one job or in no job at all. We employ a linear probability model for these revealed job choices, but employing a logit rather than linear link does not change the conclusions.

For all three dependent variables (scenario preferences; job intent; revealed job engagement) we assume probabilistic selection into environments based on the same underlying random utility model. As link between the utility and the observed variable, we assume a linear link between u_i and both the observed intent in Sample 1 and the probability of observed engagement in a job in Sample 2. As all regression models include individual fixed effects as well as job fixed effects, we estimate relative effects for each environment as compared to the base group. Hence, matrix A indicates the effects of individual-level variables on the probability to enter each specific environment rather than entering the base group environment. The coefficient vector β can be interpreted as the effects of alternative-specific variables on the probability to enter any environment rather than entering the base group environment, when variable values are one point higher in the respective environments than in the base group environment.

In Section 5.4.3 we employ a similar fixed effect regression model to estimate the perceived competitive intensity (PoC) across different jobs. The $J\times1$ vector w reflects the vector of alternative-specific fixed effects, which is the independent variable of main interest here. Moreover, we include a $1\times q$ vector z_i consisting of q individual-specific control variables as well as individual-specific fixed effects v_i. The model can then be expressed as

$$\mathrm{PoC_i} = \mathrm{v_i} + (\mathrm{z_i A})' + \mathrm{w} + \epsilon_\mathrm{i} \qquad (5.3.2)$$

with $A = (\alpha_1, \ldots, \alpha_J)$ being a $q\times J$ matrix of alternative-specific regression coefficients. For the base alternative we set $\alpha_1 = 0$. The elements of the $J\times1$ vector ϵ_i are independent random variables with the same properties as described above.

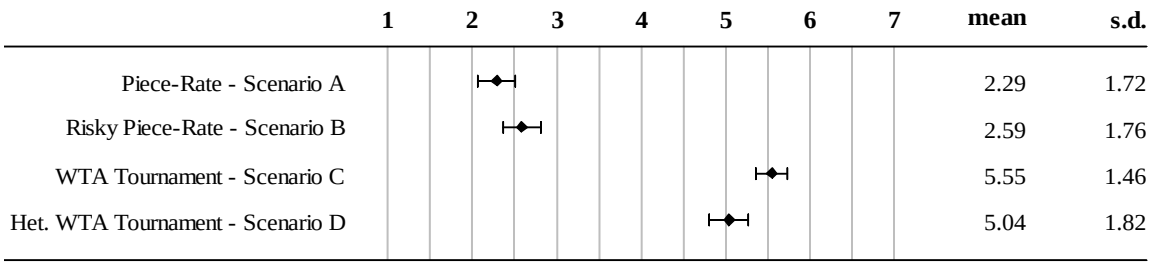
The reports of estimations include the full vector β reflecting the individual-specific effects of all alternative-specific variables and rows of the matrix *A* with three columns of alternative-specific effects on each of the three environments for individual-specific variables of main interest. Tables reporting the full matrix A of the respective models are provided in Appendix C. Moreover, we report environment-specific fixed effects *w*, relative to the base environment, i.e. scenario A or non-managerial employees respectively. Individual-specific fixed effects v_i are omitted from all reports.

5.4 RESULTS

5.4.1 Testing perception measures with experimental Scenarios

Figure 5.1 shows the average levels of perceived competitive intensity in each of the four scenarios. As expected scenarios A and B, which describe piece-rates, are perceived as substantially less competitive than scenarios C and D, which describe winner-take-all tournaments. Among the piece-rates scenario B, which includes an element of risk, is perceived as significantly more competitive, than scenario A (mean A = 2.29; mean B = 2.59; p = 0.0126). Among the WTA tournaments scenario D, which includes an element of uncertainty due to heterogeneity of tasks, is perceived as significantly less competitive, than scenario C (mean C = 5.55; mean D = 5.04; p < 0.0001). The difference between scenario B and scenario D is highly significant (mean B = 2.59; mean D = 5.04; p < 0.0001).

Figure 5.1: Perceived competitive intensity of scenarios



Note: *Figure shows mean values and 95% confidence intervals for each scenario. Anchors: 1="not at all competitive"; 7="extremely competitive"*

Table 5.9: Regression results for scenarios

Dependent variable		Study 1: Scenario Preference		
Alternatives (base: Scenario A – piece-rate)		Scenario B	Scenario C	Scenario D
Model 1				
	Competitive preference	0.07 (0.10)	0.22 (0.10)*	0.19 (0.11)+
	Constant (scenario fixed effect)	-1.37 (0.12)***	-0.80 (0.14)***	-1.46 (0.15)***
	Ind. fixed eff.		incl.	
	R^2 within / overall (F)		0.206 / 0.088 (25.97)***	
Model 2				
	Competitive preference	0.07 (0.10)	0.03 (0.15)	0.01 (0.15)
	Constant (scenario fixed effect)	-1.40 (0.13)***	-1.17 (0.20)***	-1.79 (0.21)***
	Perception of competition (PoC)		0.11 (0.05)*	
	PoC X Competitive preference		0.06 (0.03)+	
	Ind. fixed eff.		incl.	
	R^2 within / overall (F)		0.223 / 0.081 (20.79)***	
Model 3				
	Competitive preference	-	-	-
	Constant (scenario fixed effect)	-1.39 (0.13)***	-1.17 (0.20)***	-1.78 (0.21)***
	Perception of competition (PoC)		0.11 (0.05)*	
	PoC X Competitive preference		0.06 (0.02)*	
	Ind. fixed eff.		incl.	
	R2 within / overall (F)		0.222 / 0.078 (32.25)***	
Model 4				
	Competitive preference	-	-	-
	Control variables	incl.	incl.	incl.
	Constant (scenario fixed effect)	-0.56 (0.61)	-0.90 (0.72)	-1.28 (0.84)
	Perception of competition (PoC)		0.11 (0.05)*	
	PoC X Competitive preference		0.05 (0.03)*	
	Ind. fixed eff.		incl.	
	R2 within / overall (F)		0.237 / 0.083 (8.29)***	
All models	Observations		890	
	Number of Individuals		228	

Notes: *Individual and scenario fixed effects regression analyses with alternative-specific (i.e. scenario-specific) as well as individual-specific explanatory variables; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives and reported in corresponding columns). Estimated coefficients and cluster-robust standard errors in parentheses. Model 4 includes the following individual-level control variables: Gender, age, parental entrepreneurship, Abitur degree, No. of Siblings. Estimates for control variables and overall constant are omitted from table but provided in Appendix C. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table 5.9 reports regression results of the vignette study. In Model 1 we investigate the scenario-specific effect of individual competitive preferences on the preference for each scenario. We find positive coefficients of competitive preferences in both tournament scenarios ($\beta_C = 0.22$, se = 0.10; $\beta_D = 0.19$, se = 0.11), but no significant

effect in scenario B as compared to scenario A, which serves as the base group. This result indicates that individuals reporting a stronger competitive preference are more likely to like tournament scenarios relative to piece-rate scenarios, which is line with our previous findings in Chapter II.

In Model 2 we additionally include the perception of competitive intensity and its interaction with individual competitive preferences. In this model the effects of competitive preferences in both tournament scenarios turn insignificant and decrease by about 88% in size as compared to Model 1, while the effect in scenario B remains unchanged and still insignificant. The interaction of perceived competitiveness and individual competitive preferences shows a positive effect ($\beta = 0.06$, se = 0.03) suggesting that individuals reporting to be more competitive prefer scenarios they perceive as more competitive. More importantly, the effect of competitive preferences in both tournament scenarios appears to be almost entirely covered by this interaction effect.

Excluding the scenario-specific effects of competitive preferences from the estimation in Model 3 does not change the size of the interaction effect between perceived competitive intensity and competitive preferences ($\beta = 0.06$, se = 0.02). Moreover, the effect is robust when including a set of controls in Model 4.

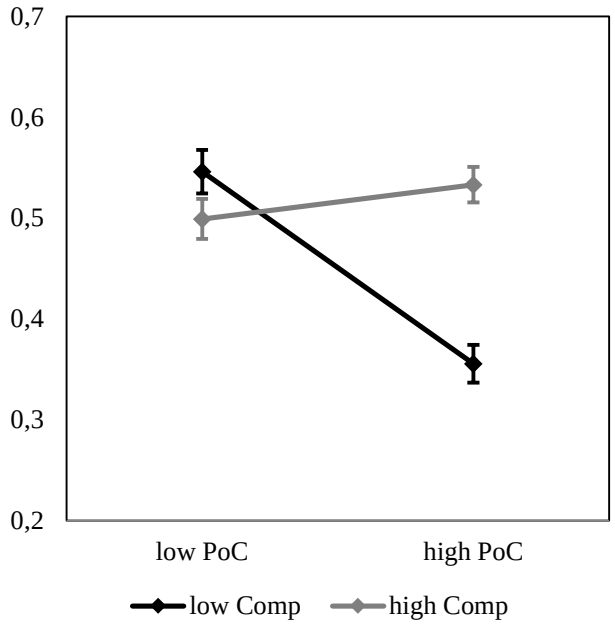
From these results we conclude that perceived competitive intensity measured by our self-reported measure reflects competition as perceived by individuals in winner-take-all tournaments. While the measure tends towards less extreme responses, if elements of risk or uncertainty are added, this does not reduce the measure's capability to clearly distinguish competitive tournaments from non-competitive piece-rates. Hence, we consider our measure of perceived competitive intensity sufficiently valid for the investigation of occupations.

5.4.2 The moderating role of perceptions of competition in jobs

For a first impression of the relation between competitive preferences and preferences for different occupations we provide some descriptive data analysis. In both samples we observe a positive correlation between competitive preferences and the individual's preferences for founding a business (sample 1: r = 0.16; sample 2: r = 0.23)

as well as for other self-employment (sample 1: r = 0.13; sample 2: r = 0.14). In sample 1 we further observe a positive correlation for management (r = 0.20) and a negative correlation for employment (r = -0.15), while there are no correlations between competitive preferences and the preferences for management or employment in sample 2.

Figure 5.2: Descriptive interaction between individual competitiveness and perceived competitive intensity



Note: *Descriptive interaction based on pooled data from both samples. Low (high) PoC indicates a perceived competitive intensity below (above) the median rating. Low (high) Comp indicates individuals with competitive preferences below (above) the median preference.*

Figure 5.2 shows pooled data for occupational preferences from both samples. Using mean split dummies for both perceptions of competitive intensity and the respective measure of competitive preferences yields a simple interaction plot. Competitive individuals are slightly more attracted to occupations they perceive as competitively intense, whereas non-competitive individuals are substantially less attracted to occupations they perceive as competitively intense. Moreover, when occupations are perceived to have a low competitive intensity, these occupations are less attractive to competitive individuals (mean = 0.50) than to non-competitive individuals (mean = 0.55). In contrast, when occupations are perceived to have a high

competitive intensity, these occupations are substantially more attractive to competitive individuals (mean = 0.53) than to non-competitive individuals (mean = 0.36).

Table 5.10 reports regression results for both samples[49]. In all models we investigate the within-subject differences between the effects on the preference for employment, which serves as base group, and the effects on preferences for the other three categories of occupations (management, self-employment, becoming a business founder). In Model 1 we investigate the occupation-specific effect of individual competitive preferences on the preference for each occupation. Relative to the base group of employment we observe positive coefficients of competitive preferences for all occupational categories in both samples. In the student sample this effect is significant for management ($\beta_M = 0.23$, se = 0.12), while in the general population sample we find a significant effect of competitive preferences on individuals revealed preference to become a business founder ($\beta_F = 0.19$, se = 0.09). This result is line with previous findings suggesting that competitive individuals tend to be attracted by management positions (see Chapter II) as well as entrepreneurship (Bönte & Piegeler, 2013; see Chapter IV).

In Model 2 we additionally include the perception of competitive intensity and its interaction with individual competitive preferences. In this model the interaction of perceived competitiveness and individual competitive preferences shows a positive effect in both the students sample ($\beta = 0.06$, se = 0.03) and the general population sample ($\beta = 0.08$, se = 0.03). This indicates that more competitive individuals prefer occupations they perceive as more competitive and provides empirical support for Hypothesis 1. Furthermore, the effects of competitive preferences for all occupations in both samples turn (or remain) insignificant and decrease in size as compared to Model 1, or even show a negative sign. Hence, the occupation-specific effects of competitive preferences appear to be covered by this interaction effect. Excluding the occupation-specific effects of competitive preferences from the estimation in Model 3 does slightly reduces the size of the interaction effect between perceived competitive intensity and competitive preferences in both samples (sample 1: $\beta = 0.05$, se = 0.02; sample 2: $\beta = 0.06$, se = 0.02), but does not change our conclusion.

[49] In order to improve clarity of presentation, we only report regression results for the variables of primary interest. The full results of all models are reported in Appendix C.

Table 5.10: Regression results for job categories

Dependent variable		Study 1: Job Preference			Study 2: Job Ever		
Alternatives (base: Non-managerial employees)		Manager	Self-Employed	Founder	Manager	Self-Employed	Founder
Model 1	Competitive preference	0.23 (0.12)*	0.10 (0.09)	0.12 (0.11)	0.05 (0.09)	0.12 (0.10)	0.19 (0.09)*
	Control variables	incl.	incl.	incl.	incl.	incl.	incl.
	Constant (job fixed effect)	3.22 (0.73)***	2.23 (0.63)***	2.85 (0.68)***	-0.66 (0.21)**	-0.28 (0.20)	-0.58 (0.18)**
	Control variables + ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)	0.549	/ 0.457 (32.29)***		0.427	/ 0.281 (13.08)***	
Model 2	Competitive preference	0.06 (0.14)	-0.10 (0.12)	-0.11 (0.15)	-0.15 (0.12)	-0.11 (0.14)	-0.10 (0.14)
	Control variables	incl.	incl.	incl.	incl.	incl.	incl.
	Constant (job fixed effect)	3.22 (0.74)***	2.25 (0.64)***	2.81 (0.69)***	-0.75 (0.27)**	-0.38 (0.26)	-0.72 (0.26)**
	Perception of competition (PoC)		0.00 (0.04)			0.05 (0.06)	
	PoC X Competitive preference		0.06 (0.03)*			0.08 (0.03)**	
	PoC X Risk preference					-0.05 (0.03)	
	PoC X Confidence					-0.01 (0.01)	
	Control variables + ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)	0.552	/ 0.463 (30.21)***		0.434	/ 0.262 (14.09)***	
Model 3	Competitive preference	-	-	-	-	-	-
	Control variables	incl.	incl.	incl.	incl.	incl.	incl.
	Constant (job fixed effect)	3.13 (0.74)***	2.27 (0.64)***	2.84 (0.68)***	-0.74 (0.27)**	-0.38 (0.26)	-0.72 (0.26)**
	Perception of Competition		0.01 (0.04)			0.05 (0.06)	
	PoC X Competitive Preference		0.05 (0.02)*			0.06 (0.02)**	
	PoC X Risk Preference					-0.04 (0.03)	
	PoC X Confidence					-0.01 (0.01)	
	Control variables + ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)	0.549	/ 0.461 (33.30)***		0.432	/ 0.276 (14.51)***	
All models	Observations		887			808	
	Number of Individuals		227			202	

Notes: *Individual and job fixed effects regression analyses with alternative-specific (i.e. job-specific) as well as individual-specific explanatory variables; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives and reported in corresponding columns). Estimated coefficients and cluster-robust standard errors in parentheses. All models for Sample 1 include the following individual-level control variables: Gender, age, parental entrepreneurship, Abitur degree, No. of Siblings, and the following alternative-specific control variables: Job expectations, familiarity. All models for Sample 2 include the following individual-level control variables: risk-preferences confidence, gender, age, parental entrepreneurship, education level, German native speaker, day of experiment. Estimates for control variables and overall constant are omitted from table but available in Appendix C. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1.*

We run a set of robustness checks for this analysis based on the specification of Model 3. Results of all robustness checks are reported in Appendix C.

