Does Personality get in the way of Incumbent & Entrant Behaviour?

Experimental Research on Personality in the context of the Fudenberg-Tirole Taxonomy

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This thesis represents the outcome of the academic research that I have focussed on for the past few years. I would like to acknowledge and thank two persons, without whom it would not have been possible for me to complete this project.

First, I would like to thank my supervisor Prof. Dr. Hagen Lindstädt who assisted me with fruitful comments and discussions along the whole journey. Starting from scoping an interesting research question (i.e., not overscoping), via useful hints and comments for the experiment preparation (i.e., avoiding typical pitfalls), to presenting the identified results in a digestible way (i.e., avoiding extremely complex tables), Prof. Lindstädt's comments have been very helpful and essential in order to complete this dissertation.

Secondly, I would like to thank my fiancée Flora Janik for her personal and psychological support during this time. The periodic 'ups' and 'downs' (and the associated mood swings) that a project like this entails have not always been easy to persevere, but Flora helped me look beyond these and focus on the overall goal and accept these downs as typical challenges that need to be overcome. Regaining the motivation in more difficult moments has been critical for completing the project with the required focus. I am deeply thankful for that and cannot wait until the end of July.

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I INTRODUCTION

"Adventure. Excitement. One should not crave these things. […]
Anger, fear, aggression; the dark side they represent."

I. 1 Background, Applicability & Motivation

In 2014, the European Union's[1] business economy, comprising of around 26 million active enterprises, recorded a 10 percent birth rate with 2.6 million newly born enterprises[2]. While this rate signifies an impressive economic development, the 2.3 million recorded death business[2], on the other hand, put this number into perspective. The similar magnitude of birth and death rates suggests that the excess of businesses created by the new entrants is balanced by the death rates. Interestingly, of all new businesses from 2009, only 44 percent survived past the fifth year[2], suggesting an *excess entry effect* as reported by several other studies[3]. While a few potential economic explanations are discussed in literature, it is unlikely that those account for the entire effect (Camerer & Lovallo, 1999).

Looking at the 'other side of the table', the Incumbent firm(s) can affect the attractiveness of the market by observable pre-entry commitments and, therefore, potentially deter market entry (or drive new Entrants out of the market). However, an Incumbent's reaction to potential entry (i.e., potential risk of losing his preeminent market position) may be irrational and yield significant consequences for the short- and mid-term development of the market. A prominent example is the market entry into the instant photography market by Kodak in 1976[4]. The only Incumbent in the market was Polaroid, which was the first and only company to offer coloured photos. When Kodak entered with a coloured film offering, Polaroid's CEO Edwin Land, for whom the entry was an affront, responded irrationally by dropping prices drastically. Instead of keeping prices high – as Kodak had signalled even after entry and Polaroid's price drops – Land wanted to make sure Kodak would make a loss (as driving Kodak out of the market was unlikely due to their deep pockets). Accordingly, this (seemingly) irrational – somewhat

[1] Statistics refer to the EU-27 member states.
[2] Data retrieved online from Eurostat (2015).
[3] For example, empirical studies by Dunne, Roberts, & Samuelson (1988), Geroski (1995), Dennis (1997), or Headd (2003).
[4] Case example based on description by Pindyck (2013).

stubborn – reaction lead by Land cost both companies a significant amount of money, illustrating how the personality of the central decision maker can potentially affect the market dynamics. While considerable research effort has been concerned with theory-coherent Incumbent behaviours, several empirical studies[5] provide indications that Incumbents do not apply these strategies and occasionally behave in theory-deviating manners, as witnessed in the Polaroid-Kodak case.

Another, more recent example of the importance of personality and its predictive power became apparent when a Swiss newspaper reported about the big data company *Cambridge Analytica*, which presumably advised both the Brexit and Trump campaigns in 2016[6]. The company applies a model developed by Kosinski, Stillwell, and Graepel (2013) on big data to manipulate undecided voters. The underlying model predicts a range of highly sensitive personal attributes as sexual orientation, political views, or personality traits (the Big Five) based on easily accessible digital records of behaviour: Facebook likes[7]. Having access to millions of personality profiles of potential voters (especially undecided voters), allowed Cambridge Analytica (CA) to approach these focus groups through targeted online marketing on a 'street-block level precision' (Grassegger & Krogerus, 2016). While there is no direct proof of this model accounting for those unexpected wins, the fact that CA's compensation for the Trump campaign went from 100 thousand US-Dollars in July 2016 to 250 thousand in August and 5 million in September[8] provides some indirect indication for the model's effectiveness.