First, since gender differences in competitiveness are well documented by previous research (e.g. Niederle & Vesterlund, 2007), we investigate whether our findings are gender-specific. We include interactions of all model variables with the gender contrast variable. We do not find an indication that our results are gender-specific neither in the student sample, nor in the general population sample. Furthermore, while in English only some occupations have gender-specific job titles (e.g. policewoman, policeman), in German language all occupations have a male and a female form. For the general population sample we randomized the job titles, such that half of the respondents were presented female job titles, while the others were presented male job titles. Including interaction terms for perceptions of competitive intensity with a job title contrast variable indicates that our findings are robust against the gender of the job titles.

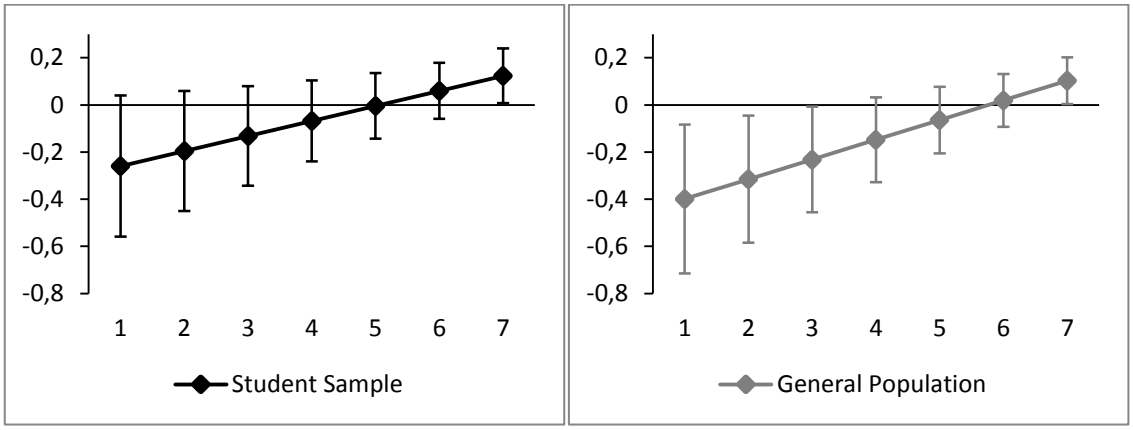
Second, we check the robustness of our results against minor variations of measurement in the general population sample. As we used two different tasks for the behavioral measure of competitive preferences in sample 2, we run an additional robustness check including interactions of perceptions of competitive intensity with a math-dice-task contrast variable.

Moreover, we use a context specific measure of risk preferences. While using context-specific measures of controls variables have advantages (Holm et al., 2013), we include a robustness check using an established more general measure of risk preferences (Eckel & Grossman, 2008). Our findings are robust against all of these variations of measurement. Finally, applying a logistic regression model instead of a linear probability model in sample 2 does not change our conclusion.

Based on the specification of Model 2 we predict the effect of an individual's competitive preferences on the individual's preference for an occupation conditional on the perceived competitive intensity in the occupation. Figure 5.3 shows the prediction for both samples. In the student sample the effect ranges from an insignificant negative effect (β = -0.26, p = 0.15) for an occupation, which is perceived as not at all competitive, to a positive effect (β = 0.12, p = 0.08) for an occupation, which is perceived as extremely competitive. In the general population sample the effect ranges

from a negative effect (β = -0.40, p = 0.04) for an occupation, which is perceived as not at all competitive, to a positive effect (β = 0.10, p = 0.09) for an occupation, which is perceived as extremely competitive.

Figure 5.3: Predicted interaction between individual competitiveness and perceived competitive intensity



Notes: *Predicted coefficient of Competitive Preference for different levels (1="not at all competitive" to 7="extremely competitive") of perceived competitive intensity. Vertical lines indicate 90% confidence interval.*

Moreover, we calculate the indirect effects of each occupational category on the relation between competitive preferences and the relative attractiveness of the occupation, which are due to their differences in perceived competitive intensity. Table 5.11 reports these indirect effects for both samples. Our results indicate that the difference in perceived competitive intensity between founding a business and working as an employee makes an individual's competitive preference increase the attractiveness of business founding relative to the attractiveness of employment by 0.231 (sample1) to 0.288 (sample 2). Our results also indicate positive, yet slightly lower, indirect effects for self-employment relative to employment (sample 1: 0.193; sample 2: 0.227) and management relative to employment (sample 1: 0.167; sample 2: 0.199).

Table 5.11: Indirect job-specific effects of individual competitiveness on job attractiveness mediated by perceptions of competitive intensity

	Study 1		Study 2	
	Indirect effect	$CI_{95\%}$	*Indirect effect*	$CI_{95\%}$
Founder vs. employees	.231+	[-.024 .367]	.288*	[.015 .545]
Self-Employment vs. employees	.193+	[-.030 .421]	.227*	[.012 .421]
Manager vs. employees	.167+	[-.036 .500]	.199*	[.017 .385]

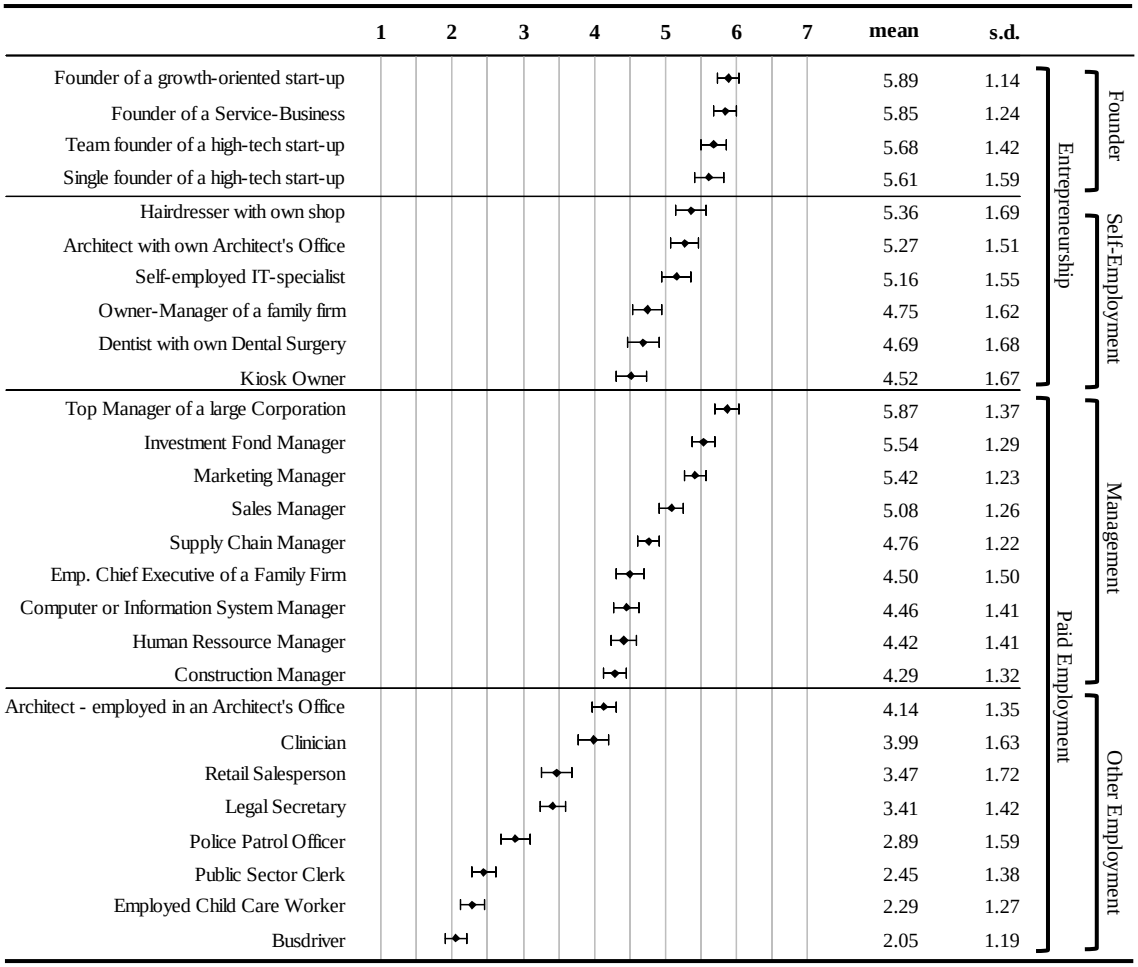
Notes: *We analyze the intervening variable effect of perceptions of competitive intensity categories on the link between individual competitiveness and job attractiveness by tests of the difference in coefficients (Freedman & Schatzkin 1992; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). We employ models reported in Table 5.10 and compare coefficients of job-specific effects of individual competitiveness before and after including the interaction of individual competitiveness with perceptions of competitive intensity (i.e. individual competitiveness conditioned on the perceived competitive intensity). We use bootstrapping with 5.000 replications to calculate bias-corrected and accelerated confidence intervals. We report the 95% confidence interval. The p-value associated with the largest confidence interval not including zero is assumed to indicate the significance level. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

5.4.3 Perceptions of competition in jobs

Figure 5.4 summarizes the evaluations of the 27 jobs. We see that on average entrepreneurial jobs are perceived as more competitively intense than paid employments; however and as expected, within both groups there is substantial heterogeneity, start-ups are perceived as more competitively intense than self-employment and managerial jobs are perceived as more competitively intense than non-managerial jobs.

Based on the results of factor analyses described in Section 5.3.2 (see Table 5.1) we selected three jobs for each of the four occupational categories. Figure 5.5 graphically reports the average evaluations for each of these 12 jobs as well as the average for each of the four job categories for both samples. We observe in Figure 5.5 that the evaluations are similar between the student sample and the general population sample. Based on the reported confidence intervals for these evaluations of the four job categories, we can already see that start-ups are perceived as most and non-managerial paid employment is perceived as least competitively intense.

Figure 5.4: Perceived competitiveness of 27 jobs – sample 1



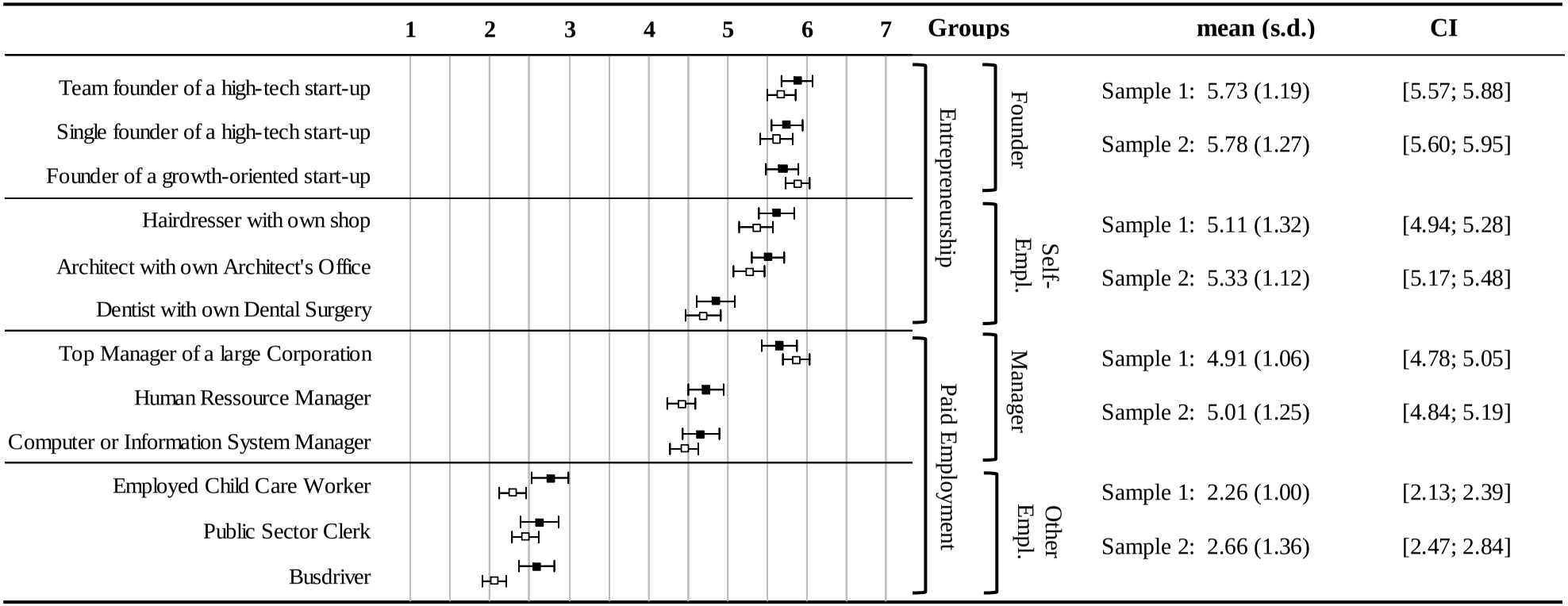
Notes: *Perceived competitive intensity of occupations(1="not at all competitive" to 7="extremely competitive"). Dots indicate mean value, horizontal lines indicate 95% confidence intervals.*

Entrepreneurial jobs are perceived as more competitively intense than paid employments in both the student sample (Paired t-test: diff=5.42-3.59=1.83>0, t=23.10, p<0.001) and the general population sample (Paired t-test: diff=5.55-3.83=1.71>0, t=17.41, p<0.001). Within the group of entrepreneurship occupations start-up founding is perceived as more competitively intense than other self-employment (paired t-tests: sample 1: diff=5.73-5.11=0.62>0, t=7.23, p<0.001; sample 2: diff=5.78-5.33=0.45>0, t=5.15, p<0.001) and within paid employment managerial jobs are perceived as more competitively intense than non-managerial employment (paired t-tests: sample 1: diff=4.91-2.26=2.65>0, t=29.97, p<0.001; sample 2: diff=5.01-2.66=2.36>0, t=18.69, p<0.001). Self-employment and managerial paid employment are on average rather similar, though both are very heterogeneous. While top-management positions are

perceived almost as competitively intense as start-up founding, the other management positions are perceived as less competitively intense.

Table 5.12 reports regression results for both samples. In all models we investigate the within-subject differences between the effects on the perception of competition for non-managerial employment, which serves as base group, and the effects in the other three categories of occupations (management, self-employment, becoming a business founder). In Model 1 we test the perception of entrepreneurship occupations compared to paid employment by constraining the coefficient of management to zero and constraining the coefficients of self-employment and founders to be equal. The model indicates that entrepreneurship is perceived as more competitive than paid employment (sample 1: $\beta = 1.90$, se = 0.08; sample 2: $\beta = 1.71$, se = 0.10). Relaxing both constraints in Model 2 indicates that managerial occupations are perceived as more competitive (sample 1: $\beta = 2.69$, se = 0.09; sample 2: $\beta = 2.36$, se = 0.13) than non-managerial employment. The coefficients of self-employment (sample 1: $\beta = 2.93$, se = 0.11; sample 2: $\beta = 2.67$, se = 0.13) and start-up founders (sample 1: $\beta = 3.52$, se = 0.10; sample 2: $\beta = 3.12$, se = 0.16) are higher in both samples. Moreover, comparing the coefficients of start-up founders and self-employment yields a significant difference in both samples (sample 1: diff = 0.59 > 0, t = 6.39, $p < 0.001$; sample 2: diff = 0.45 > 0, t = 5.14, $p < 0.001$). Including a set of control variables in Model 3 does not change the conclusion. These results are consistent with the results of previous t-tests and provide empirical support for Hypothesis 2.

Figure 5.5: Perceived competitiveness of 12 jobs across samples 1 and 2



Groups		mean (s.d.)	CI
Entrepreneurship	Founder	Sample 1: 5.73 (1.19)	[5.57; 5.88]
		Sample 2: 5.78 (1.27)	[5.60; 5.95]
	Self-Empl.	Sample 1: 5.11 (1.32)	[4.94; 5.28]
		Sample 2: 5.33 (1.12)	[5.17; 5.48]
Paid Employment	Manager	Sample 1: 4.91 (1.06)	[4.78; 5.05]
		Sample 2: 5.01 (1.25)	[4.84; 5.19]
	Other Empl.	Sample 1: 2.26 (1.00)	[2.13; 2.39]
		Sample 2: 2.66 (1.36)	[2.47; 2.84]

Notes: *Perceived competitive intensity of occupations(1="not at all competitive" to 7="extremely competitive"). Squares indicate mean value for sample 1 (white) and sample 2 (black), horizontal lines indicate 95% confidence intervals.*

Table 5.12: Regression results – Stability of relative perceptions of competitive intensity

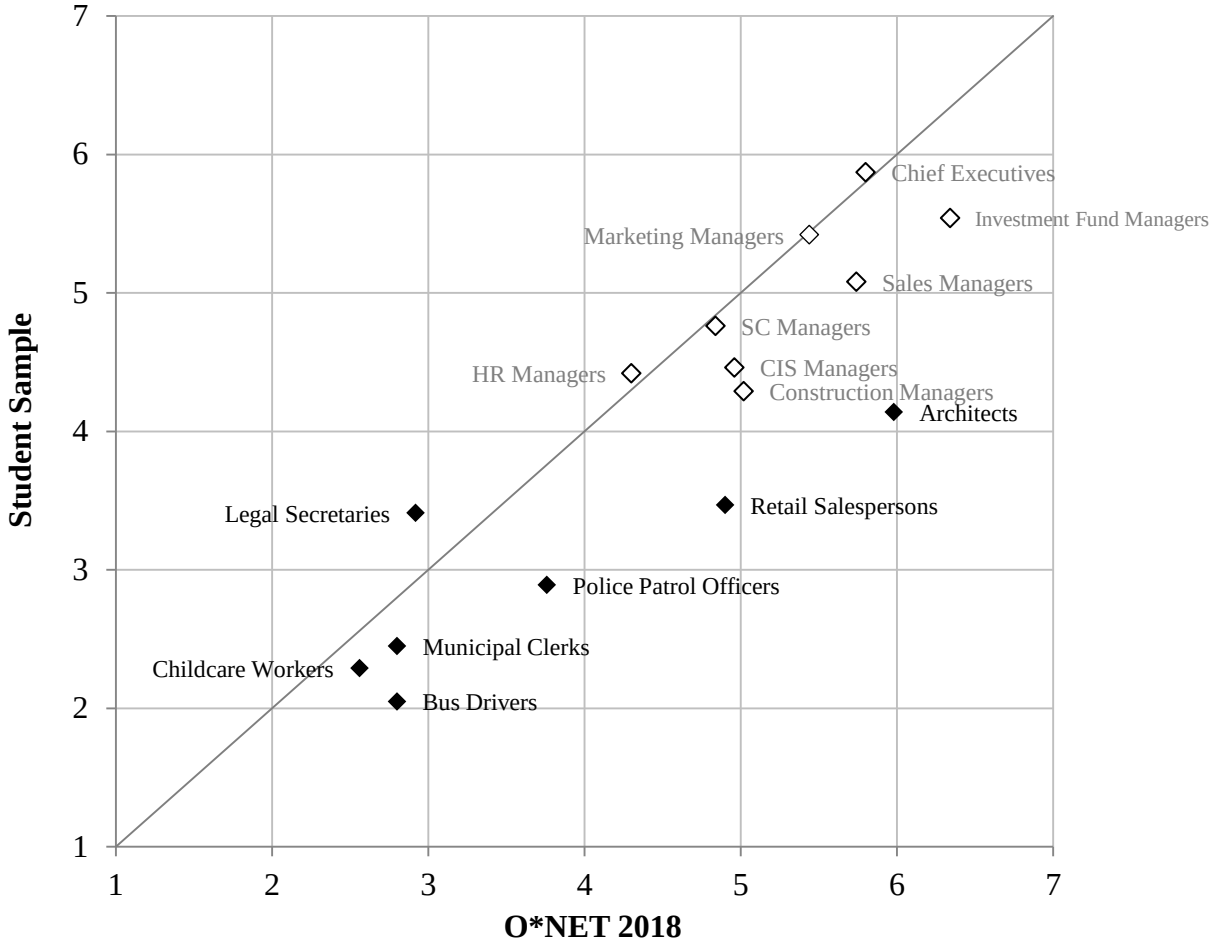
Dep. Var. = Perception of Competition		Study 1: Student sample			Study 2: General Population		
Alternatives (base: Non-managerial employees)		Manager	Self-Employed	Founder	Manager	Self-Employed	Founder
Model 1							
	Entrepreneurship	0.00	1.90 (0.08)***	1.90 (0.08)***	0.00	1.71 (0.10)***	1.71 (0.10)***
	Ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)		0.341 / 0.292 (574.6)***			0.290 / 0.244 (302.6)***	
Model 2							
	Job fixed eff.	2.69 (0.09)***	2.93 (0.11)***	3.52 (0.10)***	2.36 (0.13)***	2.67 (0.13)***	3.12 (0.16)***
	Ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)		0.704 / 0.595 (463.3)***			0.574 / 0.484 (152.1)***	
Model 3							
	Competitive Preferences	0.05 (0.07)	-0.05 (0.09)	-0.09 (0.08)	-0.18 (0.25)	-0.47 (0.27)+	-0.48 (0.31)
	Gender (m=1, f=-1)	-0.05 (0.10)	-0.06 (0.12)	-0.15 (0.12)	-0.18 (0.25)	-0.29 (0.14)*	-0.07 (0.15)
	Age	-0.01 (0.04)	0.00 (0.05)	0.07 (0.04)+	-0.19 (0.12)	-0.01 (0.01)	-0.02 (0.01)
	Father entrepreneur	-0.06 (0.22)	0.20 (0.22)	0.15 (0.24)	-0.01 (0.01)	0.14 (0.31)	0.43 (0.38)
	Mother entrepreneur	-0.20 (0.41)	-0.27 (0.41)	-0.17 (0.51)	0.07 (0.27)	-0.04 (0.42)	-0.15 (0.46)
	Job fixed eff.	2.72 (0.10)***	2.90 (0.13)***	3.50 (0.12)***	2.39 (0.20)***	2.88 (0.21)***	3.25 (0.24)***
	Ind. fixed eff.		incl.			incl.	
	R^2 within / overall (F)		0.711 / 0.595 (86.07)***			0.591 / 0.484 (31.23)***	
All models	Observations		887			808	
	Number of Individuals		227			202	

Notes: *Joint significance test of individual characteristics (competitive preferences, gender, age, parental entrepreneurship) indicates no significant differences in perception of competition for study 1 (F[15, 226] = 0.97), but for study 2 (F[15, 201] = 1.87*). Clustered standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

5.4.4 Perceptions of competition in O*NET

Since we perform within-subject analyses, we further examine the uniqueness of our samples. While the main focus of our previous analyses is on entrepreneurship occupations, we also measured the perceived competitive intensity of 17 occupations in paid employment including 9 managerial and 8 non-managerial occupations. For these occupations O*NET data on job competitiveness are available[50].

Figure 5.6: Comparison of our student sample to O*NET 2018



Note: *O*NET ratings are originally measured on a scale ranging from 0 to 100. O*NET values are transposed to a seven point scale ranging from 1="not at all competitive" to 7="extremely competitive". Managerial occupations are displayed in grey; non-managerial occupations are displayed in black.*

[50] In the comparison with O*NET data we drop the occupation *clinician* from the analysis, since O*NET does not list this occupation, but lists several specialist (e.g. radiologists) with different competitiveness ratings. Moreover, O*NET does not discriminate different firm sizes, so our observations for *top managers of large corporations* and *chief executives of family firms* are combined and compared to O*NET data for *chief executives*.

Figure 5.6 shows the comparison of average perceived competitive intensity of occupations in our student sample with the average perceived competitive intensity reported for these occupations by the O*NET database in 2018. We observe that occupations are on average perceived as slightly more competitive in the O*NET data than in our sample. In general managerial occupations are perceived as more competitive than non-managerial occupations in both samples. Moreover, most occupations are shown to be perceived similarly competitive in our sample and the O*NET data. Particularly the ratings of several managerial occupations (e.g. human-resource manager, or marketing-manager) are almost identical. The largest differences can be observed for architects and retail salespersons, which are perceived as more competitively intense by the O*NET respondents. We report the score for employed architects, while the perceived competitive intensity for self-employed architects in our sample is higher (see Figure 5.4). The O*NET rating might include employed as well as self-employed architects, which might at least partially explain the deviation. Neither architects, nor retail salespersons were included in our final set of 12 occupations.

Table 5.13: Comparison of factor av. scores in both our samples to O*NET 2016 and 2018

	Student Sample	General Population	O*NET 2016	O*NET 2018
Managers *CEO / HR / CIS*	**4.91**	**5.01**	**4.88**	**5.02**
Employees *Childcare / Clerk / Busdriver*	**2.26**	**2.66**	**2.72**	**2.72**

Note: *O*NET values are originally measured on a scale ranging from 0 to 100. O*NET values are transposed to a seven point scale ranging from 1="not at all competitive" to 7="extremely competitive".*

The similarity between our samples and the O*NET ratings is even stronger when we compare perceptions for occupational categories rather than specific occupations. Based on our final set of 12 occupations we measure the perceived competitive intensity of managerial occupations by an average score of (1) top-managers, (2) computer and information system managers, and (3) human resource managers. Moreover, we measure the perception of competition within non-managerial

employment by the average score of (1) employed childcare workers, (2) municipal clerks, and (3) bus drivers. As a comparison we also calculate these two average scores based on the O*NET ratings for the respective occupations. Table 5.13 reports these average scores (management & non-managerial employment) for both our student sample and our general population sample as well as for the ratings reported by O*NET in 2016 and in 2018. For management the perceived competitive intensity in both our samples (sample 1: 4.91; sample 2: 5.01) is between the O*NET data of 2016 (4.88) and 2018 (5.02). For non-managerial employment the values observed in our samples, particularly in the student sample (2.26), are slightly lower than the values reported by O*NET (2.72).

5.5 DISCUSSION

5.5.1 Summary of findings

Chapter V examines the mechanisms linking individual competitiveness to the respective individual's career choices. In the general framework in Chapter I the competitive intensity of environments is conceptualized as the critical contingency of enjoyment of competition, which is a motive to enter these environments. In Chapter V we investigate individual heterogeneity in perceptions of competitive intensity of occupations. We hypothesize, that individual heterogeneity in perceptions of competitive intensity moderates the relationship between individual competitiveness and career choices. Moreover, based on our finding from Chapter IV that entrepreneurs embrace competition we hypothesize that entrepreneurship is perceived as more competitive than paid employment.

We investigate perceived competitive intensity of occupations in two separate studies. Study 1 features self-reported measures of individual competitiveness and job intentions of 227 undergraduate students. Study 2 employs behavioral measures of individual competitiveness and revealed occupational choices in a general population sample of 202 individuals.

In support of Hypothesis 1 both studies provide empirical evidence for the moderating effect of individuals' perceptions of competitive intensity. Competitive individuals are shown to be more likely to prefer and enter those occupations they

perceive as more competitive, while non-competitive individuals tend to avoid those occupations. In both studies the predicted effect of individual competitiveness is positive (negative) for occupations with high (low) perceived competitive intensity. Our findings suggest that the differences in relations between self-selection into competition and preferences for the respective occupations are largely explained by the competitive intensity individuals perceive in the respective occupations. These results are in line with previous research in the domain of risk taking behavior (Weber & Milliman, 1997; Weber et al., 2002) indicating the importance of individual heterogeneity in perceptions rather than only in preferences for the explanation of individuals' choices in specific environments.

To further demonstrate the relevance of perceptions for individuals' selection into the examined job categories we identify positive indirect effects of founding businesses, self-employment, and management relative to the base group of non-managerial employment mediated by perceptions of competitive intensity on the relation between individual competitiveness and job attractiveness. These estimations suggest that due to differences in perceived competitive intensity competitive individuals are more likely to prefer entrepreneurship as well as management over other paid employment.

Moreover, in support of Hypothesis 2 our results indicate that individuals assess entrepreneurship, on average, as substantially more competitive than paid employment. Our studies provide empirical evidence that perceptions of both students and the general population sample systematically support Kirzner's (1973) assertion that entrepreneurship is inherently competitive. We also find systematic differences in perceived competitive intensity between start-up founders versus other self-employment as well as between managerial employment versus non-managerial employment. Our findings also support the view of previous economic competitiveness literature (e.g. Gneezy et al., 2003; Niederle and Vesterlund, 2007) that top-managers and chief-executives work in highly competitive environments. The levels of perceived competitive intensity in the respective occupations are very similar between our students sample and our general population sample and consistent with the average assessment of job insiders reported by the O*NET database[51].

[51] O*NET data are only available for paid employment, but not for entrepreneurship.

An additional plausibility check confirms that consistent with our definition of competitive environments winner-take-all tournaments are perceived as highly competitive, while the competitive intensity within piece-rate schemes is perceived as very low. Moreover, individual heterogeneity in the perceived competitive intensity of these artificial scenarios moderates the effect of individual competitiveness on the attractiveness of these scenarios.

5.5.2 Limitations

While we believe this chapter to make worthwhile contributions to our understanding of individual competitiveness, we acknowledge limitations implied by our specific research design. This chapter reports results from two separate studies, which are based on different samples (undergraduate students vs. general population), apply different measures of individual competitiveness (self-reported vs. behavioral) and of job preferences (intent vs. revealed choice), and use different sets of controls. While we consider this an advantage of our design allowing us to demonstrate the robustness of our findings, it also implies that we can neither combine data from both studies, nor replicate one study with the other. Hence, we cannot fully rule out the possibility of different measurement errors inducing the same result in both studies.

Since both studies are based on cross-sectional data, we cannot measure a causal effect and the estimated coefficients are to be interpreted as correlations. Nonetheless, our finding that the effect of individual competitiveness on both intentions to enter an occupation in the future (study 1) and revealed choice of having already entered an occupation (study 2) are moderated by individual perceptions of competition is suggestive of a causal link between individual competitiveness and occupational choice, because intense competition in an occupation appears to be a necessary condition for competitive (non-competitive) individuals to systematically favor (avoid) the respective occupation. Moreover, we test the interaction of perceived competitive intensity with both risk aversion and confidence, but do not find significant moderation effects. Hence, alternative explanations, such that risk-averse individuals avoid the risks of intense competition, or that more confident individuals tend to prefer occupations with higher competitive intensity, are not supported by our results.

We use self-reported, non-incentivized measures of perceived competitive intensity for both studies. Hence, these measures rely on the assumption of "*epsilon truthfulness*" (see Cummings et al., 1997) discussed in Chapter II. Should participants in our studies have any reason to systematically misreport their perception of different occupations, our results might be biased. We are neither aware of any such systematic misincentives, nor aware of any way to incentivize truthful responses regarding subjective perception.

5.5.2 Contributions and implications

1. Influencing individuals' competitive behavior

Emphasizing the role of individual heterogeneity in perceptions of competitive intensity extends the interpretation of previous findings (e.g. Reuben et al., 2015) in an important way, because individual beliefs, other than preferences, can be influenced directly by additional information or different framing (e.g. Ellingsen, Johannesson, Mollerstrom, Munkhammar, 2012).

After Niederle and Vesterlund (2007) suggested that the way men and women respond to competitive environments might give rise to inefficiencies, subsequent studies examined how changing the rules of a competition affects individuals' decision to enter (Shurchkov, 2012; Niederle et al., 2013, Leibbrandt et al., 2017). Niederle, Segal, and Vesterlund (2013, p.1), for instance, argue that *"high-performing women fail to enter competitions they can win"* and seek to increase their entry. While this is a promising field for behavioral market design (Niederle, 2017), recent experimental research also highlights unintended consequences of modifying the rules of competition (Leibbrandt et al., 2017). In addition to such institutional changes, future research might also explore effective ways to influence individual beliefs regarding competitive intensity e.g. providing additional information about certain career paths or educational programs. If inefficiencies in behavioral responses to competitive environments have been identified, shaping individual beliefs about competition in favor of more desirable responses may in some cases be more feasible and less costly than modifying the environment to induce more desirable responses. This is of particular interest for environments such as entrepreneurship, where designing competition by institutional regulation is extremely difficult.

2. Systematic order of competitive occupations

Our study of perceived competitive intensity in Chapter V provides a systematic approach to the relations between self-selection into competition in incentivized experiments and different career choices. By demonstrating that perceived competitive intensity moderates this relation our study suggests that perceived competitive intensity provides a systematic and meaningful order of various occupations. This approach enables future research to predict which occupational choices are most likely influenced by individuals' preferences for competition.