Combining this predictive power that lies within individual differences with the theory-deviating and sometimes irrational empirical observations of market entry behaviour provides a very promising research area. Several other studies confirm this approach by pointing out that, when empirical observations are not well explained by rational assessment or developed underlying theory, research of individual differences might shed light on predictors of economics

[5] Empirical efforts include, for example, studies by Cubbin & Domberger (1988), Siegfried & Evans (1994), or Thomas (1999).

[6] The reference refers to an article by Grassegger & Krogerus (2016) in *Das Magazin*.

[7] For example, based on 68 likes the model can predict a person's skin colour (95% accuracy), sexual orientation (88% accuracy), or political party preference (85% accuracy). Furthermore, the model can predict the behaviour of a person better than a friend based on 70 likes, better than the person's parents based on 150 likes, and, somewhat worryingly, better than oneself based on 300 likes.

[8] According to Cambridge Analytica's CEO, Alexander James Ashburner Nix (Grassegger & Krogerus, 2016). The total compensation amounted to 15 million US-Dollars.

behaviour (e.g., Caplan, 2003). Accordingly, I argue that personality accounts – at least partly – for the described theory-deviating behaviour that this thesis aims to investigate.

I. 2 Research Objective & Methodology

This research aims to shed light upon the discrepancies between theory-coherent market entry behaviour and the associated empirical observations for both the Incumbent (i.e., theory-deviating strategies) and Entrant firms (i.e., excess entry phenomenon). In order to investigate this matter, research of individual differences is applied to investigate whether personality accounts for some of the recorded discrepancies, as suggested by prior research (Almlund, Duckworth, Heckman, & Kautz, 2011; Bergstrom, Parendo, & Sonstelie, 2016; Caplan, 2003).

Accordingly, this experimental study's objective is to investigate the following questions:

- *Do Incumbents apply entry deterring as well as encouraging strategies adequately?*
- *Do the Incumbent strategies successfully affect the Entrant's market entry decisions?*

Empirical studies indicate that Incumbents do not make use of entry deterring strategies as theory would predict (Abbink & Brandts, 2005). Prior experimental studies, on the other hand, applied significantly reduced complexities in their experimental designs[9], which might account for the ignorance of these strategies by the Incumbent firms. While a few experimental studies investigate the use of entry-deterring strategies, this study is – to the best of our knowledge – the first to examine the use of entry encouraging pre-entry strategies. To that effect, this study also analyses whether the applied pre-entry strategies are affecting Entrant behaviour, namely, affecting the entry decisions in the expected direction.

Despite the fact that no experimental study to date investigated **Incumbent behaviour** against the background of personality or individual differences, findings from several experimental studies analysing other economic settings suggest a predictive power of individual differences (e.g., Brandstätter & Güth, 2002; Lönnqvist, Verkasalo, & Walkowitz, 2011). This is especially promising, as previous efforts attempting to find potential alternative explanations for the discrepancy between theory and empirical findings did not yield conclusive results (e.g., Brandts et al., 2007). Thereby, this research thesis aims to also answer the following question:

[9] Namely, the experimental designs reduced Incumbent decisions to a selection of strategies based on a payoff matrix, which compressed the two- or even three-stage model into a single strategy choice (e.g., Brandts, Cabrales, & Charness, 2007).

- Do highly pronounced personality characteristics as aggression or agreeableness account for the heterogeneity in pre-entry Incumbent behaviour?

Namely, the objective is to investigate whether these strongly pronounced personality dimensions explain some of the theory-deviating behaviour observed by empirical studies. High scoring individuals on the aggression or dominance scales potentially tend to prefer more confrontational pre-entry strategies – although these might not always be the most adequate in a specific setting. High scores on dimensions as honesty-humility or agreeableness, on the other hand, might tend to choose cooperating pre-entry strategies – again, depending on the context, these might not represent the best available options.