While we investigate perceptions of 27 specific jobs, we use the same measure of perceived competitive intensity that is used in the O*NET database. O*NET does not provide individual-level data and no data at all on entrepreneurship, but reports average competitiveness ratings for more than 900 different jobs and occupations. For those occupations that are included in both our studies as well as in the O*NET database we find that average perceived competitive intensity in these occupations is consistent between our undergraduate students, our general population sample in Germany, and the ratings of Job insiders in the U.S. as reported by O*NET.

Hence, we suggest, that future research can use O*NET data not only as a systematic indicator of competitive intensity in various jobs, which is already used in a recent psychological study (Houston et al., 2015), but also to predict for any set of occupations, whether and to what extent individuals' choices between these occupations are likely influenced by the individuals' competitive preferences. This is particularly useful to derive predictions for future studies similar to the one by Reuben and colleagues (2015), where individuals are likely to select a job from a specific subset of occupations with similar characteristics (e.g. require the degree, have similar prospective earnings).

3. Multiple individual heterogeneities

In addition to individual heterogeneity in competitive preferences we find substantial heterogeneity regarding the perception of competition within the same occupation by different individuals. The implications of such heterogeneous beliefs may differ depending on the particular research questions and definition of competitiveness.

Future research viewing individual competitiveness and beliefs of competitive intensities as distinct constructs might follow a line of research in the literature on risk taking behavior that distinguishes individual *perception of risk* from *perceived-risk aversion* (Weber & Milliman, 1997; Weber et al., 2002). Based on this distinction Weber and Hsee (1998, p.1205) identify "cross-cultural differences in risk perception, but cross-cultural similarities in attitudes towards perceived risk". A similar approach might be useful for cross-country studies on competitive preferences like the one by Bönte (2015). Future studies might examine individual competitiveness as an individual's general tendency to self-select into environments, which the individual perceives to be competitive. As perceptions of competition moderate the influence of competitive preferences on career choices, and might also moderate its effects on other choices, future research that is interested in preferences for perceived competition might additionally elicit and control for such perceptions, in order to isolate effects of heterogeneous preferences from effects of heterogeneous perceptions. Particularly, an examination of cross-country differences in perceptions of competition in addition to differences in preferences for perceived competition might be a promising extension for competitiveness research.

In contrast, most previous economic research investigates individual competitiveness as an individual's tendency to self-select into an objectively defined set of environments, which are considered as competitions by a theory or the researcher (e.g. Niederle & Vesterlund, 2007; Buser et al., 2014, 2017, Reuben et al., 2015; see also Chapter III). Future research interested in behavioral responses to particular institutions or environments (cf. Niederle et al., 2013; Flory et al., 2015) might follow this approach and, thereby, explicitly or implicitly include individual perceptions of competitive intensity alongside competitive preferences as a second determinant of the individual's competitiveness. Future research following this broader concept of competitiveness might emphasize the potential role of heterogeneous perceptions in the interpretation of findings.

4. Perception of competition in the lab

We also investigate the perceived intensity of competition within artificial scenarios. We find that winner-take-all tournaments are perceived almost as competitive as the most competitive occupation (e.g. founders of high-tech start-ups, or top managers of large corporations), while the perceived intensity of competition within piece-rate payments is similar to the least competitive occupations in our study (e.g. bus drivers, or employed childcare workers). Hence, in terms of perceived competitive intensity the environments within economic experiments seem to represent the extreme points of an individual's spectrum of potential occupational choices.

Moreover, we find that individual heterogeneity in perceived competition within these artificial scenarios moderates the relation between individuals' self-reported competitiveness and the attractiveness of the respective scenario. On the one hand our results confirm that experimental designs, where subjects choose between winner-take-all tournaments and piece-rate payment schemes (e.g. Niederle and Vesterlund, 2007; Leibbrandt et al., 2013; Reuben et al., 2015), reflect the subjects' deliberate decision to self-select into (or avoid) competition. On the other hand, our results suggest that even self-selection into artificial competitive environments in the lab might to some extent be driven by individual heterogeneity in perceived competitive intensity rather than by competitive preferences only.

Chapter VI

Overall Discussion and Conclusion

6.1 SUMMARY OF FINDINGS

In this thesis I have provided an interdisciplinary approach to address the gap in conceptual foundations of the economic literature on individual competitiveness. Drawing on more than 100 years of psychological competitiveness research I have suggested a general framework of individual competitiveness in order to examine two related research questions:

(1) What drives individuals' decisions to self-select into competitive versus non-competitive environments?
(2) How are individuals' decisions to self-select into competitive versus non-competitive environments in incentivized economic experiments related to these individuals' decisions to pursue certain career paths?

In this framework individual competitiveness denotes an individual's general tendency to select into competitive environments. Competitive individuals are those individuals who favor competitive over non-competitive environments (Niederle & Vesterlund, 2011; Smither & Houston, 1992), irrespective of possibly associated risks and differences in confidences in winning. Competitive environments are characterized by institutions where individuals' goals are not simultaneously achievable given the sets of possible strategies (Deutsch, 1949).

I adapted three potential motives of individuals' self-selection into competition from psychological competitiveness research (Ryckman et al., 1990, 1996; Houston et al., 2002b, 2012): (1) seeking personal development in competition, (2) a desire to win in competition, and (3) an enjoyment of competition. Furthermore, I discussed the role of individuals' beliefs as critical contingencies for each motive's effect on self-selection into particular environments, i.e. a desire to win can only motivate an individual to self-select into a certain environment to the degree to which the individual believes the environment offers a chance of winning. Similarly personal development motives require an environment that offers opportunities to improve skills and mastery, whereas an enjoyment of competition can only be an effective motivation, if an environment is believed to be sufficiently competitive. Each of the studies presented in this thesis has applied this general framework in order to conceptually and empirically examine both research questions.

6.1.1 What drives self-selection into competitive vs. non-competitive environments?

Based on the general framework, studies presented in Chapters II and III focus on the first research question and examine why individuals would enter competition and what they value about competitive environments. Chapter II focusses on the identification of potential motives of individuals' self-selection into competitive environments. My co-authors and I investigate the relationship of the three different motives of competitiveness that have been identified by psychological research: (1) seeking personal development in competition, (2) a desire to win in competition, and (3) an enjoyment of competition, with self-selection into competition. We empirically test whether and to what extent these different motives are related to the self-selection into competition in an incentivized experiment as studied by behavioral economists.

Our study demonstrates that a standard behavioral measure of individuals' self-selection into a competitive environment and a psychometric scale of individual competitiveness are positively associated and that this association is primarily driven by the enjoyment of competition. Consistent with our conjecture that competitive environments in economic experiments offer little opportunities for personal development, we find no relation between personal development motives and self-

selection into competition and when we exclude personal development motives from the self-reported measure, the positive relation of the remaining motives with the behavioral measure increases. This distinction is validated based on divergent associations with personality. While enjoyment of competition and self-selection into competition show very similar relations with the Big Five personality dimensions, the patterns of correlations of these personality dimensions with personal development motives differ substantially. For the desire to win and in our particular setting, we find no relationship with self-selection into competition and the correlations with personality dimensions are similar to those of personal development competitiveness.

In Chapter III I test whether these motives constitute preferences for competitive environments. For this purpose I link self-selection into competition to an individual's utility maximizing behavior by providing a utility-based model that includes both an enjoyment of competition and a desire to win in the individual's utility function. Thereby, I provide a theory-driven attempt to disentangle genuine preferences for competitive environments from utility maximizing behavior that can be explained by well-known economic preferences. Within this model I derive expected effects of both a value of competing reflecting an individual's enjoyment of competition and a value of winning reflecting an individual's desire to win on the individual's self-selection into competitive versus non-competitive environments.

In order to experimentally quantify the individual value of these motives I introduce an experimental treatment that allows manipulating the probability of winning the competition exogenously and identify piece-rate equivalents for multiple competitive environments. Based on this experiment I calculate a non-monetary value of competing as well as a non-monetary value of winning. In support of the model I identify a causal effect of the probability of winning on subjects' piece-rate equivalent. This effect is similar between a math task, where performance depends on ability and effort, and a dice task, where performance is the result of pure luck. Subjects' deviation from the benchmark model provides evidence for a significant positive average value of competing, but no evidence for a value of winning among the subjects. Moreover, I show that subjects with a higher individual value of competing are substantially more likely to self-select into the competitive tournament in a classical Niederle and Vesterlund (2007) experiment.

The studies presented in Chapters II and III identify an enjoyment of competition as a relevant motive of individuals' self-selection into competition and indicate that such a non-monetary value of competing can be interpreted as a competitive preference. I conclude, that enjoyment of competition drives individuals' self-selection into competitive environments, while at least for self-selection into the investigated competitive environments in incentivized experiments personal development motive and a desire to win are rather irrelevant. I further conclude that enjoyment of competition, which is conceptualized as a personality characteristic in psychological research, has a meaningful economic interpretation as a unique non-monetary value associated with competing, which also provides a quantifiable measure to identify a single individual's competitive preference.

6.1.2 How is self-selection into competitive environments related to career choices?

Based on my general framework and findings from Chapters II and III, studies presented in Chapter IV and Chapter V focus on the second research question and examine how self-selection into competitive environments in experiments is related to career choices and which career paths are more attractive to competitive individuals than others. Since the previous analyses have highlighted the enjoyment of competition as driver for self-selection into competitive environments in experiments, while the other motives are shown to be less relevant for these choices, I focus on enjoyment of competition as a potential explanation for the relation between self-selection into competitive environments in experiments and self-selection into certain career paths.

In Chapter IV I demonstrate the relevance of enjoyment of competition for the relationship between self-selection into competition and career choices. My co-authors and I conduct a lab-in-the-field study with 224 visitors at a shopping mall in a large German city and demonstrate that entrepreneurs—both revealed entrepreneurs (individual who are or have been entrepreneurs) and potential entrepreneurs (who consider entrepreneurship a possible future option)—are more likely to select into competition than non-entrepreneurial individuals (who have no intention at all to start a business). Employing particular experimental designs to account for individuals' desires to win and mastery-related achievement motivations, our results indicate that

entrepreneurs tend to enter competition for the sake of competition itself rather than for the prospect of winning a competition or personal development in competition. Our results suggest that enjoyment of competition might be an additional factor driving entrepreneurs' market entry decisions beyond well-known factors like overconfidence and risk taking. This study demonstrates that an individual's enjoyment of competition is a sufficient constituent for the relationship between that individual's self-selection into an artificial competitive environment and the individual's career choices.

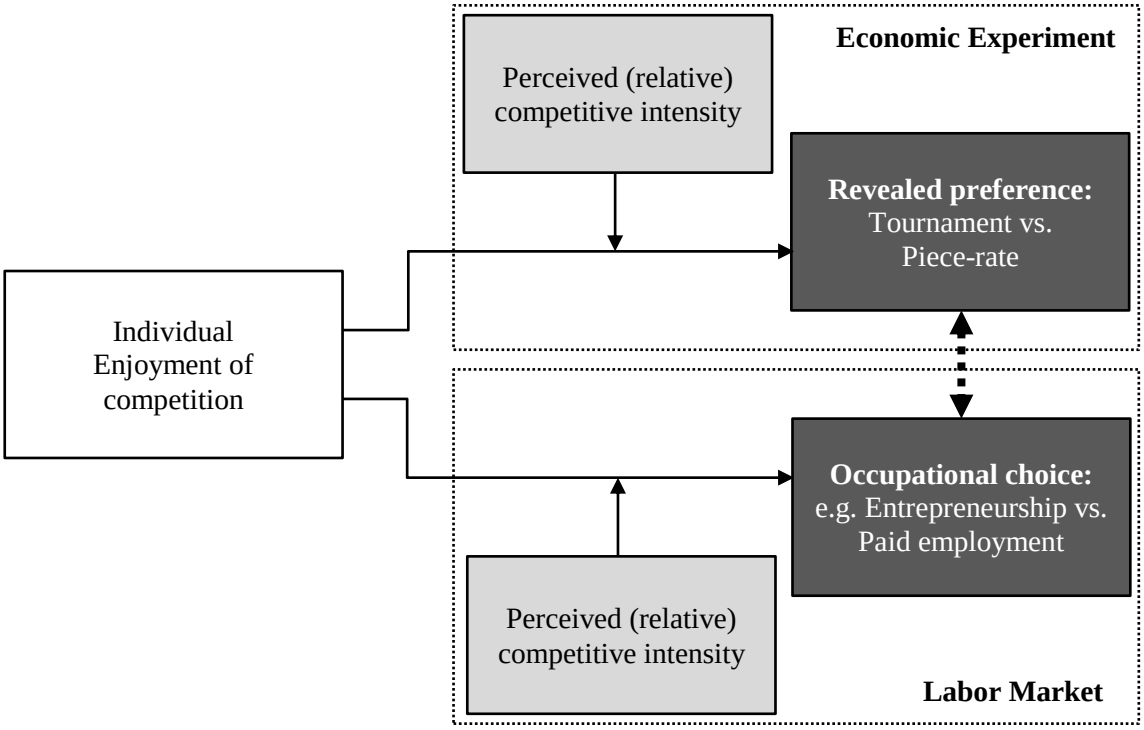
Chapter V seeks to further scrutinize this finding and investigates the mechanisms by which the condition that some individuals enjoy competing more than others influences the relationship between self-selection into competition and the respective individual's career choices. While Chapter IV treats entrepreneurs all alike, entrepreneurship research often separates growth-oriented start-ups from other entrepreneurs that are rather classified as self-employed (cf. Shane, 2003; Spencer et al., 2008; Acs et al., 2016), Chapter V acknowledges these differences. Furthermore, for the group of employed people Chapter V differentiates between managerial and non-managerial employment. We provide empirical evidence for the moderating effect of individuals' perceptions of competitive intensity. Competitive individuals are shown to be more likely to prefer and enter those occupations, they perceive as more competitive, while non-competitive individuals tend to avoid those occupations. Our findings suggest that the differences in relations between self-selection into competition and preferences for respective occupations are largely explained by the competitive intensity individuals perceive in the respective occupations. Conducting two separate studies we find this interaction effect of individual competitiveness and perceived competitive intensity of occupations on both the job intentions of undergraduate students (study 1) and revealed occupational choices in a general population sample (study 2).

Moreover, our results indicate that individuals assess entrepreneurship, on average, as substantially more competitive than paid employment. We also find systematic differences in perceived competitive intensity between start-up founders versus other self-employment as well as between managerial employment versus non-managerial employment. The levels of perceived competitive intensity in the respective occupations are very similar between the student sample and the general population sample and consistent with the average assessment of job insiders reported by the

O*NET database[52]. An additional plausibility check confirms that consistent with my definition of competitive environments winner-take-all tournaments are perceived as highly competitive, while the competitive intensity within piece-rate schemes is perceived as very low.

By investigating individual perceptions of competitive intensity in various occupations my co-authors and I demonstrate a simple mechanism indicating why certain occupations are more (less) attractive for competitive individuals and provide a systematic approach predicting which career choices are most likely related to competitive behavior in incentivized experiments. Figure 6.1 illustrates my conclusion.

Figure 6.1: Enjoyment of competition in the lab and in the labor market



Based on the findings presented in this thesis I conceptualize enjoyment of competition as an individual preference for competition (Chapter III) that drives individuals' self-selection into competitive environments in economic experiments (Chapter II) as well as individuals' self-selection into competitive occupations in the

[52] O*NET data are only available for paid employment, but not for entrepreneurship.

labor market (Chapter IV). In contrast to the general framework presented in Chapter I I do not include desires to win and personal development motives, since my co-authors and I find no relationship between these motives and individuals' choices in an incentivized experiment. Yet as discussed in Chapter II these motives may still be relevant for individuals' self-selection into competitive occupations in the labor market.

As in my general framework I still conceptualize the perceived competitive intensity of an environment as critical contingency for the influence of an individual's enjoyment of competition. When individuals choose between two given environments (e.g. entrepreneurship vs. paid employment) the effect of enjoyment of competition on this decision is supposed to depend on perceptions of relative competitive intensity, i.e. if individuals perceive one environment as substantially more competitive than the other, I expect a strong effect of enjoyment of competition, but if individuals perceive a high (low) competitive intensity in both environments, I expect no effect of enjoyment of competition.

In principle this mechanism is the same in experiments and in the labor market. Hence, enjoyment of competition co-determines an individual's choices between the respective alternative environments in these different domains to the extent to which the individual perceives differences in competitive intensity between the artificial environments in the lab and between the occupations in the labor market. In this case decisions in incentivized experiments are predictive for occupational choices. If either in the experiment, or in the labor market individuals perceive the alternative environments as similarly competitive, then the individuals' choice in the respective domain is less (or not at all) influenced by their preferences for competition and, therefore, their choices in the lab cannot be expected to predict their choices in the labor market.

With respect to the labor market I show that entrepreneurs are more likely to enjoy competing than non-entrepreneurs (Chapter IV) and that entrepreneurship is perceived as substantially more competitive than paid employment (Chapter V). With respect to experimental environments findings presented in this thesis confirm that winner-take-all tournaments are perceived as substantially more competitive than piece-rate payments (Chapter V). Consistent with these findings and the result that enjoyment of competition drives individuals' decisions to self-select into competitive environments

in an experiment (Chapter II) I show that perceptions of competition within occupational environments effectively moderate the relation between competitive behavior in an experiment and preferences for these occupations (Chapter V), i.e. competitive individuals are attracted to those occupations they perceive as highly competitive and vice versa. Investigating the link between individual competitiveness in the lab and in the labor market is of primary interest in current research (e.g. Buser et al., 2014, 2017; Reuben et al., 2015, 2017). For future studies examining this link it is important to note that the link is moderated by individual perceptions of the alternative environments in both domains. Examining this link necessarily involves at least four different environments and may require elaborating the effects of individual heterogeneity in the perceptions of each environment involved.

The scope of this thesis is limited to the concept of individual competitiveness defined as a tendency to self-select *into* competitive environments, whereas I do not examine other concepts of competitiveness focusing on individuals' behavior and performance *within* competitive environments (e.g., van Lange et al., 1997; Manning & Taylor, 2001). Investigating the influence of enjoyment of competition as well as desires to win, or personal development motives on individuals' behavior and performance *within* competition is beyond the scope of this thesis, but appears to be a natural extension of the research presented here. Some related questions have already been studied by other researchers. For instance, Berge and colleagues (2015) examine the relationship of competitiveness in the lab with competitive choices (investment and employment) and performance (profit and sales) of entrepreneurs in the field. Results of economic studies examining effects of exogenously imposed competition on performance suggest a high symbolic value of winning a tournament (e.g. Blanes i Vidal & Nossol, 2011; Kosfeld and Neckermann, 2011; Delfgaauw et al., 2013), which points to potential performance effects of individual's desire to win. Moreover, interaction effects of perceived competitive climate and individual competitiveness on work performance have been intensely studied (e.g. Brown, Cron, and Slocum, 1998; Fletcher, Major, and Davis, 2008; Arnold, Flaherty, Voss, & Mowen, 2009).

My conclusions are derived from the results of five separate empirical studies. Each of these studies is designed and optimized for its narrow research question and applies specific measurements. This might be of particular relevance in the light of the recent discussion about a replication crisis (e.g. Loken & Gelman, 2017) in behavioral

sciences (e.g. Camerer et al., 2016). Several aspects of the five studies presented in this thesis are mutually replicated in the other studies. For instance, I demonstrate the relationship between self-reported and behavioral measures of competitiveness (Chapter II) and I show that self-reported and behavioral measures provide the equivalent result (Chapter V). Moreover, I show that potential and revealed entrepreneurs embrace competition (Chapter IV) and I show the moderating effect of perceptions of competition for both job intent and revealed occupational choice (Chapter V). I also replicate findings of previous experiments by Niederle and Vesterlund (2007) as well as by Ifcher and Zarghamee (2016a) (Chapter III). Yet, I am not able to include measures to replicate all aspects of the respective studies, which is a further limitation of my research. For example, in Chapter II I show that a behavioral measure of competitiveness is related to a self-reported measure of enjoyment of competition, but not to self-reported measures of a desire to win or personal development motives. Chapters III and IV use refined behavioral measures that focus even more on enjoyment of competition, but these studies do not include additional self-reported measures of competitiveness.

The research presented in this thesis was conducted at a German university and the subjects of all five studies were recruited in Germany. Hence, my conclusions may not hold for individuals in other countries or cultures. Previous research indicates cross-cultural differences in individual competitiveness (e.g. Houston et al., 2012; Cárdenas et al., 2012). This might also be relevant for individual perceptions of competitive intensity as examined in Chapter V, since previous research, for instance, shows substantial cross-cultural differences in perceptions of risk (e.g. Weber, Hsee; 1998). For a subset of occupations I compare the perceived competitive intensity in two German samples with the perception of individuals in the U.S. reported by O*NET and find that these perceptions are on average very similar. Moreover, with respect to individual competitiveness I replicate the main findings of the experiment by Niederle and Vesterlund (2007) that was conducted in the U.S. Hence, the German sample appears to be not completely different from U.S. samples. Nevertheless, cross-cultural studies that also examine enjoyment of competition and perceived competitive intensity with samples from e.g. Asian, African, or South American countries are a promising extension of my research.

6.2 IMPLICATIONS FOR FUTURE RESEARCH

6.2.1 Benefits from interdisciplinary competitiveness research

In this thesis I present an interdisciplinary approach to individual competitiveness and examine three conceptually distinct motives of self-selection into competition drawn from psychological research. The study presented in Chapter II shows how personality frameworks can be employed to better understand economic behavior. My co-authors and I compare multiple competitiveness measures and use their respective relations to Big-five personality to confirm the association between the enjoyment of competition and self-selection into competition as well as the distinction between enjoyment of competition and the other motives. By quantifying an individual value of competing that is conceptually derived from the enjoyment of competition in Chapter III I demonstrate how economic research can benefit from the inclusion of these personality characteristics as model parameters (see Borghans et al., 2008).

This analysis holds an immediate implication for future experimental competitiveness research. Since personal development motives are unrelated to current behavioral competitiveness measures, researchers, who intent to cover personal development motives in their behavioral measures, need revised experimental designs. Likewise, researchers intending to isolate these motives may want to refine their experimental designs. In Chapter IV I show a design that allows isolating effects of the enjoyment of competition from effects of an individual's desires to win as well as from effects of personal development motives. The presented study indicates that self-selection into an entrepreneurial career can be predicted based on individuals' self-selection into competition in a simple math task and a dice task that are both completely unrelated to entrepreneurship tasks. Comparing individuals' decisions to self-select into multiple competitions with unrelated artificial tasks as shown in Chapter IV allows isolating the three motives and can further reduce measurement errors and task-specific biases.

In addition to linking economic and psychological competitiveness research, Chapter IV integrates the general framework of individual competitiveness presented in Chapter I with previous findings from entrepreneurship research. While the competitiveness of entrepreneurs has been theorized and two of the three competitiveness motives have been indirectly addressed in entrepreneurship research

via related constructs, the framework reveals entrepreneurs' enjoyment of competition to be a mutual white spot of both literatures. The presented results suggesting entrepreneurs' market entry decisions to be to some extent explained by individuals' enjoyment of competition point to a fruitful area of future entrepreneurship research. Considering a non-monetary value associated with competing itself might also explain why entrepreneurs do not give up so easily, once winning becomes less likely, but continue competing.

6.2.2 Measuring competitiveness at the individual level

This thesis introduces several refinements in the measurement of individual competitiveness that have implications for future research seeking to measure an individual's competitiveness. In previous behavioral economic literature the identification of competitive preferences typically relies on some kind of group heterogeneity in the self-selection into competition (e.g. men vs. women), but without such group differences individual competitive preferences could not be identified. In this thesis I introduce two different measurement methods future research can use to identify competitive preferences of a single individual.

In Chapter III I present an experimental design that uses multiple behavioral measures to quantify a non-monetary value of competing as well as a non-monetary value of winning based on the individual's revealed behavior. These values can be interpreted as an individual's willingness to pay for competing and winning respectively within the given experimental environment and the measurement method can be applied to various designs of competitive environments. Measuring the value of competing and the value of winning allows the identification of individual competitive preferences as a comparison between the observed decisions and a utility-based benchmark model, which is conceptually and empirically independent from the identification of group differences in such preferences[53]. Moreover, the value of competing and the value of winning are corrected for effects of risk preferences and (over-)confidence. Therefore,

[53] This is particularly relevant, since consistent with results of van Veldhuizen (2017) I observe gender differences in self-selection into the competitive environment, but I do not observe significant gender differences in either the value of competing or the value of winning.

these two competitive preferences are not only distinct from each other, but also distinct from those typical confounding factors.

The results of my experiment suggest that individuals value competing. This finding confirms that even in the potential absence of group differences in competitiveness the estimated effects of individual competitiveness measures on career choices (e.g. Buser et al., 2014, Reuben et al., 2015) are informative beyond effects of other related measures, such as risk taking and overconfidence, since the former tend to reflect a value of competing, i.e. an enjoyment of competition, while the latter do not. Further theoretical and experimental examination of competitive preferences is therefore a promising field for behavioral economists. Although I do not find evidence for a non-monetary value of winning in my experiment, the measurement technique for this value may still serve as a tool for future research seeking to understand the role of winning for self-selection into competitive environments.

Moreover, in Chapter II I show how self-reported psychometric measures of individual competitiveness are related to self-selection into competitive environments within incentivized experiments. The presented findings imply that with all the advantages and limitations of self-reported measures discussed in Chapter II future research can approximate behavioral measures of individual competitiveness by self-reported multi-item scales focusing on enjoyment of competition (e.g. Houston et al., 2002b). These self-reported measures can not only distinguish between different motives to enter competition, but also provide an individual-level measurement independent from group differences in competitiveness. Self-reported measures of individual competitiveness can also be implemented in environments, where incentivized economic experiments are difficult to implement or very costly, such as large-scale surveys (cf. Bönte & Piegeler, 2013), or for representation in socio-economic panels, which also address individuals' psychological backgrounds such as risk attitudes (e.g., Dohmen et al., 2011). Research on individual competitiveness might benefit from the analysis of such representative and large-scale surveys in order to get a more comprehensive understanding of how competitive preferences are distributed across populations and how it relates to real world behavior.

Future research can use self-reported measures not only to approximate behavioral measures of individual competitiveness, but also to elicit an individual's

perceptions of competitive intensity. The studies reported in Chapter V show that there is substantial heterogeneity regarding the perception of competition within the same environment by different individuals and that this heterogeneity moderates the influence of competitive preferences on career choices. Hence, such individual beliefs regarding competition in certain environments may be considered as an additional determinant of the individual's competitiveness that can be assessed with self-reported measures as I have shown in Chapter V.

Future competitiveness research might not only use these measures to separate effects of heterogeneous beliefs from effects of heterogeneous competitive preferences, but also to explore ways to influence beliefs regarding competition in certain environments, e.g. by providing tailored information regarding these environments. This approach might be informative for behavioral market design with respect to competitive institutions (Niederle, 2017). Targeting subjective beliefs about competitive intensity rather than objective rules and institutions can provide alternative design instruments for environments, where institutional changes (e.g. Niederle et al., 2013) may have unintended consequences (cf. Leibbrandt et al., 2017), or are hard to implement (like in entrepreneurship).

6.2.3 Environments to study individual competitiveness

Previous research has studied individual competitiveness in various environments (e.g. Gneezy et al., 2009; Cárdenas et al., 2012; Shurchkov, 2012; Leibbrandt et al, 2013; Buser et al., 2014, 2017; Flory et al., 2015; Reuben et al., 2015). The analysis of competitive environments in this thesis provides several implications with respect to occupational environments as well as experimental environments in which future research might most effectively study individual competitiveness.

Chapter III introduces a distinction between environments, where individuals provide a maximum feasible performance, and environments, where individuals optimize their performance by providing a lower performance level. I demonstrate that only under the assumption of maximum performance provision competitive preferences can be isolated from effects of expected performance differences. This implies that only environments, where this assumption holds, e.g. because individuals can only provide

restricted effort, allow the quantification of individual values of competing and winning without eliciting expected performance differences.

The dice tasks applied in the studies presented in Chapters III, IV, and V are variations of non-agency tasks (see Ifcher & Zarghamee, 2016b) and can be used by future research to ensure that the assumption of maximum performance provision holds for their experimental environments. In contrast, employing these dice tasks to measure risk preferences (cf. Große & Riener, 2010) is likely problematic. While these dice tasks can be seen as equivalent to complex lotteries, they still represent interactive, competitive environments in the sense that outcomes of one individual depend on outcomes of other individuals. Hence, behavior in a dice task likely reflects both risk preferences and competitive preferences. Consistently, my findings suggest that individuals still value competing in a dice task and that the presented results are robust against using either the dice task, or the math task, which is the standard measure of individual competitiveness (cf. Niederle & Vesterlund, 2007). Future research might, therefore, favor other measures of risk taking that do not include a competitive environment (e.g. Holt & Laury, 2002)[54].

I also investigate the perceived intensity of competition within artificial scenarios in Chapter V. I show that winner-take-all tournaments are perceived almost as competitive as the most competitive occupation (e.g. founders of high-tech start-ups, or top managers of large corporations), while the perceived intensity of competition within piece-rate payments is similar to the least competitive occupations in the presented studied (e.g. busdrivers, or employed childcare workers). These results confirm that experimental designs, where subjects choose between those payment schemes, reflect the subjects' deliberate decision to self-select into (or avoid) competition. Moreover, in terms of perceived competitive intensity the environments within economic experiments seem to represent the extreme points of an individual's spectrum of potential occupational choices.

With respect to occupational environments, the studies of perceived competitive intensity presented in Chapter V provide a systematic approach to the relations between self-selection into competition in incentivized experiments and different career choices.

[54] In fact, I use such risk measures (e.g. Holt and Laury, 2002 in Chapter III) in addition to the dice task in order to isolate the effect of competitive preferences from the effect of risk preferences.

I show that perceived competitive intensity moderates this relation. This approach enables future research to predict which occupational choices are most likely influenced by individuals' preferences for competition.

Moreover, Chapter IV shows that entrepreneurs embrace competition more than non-entrepreneurs do and Chapter V indicates that entrepreneurship is perceived as substantially more competitive than paid employment. These findings imply that future research studying the link between competitive behavior in economic experiments and selection into particular sectors or industries (e.g. Reuben et al., 2015), might additionally control for whether a career will be pursued as an entrepreneur or in paid employment, since the relationships may differ substantially.

6.3 CONCLUSION

This thesis examines individual competitiveness defined as individuals' general tendency to favor competitive over non-competitive environments. I conclude that individual competitiveness is driven by an enjoyment of competition itself, rather than a desire to win, or personal development motives. An enjoyment of competition is suggested to reflect a quantifiable individual value of competing that is distinct from subjective expected payoffs (including overconfidence), and risk-preferences.

I examine the relevance of individual competitiveness for career choices and conclude that entrepreneurs are more likely to self-select into competition than non-entrepreneurs due to their higher enjoyment of competition. Furthermore, not only individual competitiveness, but also individual perceptions of competition are relevant determinants of career choices. I show considerable individual heterogeneity in the perceived competitive intensity of the same occupation and present evidence that the effect of individual competitiveness on career choices is moderated by these perceptions. Both entrepreneurship and management positions are perceived substantially more competitive than other paid employment and competitive individuals tend to prefer these occupations due to the differences in perceived intensity of competition.

This thesis takes an interdisciplinary approach linking economic and psychological research on individual competitiveness. It contributes to this research by offering several refinements to the concept and measurement of individual competitiveness, which carry implications and show promising new directions I believe to be of relevance for future research on individual responses to competition.