Similarly, evidence for Entrant-related market entry decisions from experimental research is rather limited, as it mainly focusses on the concept of confidence (or over-confidence), as opposed to recognised personality frameworks. Although the restaurant entry study by Bergstrom et al. (2016) did not find any significant effects of the Big Five personality inventory[10] on entry decisions, the differing experimental design as well as the strong indications from previous studies on personality affecting economic decision making promise, nonetheless, insightful results. Especially the confrontational personality dimensions mentioned above, aggression and dominance, as well as 'action-seeking' characteristics as openness-to-experience or extraversion suggest promising results with regards to (excessive) entry behaviour. Accordingly, this thesis equally investigates the following Entrant-related question:

- Do highly pronounced personality dimensions as aggression, openness-to-experience or extraversion account for the observed heterogenetic and excessive Entrant behaviour?

Beyond the content-related contribution outlined above, this research aims to further contribute methodically to existing research efforts, as described in the following paragraphs. Since experimental game theory offers the opportunity to isolate variables that are in question, while other redundant variables or unnecessary complexities can be entirely excluded to limit potential distortion of results (Olson, 2000), the developed proposition are tested in an experimental study, simulating market entry situations. The experimental design refines a few design characteristics of existing research studies in order to ensure maximum applicability to the research objective and contribute to existing research methods.

[10] The study did find, however, a significant effect of two *MBTI dimensions*. Namely, low scores on the Sense-Intuition scale and high scores on the Think-Feel scale are more likely to enter the market and open a restaurant.

First, while a few studies investigated the use of entry deterring strategies in market entry games, no experimental study has investigated Incumbent behaviour in the context where the objective is to allow market entry. Accordingly, the design includes both the entry deterring as well as the entry allowing objective by the Incumbent firm.

Second, the experiment conducted within the scope of this research will simulate a three-stage game, where participants make their strategy choices sequentially. In contrast, prior designs reduced complexities by folding the two or three stages of the entry game into one payoff table, asking participants to select a preferred strategy-set. While the so called *strategy-method* may bear the advantage of collecting more information (Kübler & Müller, 2002), it *'removes possible effects of the timing of the decisions in the course of the game'* (Roth, 1995), which is especially applicable in the context of personality dimensions potentially driving theory-deviating decisions. Rapoport, Seale, Erev, and Sundali (1998) even provided evidence for this argumentation in their experiment, where participants did not actually play the strategies that they previously indicated they would play via the *strategy-method*.

Third, due to the fact that prior research indicates situational factors to impact the affectability of personality dimensions (Lönnqvist et al., 2011; Pothos, Perry, Corr, Matthew, & Busemeyer, 2011), the experimental design of this study differentiates between two types of pre-entry investment opportunities in line with the framework by Fudenberg and Tirole (1984). That is, analysing market entry behaviour in the face of tough-making and soft-making investment opportunities – with respect to post-entry competitiveness. I believe that certain personality dimensions trigger specific behaviours based on the availability of different Incumbent actions.

Fourth, instead of multi-period market entries or multi-player entries into 'empty' markets, this experiment focuses on duopoly markets (in case of entry), with a preceding monopoly including the active Incumbent. The underlying rationale is that Entrant firms are hypothesised to focus on existing players, not potential future competitors. This should provide a more realistic simulation of market entry situations.

Applying the described methodology, including the outlined alterations to address the research objective specifically, promises insightful answers to the research questions. Before reviewing existing literature, the following section provides a brief overview of the structure of this thesis.

I. 3 Structure of this Research Thesis

Having outlined the motivation and objective of this research project, this section outlines the overall structure of this thesis. First, CHAPTER II reviews the current literature landscape, synthesising the main findings of applicable research and identifying potential research gaps, which are yet to be examined. Along the fields that initiated this research project, the literature review covers findings concerning Incumbent behaviour (SECTION II.1), findings concerning Entrant behaviour (SECTION II.2), as well as personality research in economic situations, especially with focus on market entry games (SECTION II.3). The chapter closes with an outline of the identified research gap and an interim conclusion (SECTION II.4).

CHAPTER III develops the propositions and their underlying hypotheses for this research study. After deriving applicable propositions from existing findings on conflict management (SECTION III.1), the chapter formulates the propositions and hypotheses that this research aims to investigate (SECTION III.2).

CHAPTER IV, subsequently, develops the economic games, in which the participants compete in, simulating market entry situations to shed light on the developed propositions (SECTIONS IV.1 and IV.2). SECTION IV.3 describes the methodology that has been applied to select suitable personality inventories for the experimental study. SECTION IV.4 documents the implementation of the experimental study, before the chapter closes by outlining the statistical considerations in the experiment design (SECTION IV.5).

The empirical analyses and their respective results are discussed in CHAPTER V. After defining the applicable variables (SECTION V.1), the following section outlines the descriptive and univariate analyses of the collected data (SECTION V.2). Following, SECTION V.3 discusses potential problem areas associated with the underlying data set, before presenting the results of the multivariate analyses for the Incumbent and Entrant behaviour.

Closing, CHAPTER VI synthesises the empirical results against the background of the identified research gaps and developed propositions and discusses potential implications for research and real world applications (SECTION VI.1). After reviewing the study objectives (SECTION VI.2), the chapter discusses potential limitations of this research project as well as an outlook for future research efforts (SECTION VI.3).

APPENDIX A1 contains a brief glossary for the thesis-relevant personality dimensions.

II Literature Review on Market Entry Behaviour & Personality

The objective of this chapter is to provide an overview of literature findings published to date on market entry behaviour and the respective role of individual differences. Before presenting the respective discussions, findings, and potential research gaps, it is necessary to identify the respective lines of research. After defining these lines of research, they will be thoroughly surveyed and eventually combined to identify potential research gaps.

The first line is market entry behaviour. While market entry behaviour is the applicable research field, existing literature typically distinguishes between the Incumbent side (and *entry deterrence*) and the Entrant side (and *market entry* itself). Accordingly, this review of literature distinguishes between *entry deterrence* and *market entry* within the market entry behaviour domain. The second line of research, driven by the introductory hypothesis of personality potentially influencing Incumbent or Entrant behaviour, is personality in game theoretic contexts. Figure 2.1 illustrates the three lines of research that this chapter focusses on.

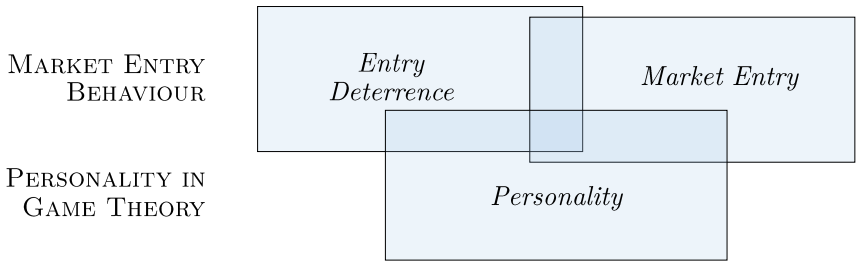

Figure 2.1: Illustration of lines of research

Correspondingly, Section II.1 introduces the *entry deterrence* side of market entry behaviour, while Section II.2 focusses on the *market entry* side (i.e., the Entrant). Section II.3, then, reviews literature on *personality in game theory*. Section 2.4 draws an interim conclusion based on the described findings and presents the identified research gap that this research focusses on.

II. 1 Incumbent Behaviour in Market Entry

The aim of this section is to review relevant market entry literature that is concerned with the behaviour of the firm that is already active within the market, i.e., the Incumbent. Literature focussing on the Incumbent behaviour does not imply that the Entrant is categorically

disregarded, but rather that she is assumed to behave completely rational. Literature incorporating both sides (see overlaps in FIGURE 2.2) is equally discussed below.

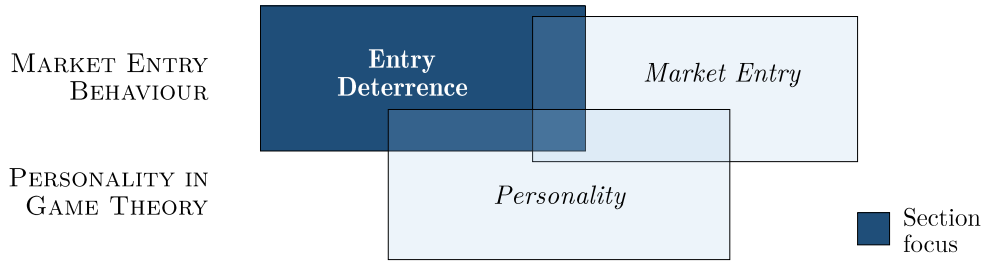

FIGURE 2.2: Focus of SECTION 2.1 within research framework

First, SUB-SECTION II.1.1 discusses different entry deterrence models and their respective findings in detail. SUB-SECTION II.1.2 extends Incumbent behaviour beyond simple entry '*deterrence*', outlining the influential taxonomy developed by Fudenberg and Tirole (1984). Subsequently, this section reviews findings from empirical and experimental research on market entry behaviour against underlying theory (see SUB-SECTION II.1.3).