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LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
AoO	Attractiveness of Occupation
ARS	Acquiescence Response Style
BC	Behavioral Competitiveness
BFI	Big Five Inventory
BIC	Bayesian Information Criterion
CCAS	Competition-Cooperation Attitude Scale
CFI	Comparative Fit Index
CI	Competitiveness Index
CI-R	Competitiveness Index - Revised
CMV	Common Method Variance
COM	Competitive Orientation Measure
CQ	Competitiveness Questionnaire
CRRA	Constant Relative Risk Aversion
DC	Dice-based competition
DRS	Diacquiescence Response Style
DW	Desire to win
ERS	Extreme Response Style
GM	General Management Career Anchor
GSE	General Self-Efficacy
HAS	Hypercompetitive Attitude Scale
ISCO	International Standard Classification of Occupations
JAS	Jenkins Activity Survey
MC	Math-based competition
MCOI	Multidimensional Competitive Orientation Inventory
MRS	Midpoint Response Style
O*NET	Occupational Information Network
PD	Personal Development
PDCAS	Personal Development Competitive Attitude Scale
PoC	Perception of competition
PR	Piece-rate
RC	Ranked compensation
RS	Revenue sharing
SC	Self-reported competitiveness
SC_{DW}	SC due to the desire to win
SC_{EC}	SC due to enjoyment of competition
SC_{noPD}	SC not due to personal development
SC_{PD}	SC due to personal development
SCTI	Sports Competition Trait Inventory
SOQ	Sports Orientation Questionnaire
SRMR	Standardized Root Mean Square Residual
Vcomp	Value of competing
Vwin	Value of winning
WOFO	Work and Family Orientation questionnaire
WTA	Winner-take-all tournament

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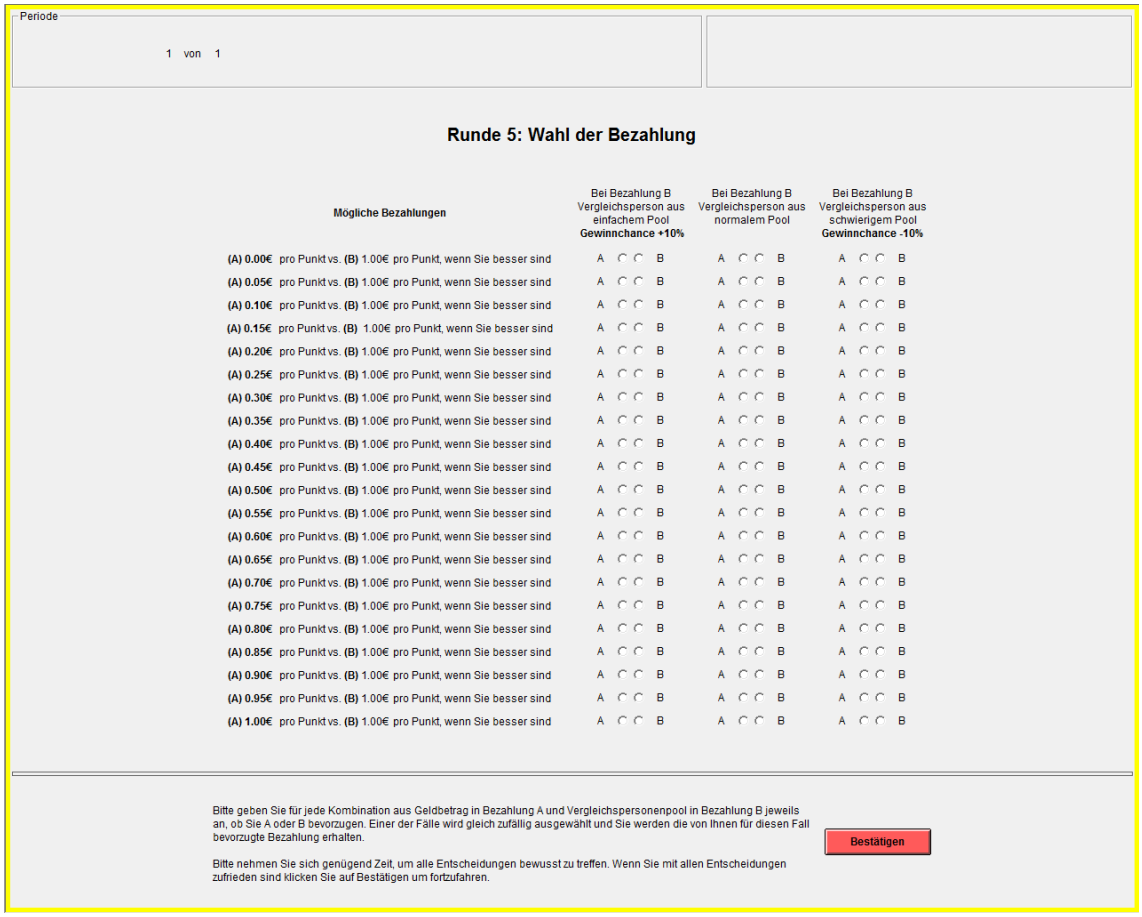
APPENDIX

A – Detailed description of tasks 5 and 6 of my experiment

German original	English translation
Runde 5	***Round 5***
In dieser Runde besteht Ihre Aufgabe noch einmal darin, in einem Zeitraum von 5 Minuten (300 Sekunden) Rechenaufgaben zu lösen. In jeder dieser Rechenaufgaben sind fünf zweistellige Zahlen zu addieren. Für jede richtig gelöste Aufgabe erhalten Sie einen Punkt. Für jede falsch gelöste Aufgabe erhalten Sie keinen Punkt. Die Darstellung der Aufgaben ist identisch zu den vorherigen Runden.	*In this round, your task is once again to solve arithmetic problems over a period of 5 minutes (300 seconds). In each of these arithmetic tasks, five two-digit numbers are to be added. For every correctly solved task you get one point. You will not get a point for any task that is solved incorrectly. The presentation of the tasks is identical to the previous rounds.*
Auch in dieser Runde können Sie auswählen, welche Bezahlung Sie erhalten möchten, wenn am Ende des Experiments diese Runde ausgewählt wird. Es gibt diesmal verschiedene Geldbeträge der individuellen Bezahlung (A) und verschiedene Pools von Vergleichspersonen in der vergleichenden Bezahlung (B). Sie können sich für jede Kombination dieser Merkmale zwischen der individuellen Bezahlung (A) und der vergleichenden Bezahlung (B) entscheiden.	*In this round you can choose once more, which payment you want to receive, if this round is selected at the end of the experiment. This time there are different amounts per point in the individual payment (A) and different pools of comparators in the comparative payment (B). You can choose between individual payment (A) and comparative payment (B) for each combination of these characteristics.*
Individuelle Bezahlung (A): *Sie erhalten für jede von Ihnen in dieser Runde korrekt gelöste Aufgabe einen fixen Geldbetrag. Der Geldbetrag variiert und liegt zwischen 0,00€ und 1,00€.*	***Individual payment (A):*** *You receive a fixed amount of money for each problem you solve correctly in this round. The amount of money varies between €0.00 and €1.00.*
Vergleichende Bezahlung (B): *Die Anzahl der von Ihnen in dieser Runde korrekt gelösten Aufgaben ergibt Ihre Punktzahl. Wir vergleichen Ihre Punktzahl aus dieser Runde NICHT mit den Punktzahlen der drei anderen Personen in Ihrer Reihe, SONDERN mit der Punktzahl einer zufällig gezogenen Vergleichsperson. Wenn Ihre Punktzahl höher ist, erhalten Sie für jede von Ihnen in dieser Runde korrekt gelöste Aufgabe 1,00€. Ist Ihre Punktzahl nicht höher als die Punktzahl der Vergleichsperson, erhalten Sie für diese Runde 0,00€.*	***Comparative Payment (B):*** *The number of correctly solved problems in this round yields your score. We DO NOT compare your score from this round with the scores of the other three participants in your row, BUT with the score of a randomly drawn comparator. If your score is higher, you receive €1.00 for each problem solved correctly in this round. If your score is not higher than your comparator's score, you receive €0.00 for this round.*
Ermittlung der Vergleichsperson: *Aus allen vorherigen Punktzahlen dieser Runde wurden zufällig zehn Punktzahlen ausgewählt. Aus diesen zehn Punktzahlen wurden drei Pools gebildet und Ihre Vergleichsperson wird aus einem dieser drei Pools gezogen:*	***Determination of the comparator:*** *From all previous scores achieved in this round, ten scores were randomly selected. From these ten scores, three pools were formed and your comparator is drawn from one of these three pools:*
1. Einfacher Pool *Die höchste der zehn Punktzahlen wurde durch die niedrigste aller zuvor in dieser Runde erreichten Punktzahlen ersetzt. Ihre Gewinnchance ist somit 10% höher*, als im normalen Pool.*	***1st Easy pool*** *The highest of the ten scores has been replaced by the lowest of all scores previously achieved in this round. Your chance of winning is thus 10% higher* than in the original pool.*
2. Normaler Pool *Dieser Pool enthält die zehn ausgewählten Punktzahlen ohne Änderungen.*	***2nd Original pool*** *This pool contains the ten selected scores without any changes.*
3. Schwieriger Pool *Die niedrigste der zehn Punktzahlen wurde durch die höchste aller zuvor in dieser Runde erreichten Punktzahlen ersetzt. Ihre Gewinnchance ist somit 10% geringer*, als im normalen Pool.*	***3rd Hard pool*** *The lowest of the ten scores was replaced by the highest of all scores previously achieved in this round. Your chance of winning is therefore 10% lower * than in the normal pool.*
** Dies trifft nicht zu, wenn Sie entweder glauben, dass Ihre Punktzahl höher als alle oder niedriger als alle Punktzahlen im normalen Pool sein wird.*	** This is not the case if you believe that your score will either be higher than or lower than all scores in the original pool.*

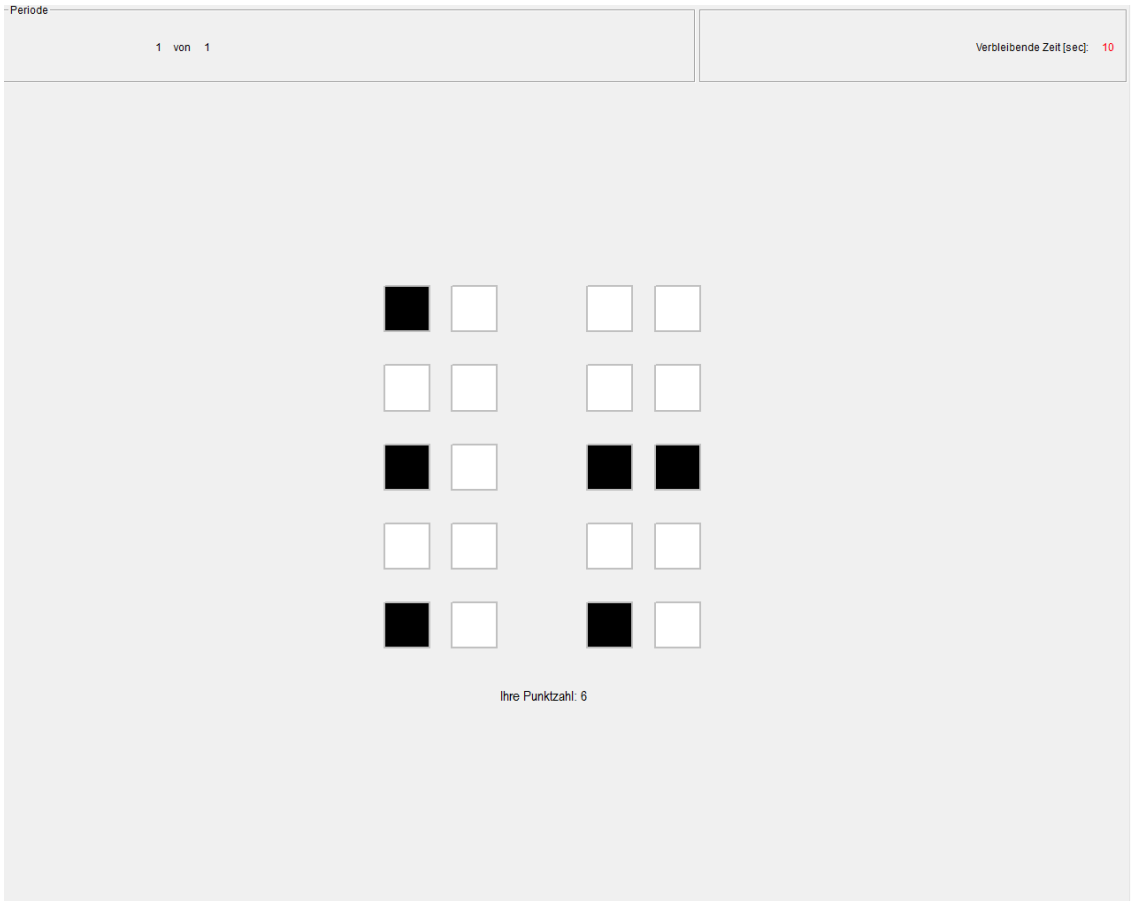
German original	English translation
Runde 6 *In dieser Runde wird die Aufgabe für Sie vollständig automatisch durch das Programm ausgeführt. Sie werden die Aufgabe starten und können dann in den Ablauf nicht mehr eingreifen. Die Aufgabe dauert insgesamt 40 Sekunden. Anschließend werden Sie aufgefordert, mit der nächsten Runde fortzufahren.* *Das Programm wird für Sie 10 Mal mit zwei virtuellen Würfeln würfeln. Beide Würfel haben jeweils 3 schwarze und 3 weiße Seiten. Für jeden Würfel, der eine schwarze Seite zeigt, erhalten Sie jeweils einen Punkt. Dagegen erhalten Sie für jeden Würfel, der eine weiße Seite zeigt, keinen Punkt. Die erreichbare Gesamtpunktzahl liegt folglich zwischen 0 und 20 Punkten. Das Würfelergebnis wurde NICHT vorab programmiert, sondern wird bei jedem Wurf zufällig ermittelt.*	***Round 6*** *In this round, the task is performed completely automatically by the program for you. You will start the task and will not be able to intervene in the procedure. The task takes a total of 40 seconds. You will then be asked to proceed to the next round.* *The program will roll a pair of virtual dice for you 10 times. Both dice have 3 black and 3 white sides each. For each dice that shows a black side, you receive one point each. On the other hand, you do not receive a point for each dice that shows a white side. Therefore, achievable total scores are between 0 and 20 points. The dice result was NOT programmed in advance, but is determined randomly at each roll.*
Auch in dieser Runde können Sie auswählen, welche Bezahlung Sie erhalten möchten, wenn am Ende des Experiments diese Runde ausgewählt wird. Es gibt diesmal verschiedene Geldbeträge der individuellen Bezahlung (A) und verschiedene Pools von Vergleichspersonen in der vergleichenden Bezahlung (B). Sie können sich für jede Kombination dieser Merkmale zwischen der individuellen Bezahlung (A) und der vergleichenden Bezahlung (B) entscheiden.	*In this round you can choose once more, which payment you want to receive, if this round is selected at the end of the experiment. This time there are different amounts per point in the individual payment (A) and different pools of comparators in the comparative payment (B). You can choose between individual payment (A) and comparative payment (B) for each combination of these characteristics.*
Individuelle Bezahlung (A): *Sie erhalten für jede von Ihnen in dieser Runde korrekt gelöste Aufgabe einen fixen Geldbetrag. Der Geldbetrag variiert und liegt zwischen 0,00€ und 1,00€.* ***Vergleichende Bezahlung (B):*** *Die Anzahl der von Ihnen in dieser Runde korrekt gelösten Aufgaben ergibt Ihre Punktzahl. Wir vergleichen Ihre Punktzahl aus dieser Runde NICHT mit den Punktzahlen der drei anderen Personen in Ihrer Reihe, SONDERN mit der Punktzahl einer zufällig gezogenen Vergleichsperson. Wenn Ihre Punktzahl höher ist, erhalten Sie für jede von Ihnen in dieser Runde korrekt gelöste Aufgabe 1,00€. Ist Ihre Punktzahl nicht höher als die Punktzahl der Vergleichsperson, erhalten Sie für diese Runde 0,00€.*	***Individual payment (A):*** *You receive a fixed amount of money for each problem you solve correctly in this round. The amount of money varies between €0.00 and €1.00.* ***Comparative Payment (B):*** *The number of correctly solved problems in this round yields your score. We DO NOT compare your score from this round with the scores of the other three participants in your row, BUT with the score of a randomly drawn comparator. If your score is higher, you receive €1.00 for each problem solved correctly in this round. If your score is not higher than your comparator's score, you receive €0.00 for this round.*
Ermittlung der Vergleichsperson: *Aus allen vorherigen Punktzahlen dieser Runde wurden zufällig zehn Punktzahlen ausgewählt. Aus diesen zehn Punktzahlen wurden drei Pools gebildet und Ihre Vergleichsperson wird aus einem dieser drei Pools gezogen:* ***1. Einfacher Pool*** *Die höchste der zehn Punktzahlen wurde durch die niedrigste aller zuvor in dieser Runde erreichten Punktzahlen ersetzt. Ihre Gewinnchance ist somit 10% höher*, als im normalen Pool.* ***2. Normaler Pool*** *Dieser Pool enthält die zehn ausgewählten Punktzahlen ohne Änderungen.* ***3. Schwieriger Pool*** *Die niedrigste der zehn Punktzahlen wurde durch die höchste aller zuvor in dieser Runde erreichten Punktzahlen ersetzt. Ihre Gewinnchance ist somit 10% geringer*, als im normalen Pool.*	***Determination of the comparator:*** *From all previous scores achieved in this round, ten scores were randomly selected. From these ten scores, three pools were formed and your comparator is drawn from one of these three pools:* ***1st Easy pool*** *The highest of the ten scores has been replaced by the lowest of all scores previously achieved in this round. Your chance of winning is thus 10% higher* than in the original pool.* ***2nd Original pool*** *This pool contains the ten selected scores without any changes.* ***3rd Hard pool*** *The lowest of the ten scores was replaced by the highest of all scores previously achieved in this round. Your chance of winning is therefore 10% lower * than in the normal pool.*
** Dies trifft nicht zu, wenn Sie entweder glauben, dass Ihre Punktzahl höher als alle oder niedriger als alle Punktzahlen im normalen Pool sein wird.*	** This is not the case if you believe that your score will either be higher than or lower than all scores in the original pool.*