II. 1.1 Fundamental Advances in Research on Strategic Entry Deterrence

Until the 1950s very limited attention has been devoted to the investigation of the role of entry on oligopoly and monopoly markets (Modigliani, 1958). The first influential work was published by Bain (1956) who argued that the quality of performance within an industry is not only defined by the existing competition, but also by potential new competition (i.e., potential *Entrants*). The book did, however, raise that the effect might not be immediate, as *Entrants* need to overcome (entry) barriers before being able to affect the competitive landscape (Bain, 1956). While this certainly is correct in many instances, one could argue that potential market *Entrants* with patented disruptive solutions may embody an immediate threat.

Two decades later literature on market structures and strategic aspects of entry deterrence and competition for market shares thrived with numerous publications. Wilson (1992) reviewed the resulting models and defined three categories:

- *Signalling* – models explaining how an *Incumbent* can convey private information that may discourage entry by reducing expected profits for the *Entrant*. Examples are limit pricing prior to entry or attrition post-entry.
- *Pre-emption* – models concerned with how a firm claims and preserves a monopoly position. The Incumbent bears a dominant position by being already in the market and making early investments (i.e., costly actions) that irreversibly strengthen her position.

- *Predation* – models investigating how an *Incumbent* can deter future entry by battling a current *Entrant*. The respective hallmark is reputation that the *Incumbent* is building.

The focus of this research lies on the immediate threat of market entry (as opposed to long-term threat). Hence, *predation* is excluded and not discussed within this chapter[11]. Similarly, *signalling* focusses only on pre-entry *Incumbent* behaviour.

One of the first discussions of *limit pricing* as a **signalling** mean (in the context of entry) appear in Bain (1949), before firstly formalised by Milgrom and Roberts (1982). *Limit pricing* is understood as signalling private information about costs or demands to deter misguided entry (Wilson, 1992). Specifically, *limit pricing* is pricing below the profit-maximising price (Milgrom & Roberts, 1982) or pricing at a price p^* (or lower) so that no firm enters the market (Friedman, 1979). For illustration, in a monopoly a potential *Entrant* observes pricing of the *Incumbent* before making her entry decision, while not knowing the *Incumbent's* actual marginal cost. Suppose first, that the *Incumbent* anticipates the *Entrant* to have naïve inferences, i.e., the *Entrant* believes that the observed price is profit-maximising given the *Incumbent's* costs. Then, the Incumbent would prefer to lower her price to make the Entrant believe her costs are lower, and, hence, entry is less attractive. In the second supposition, that the *Incumbent* anticipates the *Entrant* to have more sophisticated inferences, the Incumbent cannot charge the actual profit-maximising price without inducing false profit hopes for post-entry (Wilson, 1992). Thus, the Incumbent should also lower pricing before entry.

Friedman (1979) is one of the first to treat pricing game-theoretically in the face of potential entry. Under his assumptions that both the Incumbent and Entrant are completely informed as to demand and cost conditions, Friedman logically concludes pre-entry pricing being independent of post-entry profits, i.e., no *limit pricing* would exist as it would only decrease pre-entry profits. While this holds true in any complete-information, game-theoretic model, Milgrom and Roberts (1982) formalise a model where marginal costs are private and *limit pricing* does occur in equilibrium. However, they do point out that probability of entry might be lower, equal, or even higher than with complete information. Simply because their model includes rational assumptions of the *Entrant* regarding the pricing behaviour of the *Incumbent*, i.e., expecting *limit pricing* by the Incumbent.

[11] For a detailed review and discussion of *predation* please refer to Wilson (1992).

Ramey (1987) points out that, if the gains from entry deterrence were sufficiently large, it is required to assume that the Entrant assumes equal pricing behaviour for differing cost levels by the Incumbent (*pooling* equilibrium). In particular, if costs are independent, as no amount of price reduction could credibly deter entry in face of sufficiently large gains from non-entry. Thus, implying no equilibria when the Entrant assumes different pricing behaviour for different cost levels (*separating* equilibrium). Furthermore, equilibria with *limit pricing* are found in extended models, including the price observation being affected by noise (Matthews & Mirman, 1983), noise effects in a multiperiod model (Saloner, 1982), price in combination with another expenditure as advertising (Bagwell & Ramey, 1988), or with focus on the initial phase after entry (Roberts, 1985). While these studies, as well as several others (e.g., Mailath, 1987), accredit lower Incumbent prices when facing threat of entry, Harrington (1987) describes a reversed effect, of higher pre-entry prices. Specifically, if the Entrant does not know her costs, but knows that her costs are correlated to the Incumbent's, entry is deterred by *limit pricing* with higher prices, i.e., signalling lower post-entry profits.

As opposed to signalling, **pre-emption** strategies represent costly, irreversible investments (i.e., commitments). These commitments strengthen the Incumbent's position after entry (and burden the Entrant's). Existing literature thoroughly investigates several models of strategic entry deterrence through several distinctive Incumbent activities. These include (i) offering large product lines, (ii) increasing market capture in the face of switching costs, (iii) raising entrants' sunk costs, (iv) vertical integration (when buyer is monopolist), (v) investment into cost-reducing machinery, (vi) learning-by-doing, or (vii) installing excessive capacity in Cournot competition[12]. FIGURE 2.3 provides an overview of the respective literature publications.

[12] The Cournot model was developed by A. A. Cournot and represents a market where firms compete on the output they produce, where overall market output defines the market price (Cournot, 1838). Accordingly, the respective reaction functions, i.e., a function for a firm's own output dependent on the output of the competitor's output, are downward sloping.