Figure A.1: Screenshot of subjects' payment decision in tasks 5 and 6



Subjects chose their preferred payment scheme between a piece-rate (A) and a winner-take-all tournament (B) for 21 different piece-rate levels ranging from €0.00 per point up to €1.00 per point. All 21 choices were displayed vertically in a single column with piece-rate levels in ascending order. In all tournaments subjects received a payment of €1.00 per point, if they outperformed one anonymous, randomly drawn competitor. Subjects fixed their choices for an easy (left column), an original (middle column), and a hard (right column) competitor pool (see Section 3.3.4). Subjects were only able to proceed to the next screen, when all options were filled in. The payment choice screens in tasks 5 and 6 were identical except for the headline indicating the respective task.

Figure A.2: Screenshot of dice-task in task 6



In task 6 of my experiment subjects participated in a non-agency task (see Section 3.3.5). During this task the program rolled ten pairs of virtual two-colored dice, where subjects' score was calculated as the number of black sides. The program displayed the result of the respective next pair of dice every 3 sec starting in the upper left, filling the left column first, and adding the last pair at the bottom right. The text "rolling dice – please wait" was displayed at the respective next pair's position. All previous pairs of dice remained visible, so subjects could track their score. Subsequently, the score was calculated and displayed below all the pairs for 10 sec. After 40 sec the task ended automatically. During the task subjects could not interfere in any way.

B - Alternative risk adjustment

Sections 3.4.5 and 3.4.6 report results for the Values of competing and winning. Calculation of these values includes risk adjustment based on Holt's and Laury's (2002) risk measure, which identifies intervals for individual risk aversion. In the main text I report results based on the lower bound of CRRA intervals. Tables B.1 and B.2 show robustness of results, when interval midpoints or upper bounds are used instead.

Table B.1: Values of competing and winning for alternative risk-adjustments

Variable	CRRA	mean	(s.e.)	median	(s.e.)	95% conf. Int.	
Value of competing	low	2.19	(.59)***	2.07	(.12)***	[1.10	3.38]
	mid	2.51	(.56)***	2.23	(.11)***	[1.49	3.63]
	high	2.82	(.52)***	2.46	(.11)***	[1.91	3.95]
Value of winning	low	-6.63	(4.98)	-1.98	(.12)***	[-24.00	-0.59]
	mid	-5.98	(5.41)	-1.94	(.11)***	[-22.48	1.47]
	high	-2.62	(7.99)	-1.93	(.10)***	[-14.57	19.35]

Note: *Results for risk-adjustment based on lower bound (low), interval midpoint (mid), and upper bound (high) of CRRA parameter. Median test based on the Hodges-Lehmann (1963) percentile difference. Table reports bias-corrected and accelerated confidence intervals based on bootstrapping (10000 repetitions). ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

Table B.2: Regression results for alternative risk-adjustments

	Midpoint CRRA			Upper bound CRRA		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.:	WTA task 3	WTA task 3	WTA task 3	WTA task 3	WTA task 3	WTA task 3
	OLS	OLS	probit mfx	OLS	OLS	probit mfx
Value of competing	0.03(0.02)+	0.04(0.02)*	0.05(0.02)*	0.04(0.02)+	0.05(0.02)*	0.05(0.02)*
Value of winning	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
Overconfidence Math		0.04(0.02)+	0.05(0.03)+		0.04(0.02)+	0.05(0.03)+
Overconfidence Dice		0.01(0.02)	0.01(0.02)		0.01(0.02)	0.01(0.02)
CRRA		-0.14(0.15)	-0.16(0.16)		-0.13(0.15)	-0.14(0.16)
Constant	0.30(0.08)**	0.30(0.12)*		0.28(0.09)**	0.28(0.14)*	
Observations	50	50	50	50	50	50
R^2	0.068	0.147		0.073	0.152	

Note: *Regression results for risk-adjustment based on interval midpoint and upper bound of CRRA parameter. Columns 1, 2, 4, and 5 report coefficients of linear probability models. Columns 3 and 6 report marginal effects from probit regression. ***, **, *, + indicate statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively.*

C – Detailed reports of regression analysis and robustness checks

This appendix provides more detailed reports of regression analysis and robustness check of Chapter V. A detailed report of all variables in Model 4 of Section 5.4.1 is provided in Table C.1. Detailed reports of all variables in Models 1, 2, and 3 of Section 5.4.2 are provided in Tables C.2, C.3, and C.4, respectively. Robustness checks for interactions of a gender contrast with all other variables are reported in Tables C.5 (sample 1) and C.6 (sample 2). Robustness checks for interactions with contrast codes indicating female vs. male job titles and math vs. dice task are reported in Tables C.7 and C.8, respectively. Table C.9 shows a robustness check controlling for CRRA. Finally, Table C.10 shows a robustness check using a logistic regression instead of a linear model.

Table C.1: Regression results for scenarios (detailed report of Model 4)

Dependent variable	Study 1: Scenario Preference		
Alternatives (base: Scenario A – piece-rate)	Scenario B	Scenario C	Scenario D
Model 4			
Competitive preference	-	-	-
Gender (m=1, f=-1)	0.25 (0.13)*	0.15 (0.15)	0.10 (0.17)
Age	-0.01 (0.05)	-0.03 (0.05)	0.03 (0.05)
Father self-employed	-0.25 (0.36)	0.04 (0.36)	-0.12 (0.38)
Mother self-employed	-0.44 (0.42)	-0.43 (0.63)	-0.46 (0.74)
Abi degree	-0.27 (0.24)	-0.10 (0.26)	-0.08 (0.30)
# of Siblings	-0.08 (0.10)	-0.01 (0.12)	-0.18 (0.13)
Constant (scenario fixed effect)	-0.56 (0.61)	-0.90 (0.72)	-1.28 (0.84)
Perception of competition (PoC)		0.11 (0.05)*	
PoC X Competitive preference		0.05 (0.03)*	
Ind. fixed eff.		incl.	
Constant		5.17 (0.12)***	
R2 within / overall (F)		0.237 / 0.083 (8.29)***	
Observations		890	
Number of Individuals		228	

Notes: *Individual and scenario fixed effects regression analyses with alternative-specific (i.e. scenario-specific) as well as individual-specific explanatory variables; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives and reported in corresponding columns). Estimated coefficients and cluster-robust standard errors in parentheses. Model 4 includes the following individual-level control variables: Gender, age, parental entrepreneurship, Abitur degree, No. of Siblings. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.2: Regression results for job categories (detailed report of Model 1)

Dep. Var. = Job Preference	Student Sample			General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder	Manager	Self-Empl.	Founder
Competitive Preference	0.23 (0.12)*	0.10 (0.09)	0.12 (0.11)	0.05 (0.09)	0.12 (0.10)	0.19 (0.09)*
Risk Preference				-0.08 (0.09)	0.00 (0.09)	-0.01 (0.08)
Confidence				0.04 (0.03)	-0.02 (0.03)	-0.03 (0.03)
Gender (m=1, f=-1)	0.21 (0.14)	0.34 (0.12)**	0.39 (0.13)**	0.05 (0.05)	0.03 (0.05)	0.03 (0.04)
Age	-0.10 (0.05)*	-0.01 (0.04)	-0.04 (0.05)	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	0.04 (0.34)	0.31 (0.27)	-0.13 (0.31)	-0.25 (0.10)*	-0.08 (0.10)	-0.08 (0.08)
Mother self-employed	0.04 (0.45)	0.31 (0.48)	0.03 (0.43)	0.25 (0.12)*	0.12 (0.10)	0.23 (0.10)*
Education: Hauptschule				0.05 (0.11)	0.24 (0.14)+	0.13 (0.12)
Education: Realschule				0.12 (0.09)	0.13 (0.12)	0.27 (0.12)*
Education: Fachabitur				-0.04 (0.11)	0.05 (0.13)	0.08 (0.12)
Education: Abitur				-0.07 (0.09)	-0.08 (0.11)	-0.07 (0.10)
University Graduation				0.01 (0.11)	0.14 (0.11)	0.06 (0.10)
Professional Job Training				-0.26 (0.08)**	-0.03 (0.09)	-0.12 (0.08)
Education: Other				0.02 (0.15)	0.22 (0.16)	0.13 (0.17)
Abi degree	-0.46 (0.29)	-0.28 (0.24)	-0.42 (0.27)			
# of Siblings	-0.09 (0.10)	-0.13 (0.10)	-0.08 (0.11)			
Day 2				-0.02 (0.09)	-0.13 (0.11)	-0.08 (0.09)
Day 3				0.13 (0.09)	-0.12 (0.10)	-0.10 (0.10)
German native				0.05 (0.09)	-0.15 (0.10)	-0.00 (0.08)
Constant (job fixed effect)	3.22 (0.73)***	2.23 (0.63)***	2.85 (0.68)***	-0.66 (0.21)**	-0.28 (0.20)	-0.58 (0.18)**
Perception of Competition		--			--	
PoC X Competitive Preference		--			--	
PoC X Risk Preference					--	
PoC X Confidence					--	
Familiarity		0.05 (0.02)*				
Confidence		0.80 (0.05)***				
Ind. fixed effects		incl.			incl.	
Constant		-0.92 (0.27)***			0.82 (0.02)***	
R^2 within / overall (F)	0.549	/ 0.457 (32.29)***		0.427	/ 0.281 (13.08)***	
Observations		887			808	
Number of Individuals		227			202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.3: Regression results for job categories (detailed report of Model 2)

Dep. Var. = Job Preference	Student Sample			General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder	Manager	Self-Empl.	Founder
Competitive Preference	0.06 (0.14)	-0.10 (0.12)	-0.11 (0.15)	-0.15 (0.12)	-0.11 (0.14)	-0.10 (0.14)
Risk Preference				0.05 (0.12)	0.15 (0.13)	0.18 (0.13)
Confidence				0.06 (0.05)	0.00 (0.04)	0.00 (0.04)
Gender (m=1, f=-1)	0.21 (0.14)	0.35 (0.12)**	0.40 (0.13)**	0.05 (0.05)	0.04 (0.05)	0.04 (0.04)
Age	-0.10 (0.05)*	-0.00 (0.04)	-0.05 (0.04)	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	0.02 (0.35)	0.28 (0.28)	-0.15 (0.31)	-0.23 (0.10)*	-0.06 (0.09)	-0.05 (0.08)
Mother self-employed	0.06 (0.44)	0.34 (0.49)	0.11 (0.42)	0.23 (0.12)+	0.13 (0.10)	0.21 (0.10)*
Education: Hauptschule				0.06 (0.12)	0.26 (0.14)+	0.15 (0.13)
Education: Realschule				0.14 (0.09)	0.16 (0.12)	0.29 (0.12)*
Education: Fachabitur				-0.02 (0.11)	0.06 (0.13)	0.09 (0.12)
Education: Abitur				-0.07 (0.10)	-0.07 (0.11)	-0.06 (0.10)
University Graduation				0.02 (0.11)	0.16 (0.11)	0.07 (0.10)
Professional Job Training				-0.26 (0.08)**	-0.03 (0.09)	-0.11 (0.08)
Education: Other				0.05 (0.15)	0.25 (0.16)	0.17 (0.17)
Abi degree	-0.46 (0.29)	-0.30 (0.24)	-0.41 (0.26)			
# of Siblings	-0.10 (0.10)	-0.14 (0.10)	-0.10 (0.11)			
Day 2				-0.03 (0.09)	-0.13 (0.10)	-0.09 (0.09)
Day 3				0.10 (0.09)	-0.14 (0.10)	-0.12 (0.10)
German native				0.04 (0.09)	-0.16 (0.10)	-0.01 (0.08)
Constant (job fixed effect)	3.22 (0.74)***	2.25 (0.64)***	2.81 (0.69)***	-0.75 (0.27)**	-0.38 (0.26)	-0.72 (0.26)**
Perception of Competition		0.01 (0.04)			0.05 (0.06)	
PoC X Competitive Preference		0.06 (0.03)*			0.08 (0.03)**	
PoC X Risk Preference					-0.05 (0.03)	
PoC X Confidence					-0.01 (0.01)	
Familiarity		0.05 (0.02)*				
Confidence		0.79 (0.05)***				
Ind. fixed effects		incl.			incl.	
Constant		-0.87 (0.27)**			0.81 (0.04)***	
R^2 within / overall (F)	0.552	/ 0.463 (30.21)***		0.434	/ 0.262 (14.09)***	
Observations		887			808	
Number of Individuals		227			202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.4: Regression results for job categories (detailed report of Model 3)

Dep. Var. = Job Preference	Student Sample			General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder	Manager	Self-Empl.	Founder
Competitive Preference	--	--	--	--	--	--
Risk Preference				-0.02 (0.11)	0.10 (0.11)	0.12 (0.11)
Confidence				0.06 (0.05)	-0.00 (0.04)	0.00 (0.04)
Gender (m=1, f=-1)	0.25 (0.14)+	0.33 (0.12)**	0.38 (0.13)**	0.04 (0.05)	0.03 (0.05)	0.04 (0.04)
Age	-0.10 (0.05)*	-0.00 (0.04)	-0.04 (0.04)	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	0.05 (0.34)	0.27 (0.27)	-0.16 (0.31)	-0.23 (0.10)*	-0.06 (0.09)	-0.06 (0.08)
Mother self-employed	0.07 (0.43)	0.34 (0.49)	0.08 (0.43)	0.22 (0.12)+	0.12 (0.10)	0.21 (0.10)*
Education: Hauptschule				0.05 (0.12)	0.26 (0.14)+	0.14 (0.12)
Education: Realschule				0.14 (0.10)	0.15 (0.12)	0.29 (0.12)*
Education: Fachabitur				-0.02 (0.11)	0.06 (0.13)	0.09 (0.12)
Education: Abitur				-0.07 (0.10)	-0.08 (0.11)	-0.07 (0.10)
University Graduation				0.01 (0.10)	0.15 (0.11)	0.06 (0.10)
Professional Job Training				-0.28 (0.08)***	-0.04 (0.09)	-0.12 (0.08)
Education: Other				0.05 (0.15)	0.25 (0.16)	0.16 (0.17)
Abi degree	-0.44 (0.29)	-0.30 (0.24)	-0.43 (0.26)			
# of Siblings	-0.08 (0.10)	-0.14 (0.10)	-0.10 (0.11)			
Day 2				-0.04 (0.09)	-0.14 (0.10)	-0.09 (0.09)
Day 3				0.10 (0.09)	-0.14 (0.10)	-0.12 (0.10)
German native				0.05 (0.09)	-0.16 (0.10)	-0.00 (0.08)
Constant (job fixed effect)	3.13 (0.74)***	2.27 (0.64)***	2.84 (0.68)***	-0.74 (0.27)**	-0.38 (0.26)	-0.72 (0.26)**
Perception of Competition		0.01 (0.04)			0.05 (0.06)	
PoC X Competitive Preference		0.05 (0.02)*			0.06 (0.02)**	
PoC X Risk Preference					-0.04 (0.03)	
PoC X Confidence					-0.01 (0.01)	
Familiarity		0.05 (0.02)*				
Confidence		0.80 (0.05)***				
Ind. fixed effects		incl.			incl.	
Constant		-0.88 (0.27)**			0.81 (0.04)***	
R^2 within / overall (F)	0.549	/ 0.461 (33.30)***		0.432	/ 0.276 (14.51)***	
Observations		887			808	
Number of Individuals		227			202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.5: Regression results – study 1: gender interaction