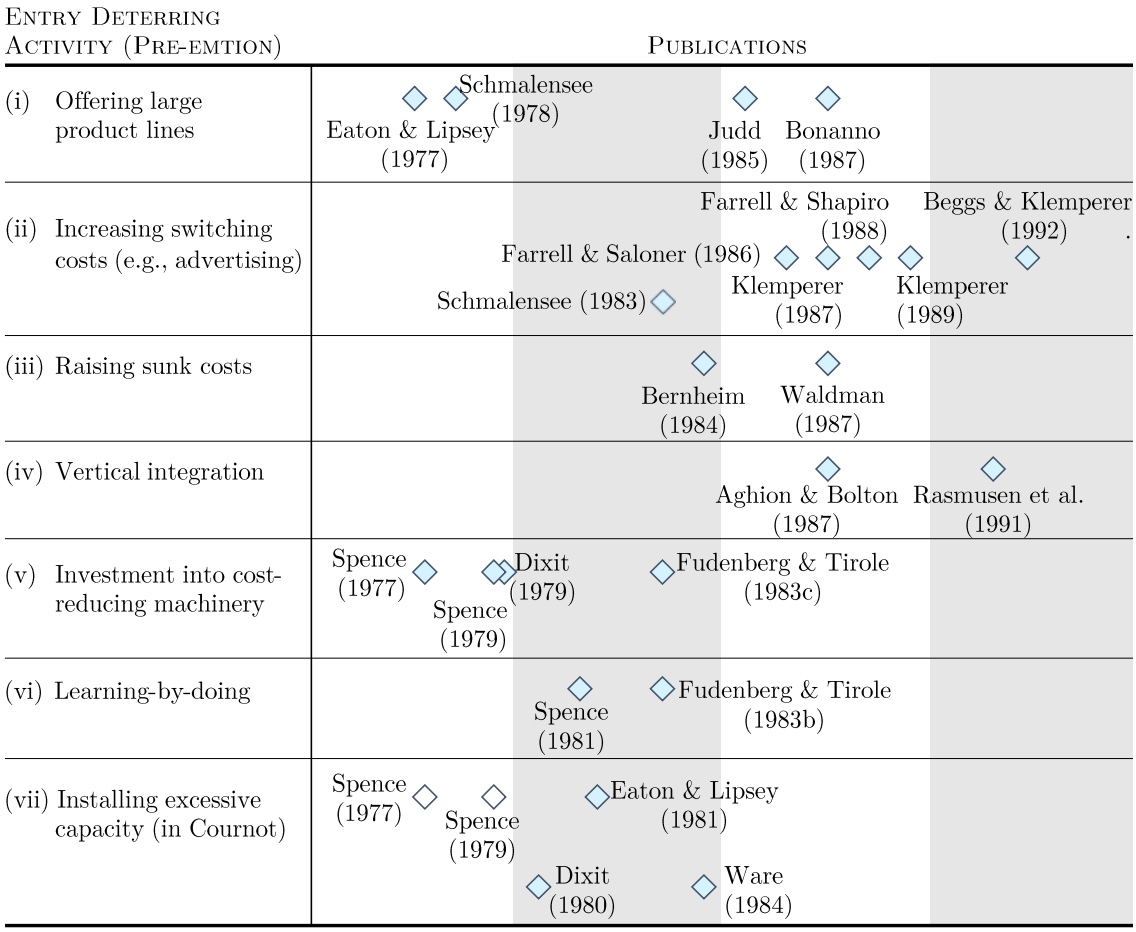

Figure 2.3: Literature on pre-emtion strategies in strategic entry deterrence

One potential entry deterring activity of the established firm is (i) to offer a large product line so that no profitable niche is left for a potential entering firm (e.g., Schmalensee, 1978). Judd (1985) points out that in case of cheaply product removal, entry might be worthwhile. The established firm would prefer to withdraw close substitutes to avoid lowered prices for its other products. Another example (ii) involves switching costs, which might deter entry if sufficiently large (e.g., Klemperer, 1987). Illustrative examples include high cancellation fees by network providers. Beggs and Klemperer (1992) include the assumption of a continual arrival of new customers in their model. They raise doubt on switching costs being barriers to entry, as the *Incumbent* would be inclined to charge high prices for her captive market, while new firms can capture new customers at lower, yet profitable prices (Wilson, 1992). It is worthwhile to mention that typically a continual inflow of new customers also is associated with a continual outflow of customers. Hence, the captive market would be shrinking over time, which would force the established firm to either compete against the new firm with lower prices or invest in expanding her captive market.

Bernheim (1984) describes how established firms can deter entry by (iii) expending resources, which would raise the Entrant's sunk cost of entry (Wilson, 1992). A popular example for increasing entry barriers is investment in advertising, firstly discussed by Schmalensee (1983), as it raises brand loyalty or exploits economies of scale. Waldman (1987) points out that in an oligopoly where the magnitude of the sunk costs is uncertain, the established firms have an incentive to ‚free ride' on other's expenditures. Hence, entry deterrence can potentially be muted – for certain types of entry deterring investments that is (Waldman, 1987). The case of (iv) vertical integration argues that established sellers and buyers might both capitalise their monopoly powers by vertically integrating or agreement on an exclusive-dealing contract between them (e.g., Aghion & Bolton, 1987).

Both, (v) investment into cost-reducing machinery (e.g., Dixit, 1979) and (vi) the concept of learning-by-doing (e.g., Spence, 1981) are examples of lower production costs that deter entry. The established firm can charge lower prices (while realising profits) and/or entry-related costs rise. When firms compete on output (Cournot competition), (vii) investment in capacity can be used to deter entry by exploiting its first-mover advantage (e.g., Dixit, 1980), low expected post-entry profits will not cover entry-related sunk costs (Wilson, 1992). In this sequential setup, Brandts et al. (2007) emphasise that it is the *commitment* factor that is of essential importance.

Dixit's (1980) two-stage model has earned considerable attention by suggesting that established firms should invest in capacity beyond the profit-maximising levels to deter potential entry. However, it has earned some criticism for not accounting for the fact that both the established as well as the entering firm infer sunk costs[13] (Ware, 1984). Accordingly, Ware (1984) developed a three-stage model, which lessens the strategic advantage in the final, post-entry period. The Incumbent can maintain a strategic advantage, as he sinks his capacity first. Bagwell and Ramey (1996) later add avoidable fixed costs to the model, which are not inferred if the firm shuts down before production. This addition substantially restricts the Incumbent's advantage due to the Entrant's superior ability to communicate his strategic intent. The hallmarks of this model are presence of avoidable fixed costs and forward induction.