Dep. Var. = Job Preference	Student Sample		
(base: Non-managerial employees)	Manager	Self-Emp.	Founder
Gender (m=1, f=-1)	-0.70 (0.71)	-0.03 (0.64)	0.10 (0.69)
Age	-0.10 (0.04)*	-0.01 (0.04)	-0.06 (0.04)
Father self-employed	-0.01 (0.34)	0.32 (0.28)	-0.09 (0.32)
Mother self-employed	0.20 (0.47)	0.11 (0.52)	-0.06 (0.37)
Abi degree	-0.46 (0.28)	-0.27 (0.24)	-0.38 (0.26)
# of Siblings	-0.09 (0.10)	-0.12 (0.11)	-0.08 (0.11)
Gender X Age	0.03 (0.04)	0.06 (0.04)	0.07 (0.04)
Gender X Father self-employed	0.58 (0.34)+	0.24 (0.28)	0.27 (0.32)
Gender X Mother self-employed	0.28 (0.47)	-0.67 (0.52)	-0.68 (0.37)+
Gender X Abi degree	0.33 (0.28)	0.07 (0.24)	0.02 (0.26)
Gender X # of Siblings	-0.08 (0.10)	-0.08 (0.11)	-0.02 (0.11)
Constant (Job fixed effects)	3.17 (0.71)***	2.13 (0.64)***	2.72 (0.69)***
Perception of Competition		-0.01 (0.05)	
PoC X Competitive Preference		0.04 (0.02)+	
Familiarity		0.05 (0.02)*	
Confidence		0.78 (0.05)***	
Gender X Perception of Competition		0.07 (0.05)	
Gender X PoC X Competitive Preference		0.03 (0.02)	
Gender X Familiarity		0.04 (0.02)+	
Gender X Confidence		-0.09 (0.05)+	
Constant		-0.84 (0.27)**	
R^2 within / overall (F)	0.569 / 0.4349 (25.31)***		
Observations	887		
Number of Individuals	227		

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.6: Regression results – study 2: gender interaction

Dep. Var. = Job Preference	General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder
Risk Preference	0.04 (0.11)	0.15 (0.12)	0.20 (0.11)+
Confidence	0.05 (0.05)	-0.01 (0.04)	0.00 (0.05)
Gender (m=1, f=-1)	0.15 (0.30)	0.21 (0.27)	0.24 (0.29)
Age	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	-0.23 (0.10)*	-0.06 (0.10)	-0.06 (0.09)
Mother self-employed	0.24 (0.12)+	0.14 (0.10)	0.22 (0.10)*
Education: Hauptschule	0.01 (0.13)	0.18 (0.14)	0.17 (0.13)
Education: Realschule	0.09 (0.10)	0.16 (0.12)	0.28 (0.12)*
Education: Fachabitur	-0.03 (0.12)	0.07 (0.15)	0.14 (0.14)
Education: Abitur	-0.10 (0.10)	-0.06 (0.10)	-0.06 (0.09)
University Graduation	-0.01 (0.11)	0.13 (0.11)	0.02 (0.10)
Professional Job Training	-0.24 (0.08)**	-0.02 (0.09)	-0.11 (0.09)
Education: Other	0.13 (0.12)	0.19 (0.17)	0.13 (0.15)
German native	0.04 (0.09)	-0.16 (0.10)+	-0.02 (0.08)
Day 2	-0.05 (0.09)	-0.15 (0.11)	-0.11 (0.10)
Day 3	0.06 (0.10)	-0.17 (0.11)	-0.18 (0.11)+
Gender X Risk Preference	-0.07 (0.11)	-0.06 (0.12)	-0.15 (0.12)
Gender X Confidence	-0.04 (0.05)	-0.05 (0.04)	-0.04 (0.05)
Gender X Age	0.01 (0.00)*	-0.00 (0.00)	0.00 (0.00)
Gender X Father self-employed	0.09 (0.10)	0.19 (0.10)+	0.07 (0.09)
Gender X Mother self-employed	-0.12 (0.12)	-0.15 (0.10)	-0.09 (0.10)
Gender X Education: Hauptschule	0.06 (0.13)	0.25 (0.14)+	-0.04 (0.13)
Gender X Education: Realschule	0.00 (0.10)	-0.03 (0.12)	0.07 (0.12)
Gender X Education: Fachabitur	0.10 (0.12)	-0.09 (0.15)	-0.08 (0.14)
Gender X Education: Abitur	0.09 (0.10)	-0.02 (0.10)	-0.07 (0.09)
Gender X University Graduation	0.04 (0.11)	-0.05 (0.11)	0.08 (0.10)
Gender X Professional Job Training	0.01 (0.08)	0.15 (0.09)	0.12 (0.09)
Gender X Education: Other	-0.08 (0.12)	0.18 (0.17)	0.15 (0.15)
Gender X German native	0.11 (0.10)	0.04 (0.10)	0.03 (0.09)
Gender X Day 2	-0.12 (0.09)	-0.11 (0.11)	-0.13 (0.10)
Gender X Day 3	-0.07 (0.10)	-0.06 (0.11)	-0.04 (0.11)
Constant (Job fixed effects)	-0.70 (0.29)*	-0.34 (0.27)	-0.71 (0.28)*
Perception of Competition		0.07 (0.07)	
PoC X Competitive Preference		0.06 (0.02)**	
PoC X Risk Preference		-0.05 (0.03)+	
PoC X Confidence		-0.01 (0.01)	
Gender X PoC		-0.01 (0.07)	
Gender X PoC X Competitive Preference		-0.01 (0.02)	
Gender X PoC X Risk Preference		0.01 (0.03)	
Gender X PoC X Confidence		0.01 (0.01)	
Constant		0.82 (0.03)***	
R^2 within / overall (F)	0.481	/ 0.278 (16.62)***	
Observations		808	
Number of Individuals		202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.7: Regression results – study 2: job title treatment

Dep. Var. = Job Preference	General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder
Risk Preference	-0.02 (0.11)	0.09 (0.11)	0.12 (0.11)
Confidence	0.06 (0.04)	-0.00 (0.04)	0.00 (0.04)
Gender (m=1, f=-1)	0.03 (0.05)	0.03 (0.05)	0.03 (0.04)
Age	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	-0.22 (0.10)*	-0.06 (0.10)	-0.06 (0.09)
Mother self-employed	0.22 (0.12)+	0.13 (0.10)	0.22 (0.10)*
Education: Hauptschule	0.04 (0.12)	0.24 (0.14)+	0.13 (0.13)
Education: Realschule	0.13 (0.10)	0.14 (0.12)	0.27 (0.13)*
Education: Fachabitur	-0.01 (0.11)	0.07 (0.13)	0.10 (0.12)
Education: Abitur	-0.08 (0.10)	-0.09 (0.11)	-0.08 (0.10)
University Graduation	-0.00 (0.10)	0.13 (0.11)	0.05 (0.10)
Professional Job Training	-0.27 (0.08)**	-0.03 (0.09)	-0.11 (0.09)
Education: Other	0.05 (0.15)	0.24 (0.16)	0.16 (0.17)
German native	0.05 (0.09)	-0.15 (0.10)	-0.00 (0.08)
Day 2	-0.04 (0.09)	-0.14 (0.10)	-0.10 (0.09)
Day 3	0.10 (0.09)	-0.14 (0.10)	-0.12 (0.10)
Constant (Job fixed effects)	-0.74 (0.27)**	-0.37 (0.26)	-0.71 (0.26)**
Perception of Competition		0.05 (0.06)	
PoC X Competitive Preference		0.07 (0.02)**	
PoC X Risk Preference		-0.04 (0.03)	
PoC X Confidence		-0.01 (0.01)	
Job titles X PoC		0.02 (0.03)	
Job titles X PoC X Competitive Preference		0.01 (0.02)	
Job titles X PoC X Risk Preference		0.01 (0.02)	
Job titles X PoC X Confidence		-0.00 (0.01)	
Constant		0.81 (0.04)***	
R^2 within / overall (F)	0.434	/ 0.276 (15.00)***	
Observations		808	
Number of Individuals		202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.8: Regression results – study 2: dice vs. math task

Dep. Var. = Job Preference	General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder
Risk Preference	-0.02 (0.11)	0.10 (0.11)	0.13 (0.11)
Confidence	0.05 (0.05)	-0.01 (0.04)	0.00 (0.04)
Gender (m=1, f=-1)	0.04 (0.05)	0.03 (0.05)	0.03 (0.04)
Age	0.01 (0.00)**	0.00 (0.00)	0.00 (0.00)
Father self-employed	-0.24 (0.10)*	-0.07 (0.10)	-0.08 (0.08)
Mother self-employed	0.24 (0.12)*	0.14 (0.10)	0.23 (0.10)*
Education: Hauptschule	0.05 (0.12)	0.27 (0.14)+	0.14 (0.13)
Education: Realschule	0.13 (0.10)	0.15 (0.12)	0.30 (0.13)*
Education: Fachabitur	-0.03 (0.11)	0.07 (0.14)	0.11 (0.13)
Education: Abitur	-0.08 (0.09)	-0.06 (0.11)	-0.05 (0.10)
University Graduation	0.02 (0.11)	0.16 (0.11)	0.08 (0.10)
Professional Job Training	-0.27 (0.08)**	-0.03 (0.09)	-0.11 (0.08)
Education: Other	0.07 (0.15)	0.27 (0.17)	0.18 (0.17)
German native	0.07 (0.10)	-0.14 (0.10)	0.01 (0.09)
Day 2	0.01 (0.11)	-0.10 (0.12)	-0.08 (0.10)
Day 3	0.12 (0.10)	-0.11 (0.11)	-0.11 (0.10)
Dice Task	-0.12 (0.24)	-0.29 (0.22)	-0.31 (0.22)
Dice Task X Risk Preference	0.01 (0.11)	0.05 (0.12)	0.12 (0.12)
Dice Task X Confidence	0.04 (0.04)	0.06 (0.04)+	0.06 (0.04)
Constant (Job fixed effects)	-0.78 (0.27)**	-0.42 (0.25)+	-0.76 (0.25)**
Perception of Competition		0.04 (0.06)	
PoC X Competitive Preference		0.05 (0.02)**	
PoC X Risk Preference		-0.03 (0.03)	
PoC X Confidence		-0.01 (0.01)	
Dice Task X PoC		0.07 (0.06)	
Dice Task X PoC X Competitive Preference		0.02 (0.02)	
Dice Task X PoC X Risk Preference		-0.03 (0.03)	
Dice Task X PoC X Confidence		-0.01 (0.01)	
Constant		0.81 (0.04)***	
R^2 within / overall (F)	0.441	/ 0.279 (11.97)***	
Observations		808	
Number of Individuals		202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.9: Regression results – study 2: CRRA

Dep. Var. = Job Preference	General Population		
(base: Non-managerial employees)	Manager	Self-Empl.	Founder
Risk Preference (CRRA)	0.01 (0.04)	0.03 (0.04)	-0.01 (0.04)
Confidence	0.05 (0.04)	0.00 (0.04)	0.00 (0.04)
Gender (m=1, f=-1)	0.04 (0.05)	0.04 (0.05)	0.04 (0.04)
Age	0.01 (0.00)*	0.00 (0.00)	0.00 (0.00)
Father self-employed	-0.23 (0.10)*	-0.07 (0.09)	-0.06 (0.08)
Mother self-employed	0.23 (0.13)+	0.14 (0.10)	0.21 (0.10)*
Education: Hauptschule	0.07 (0.12)	0.25 (0.14)+	0.16 (0.12)
Education: Realschule	0.17 (0.09)+	0.15 (0.12)	0.31 (0.12)*
Education: Fachabitur	-0.00 (0.11)	0.04 (0.13)	0.11 (0.13)
Education: Abitur	-0.04 (0.10)	-0.08 (0.11)	-0.05 (0.09)
University Graduation	0.02 (0.11)	0.14 (0.11)	0.07 (0.09)
Professional Job Training	-0.27 (0.08)**	-0.04 (0.09)	-0.11 (0.08)
Education: Other	0.04 (0.15)	0.23 (0.16)	0.16 (0.17)
German native	0.06 (0.10)	-0.16 (0.10)	-0.01 (0.08)
Day 2	-0.04 (0.09)	-0.15 (0.10)	-0.09 (0.09)
Day 3	0.11 (0.10)	-0.14 (0.10)	-0.11 (0.10)
Constant (Job fixed effects)	-0.78 (0.25)**	-0.35 (0.25)	-0.64 (0.24)**
Perception of Competition		0.04 (0.06)	
PoC X Competitive Preference		0.05 (0.02)**	
PoC X Risk Preference (CRRA)		-0.00 (0.01)	
PoC X Confidence		-0.01 (0.01)	
Constant		0.81 (0.04)***	
R^2 within / overall (F)	0.430	/ 0.274 (12.11)***	
Observations		808	
Number of Individuals		202	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*

Table C.10: Regression results – study 2: logistic regression model

Dep. Var. = Job Preference	General Population		
(base: Non-managerial employees)	Manager	Self-Empl	Founder
Risk Preference	0.60 (1.14)	2.00 (1.16)+	2.62 (1.46)+
Confidence	0.74 (0.45)	0.15 (0.45)	-0.04 (0.56)
Gender (m=1, f=-1)	-0.13 (0.46)	-0.4 (0.43)	-0.07 (0.53)
Age	0.06 (0.05)	-0.02 (0.04)	0.03 (0.05)
Father self-employed	-4.14 (1.33)**	-1.47 (1.15)	-2.11 (1.46)
Mother self-employed	2.91 (1.22)*	0.96 (1.17)	2.56 (1.45)+
Education: Hauptschule	0.23 (1.85)	1.32 (1.56)	0.09 (1.83)
Education: Realschule	0.79 (1.28)	1.08 (1.17)	2.21 (1.27)+
Education: Fachabitur	0.44 (1.51)	-0.24 (1.47)	0.82 (1.56)
Education: Abitur	-0.01 (1.01)	-0.6 (0.91)	0.12 (1.06)
University Graduation	0.84 (1.14)	1.67 (1.07)	1.84 (1.24)
Professional Job Training	-4.34 (1.38)**	-2.03 (1.31)	-2.85 (1.43)*
Education: Other	1.18 (1.49)	2.67 (1.36)+	3.35 (1.49)*
German native	1.33 (1.11)	-0.14 (0.98)	0.17 (1.20)
Day 2	0.31 (1.06)	-0.8 (0.94)	-0.82 (1.19)
Day 3	0.57 (1.30)	-1.62 (1.20)	-1.45 (1.32)
Constant (Job fixed effects)	-8.24 (3.12)**	-4.22 (3.09)	-6.22 (3.48)+
Perception of Competition		-0.15 (0.63)	
PoC X Competitive Preference		0.52 (0.26)*	
PoC X Risk Preference		-0.54 (0.33)	
PoC X Confidence		0.02 (0.12)	
Log Likelihood (χ^2[df=55])		-94.19 (303.43)***	
Observations		644	
Number of Individuals		161	

Notes: *Fixed effects regression analyses with alternative-specific regressors and individual-specific regressors; the latter being entered with alternative-specific effects (implemented as interactions with dummies for alternatives). Estimated coefficients and cluster-robust standard errors in parentheses. Significance levels: *** p<0.001; ** p<0.01; * p<0.05; + p<0.1*