Within the discussed research efforts (modelling strategic entry deterrence activities), it was Dixit (1979) who first considered whether the established firm might find it best to prevent

[13] Sunk costs defined as being committed before the production period takes place (Ware, 1984).

or allow entry to occur. Ware (1984) confirmed these findings in his three-stage model, noting that it *"may or may not be profitable to deter entry"* and the Incumbent might have to decide on an accommodating strategy. Schmalensee (1983), Bulow, Geanakoplos, and Klemperer (1985) and Fudenberg and Tirole (1984) discuss more broadly circumstances (in strategic complimentary) under which the established firm might prefer to utilise its strategic power for selecting a less aggressive strategy. Bulow et al. (1985) and Fudenberg and Tirole (1984) have independently noted the importance of the Entrant's reaction. Thus, an Incumbent's defending (i.e., deterring) behaviour is not self-evident, but seems to depend on certain circumstances. The following sub-section sheds light on these by reviewing the animal taxonomy by Fudenberg and Tirole (1984) as well as other relevant literature findings.

II. 1.2 Beyond Entry *Deterrence*: The Fudenberg-Tirole Taxonomy

Following the conclusions of a few studies (e.g., Dixit, 1979; Schmalensee, 1982), Drew Fudenberg and Jean Tirole (1984) developed a taxonomy model describing theoretically optimal pre-entry behaviour by the Incumbent (subject to the type of strategic commitments). This sub-section introduces the framework and its dimensions, discusses its combinations and resulting terminology, before finally reviewing raised criticism of the framework.

The framework by Fudenberg and Tirole (1984), henceforth *FT-framework*, characterises ideal pre-entry behaviour by the established firm based on the *strategic effect* that the respective investment opportunity entails. I.e., the strategic effect refers to the impact that the investment has on the entry and post-entry behaviour of the Entrant. Contrarily, the *direct effect* is the immediate effect that the investment has on current profits of the Incumbent. The three dimensions result in eight different strategic situations (see FIGURE 2.4).

Firstly, the framework distinguishes between types of strategic variables that the firms compete on. Specifically, whether the reaction functions of the other firm is sloping upwards or downwards. Strategic variables that result in upward-sloping reaction functions are *strategic complements* (e.g., price). Downward-sloping reaction curves are caused by *strategic substitutes* (e.g., quantity). A Bertrand market (Bertrand, 1883) represents the most typical example of strategic complements. If the competitor firm raises its price, the best reaction is to also raise one's price, as represented by the upward sloping reaction function. Equivalently, a Cournot market (Cournot, 1838) is a typical illustration of strategic *substitutes*, as the best response to a quantity increase is to lower one's own output. While prices and quantities typically represent

strategic complements and substitutes, respectively, this is not necessarily always the case (Bulow et al., 1985). Hence, the more precise definition is the slope of the reaction curve of the strategic variable, which is also used to define the dimension of the framework.

The second dimension of the framework is concerned with the Incumbent's objective towards the potential market entry by the new firm. Specifically, whether the Incumbent firm wants to *allow* or *deter* entry (while preserving the firms' self-interest in the form of achieving best possible profits). Whereas deterring market entry might seem the only 'logical' option, there might be endogenous (e.g., fighting entry is too expensive) or exogenous (e.g., regulatory restrictions[14]) reasons to prefer to allow entry. The FT-framework characterises behaviours by the Incumbent yielding the highest profitability, whereas profitability is a result of the direct as well as the strategic effect. This is how, for any direct effect (i.e., the investment cost) the strategic effect has to outweigh these costs. For strategic substitutes (downward-sloping reaction curve) a higher profitability in the second period is only achieved by playing more aggressively (e.g., increasing output). Thus, the framework in FIGURE 2.4 shows the same investment behaviour for downward-sloping reaction curves and the different objectives.

The third dimension is the type of investment or commitment that the established firm can make. The type refers to the respective effect it has on the Incumbent in the post-entry period – whether it makes him *tough* or *soft* (Fudenberg & Tirole, 1984). For price competition, an investment that would make the established firm *tough* could be a cost-reduction initiative that the firm invests in. The lower costs would enable the firm to set lower prices in the post-entry period. A *soft*-making investment opportunity, on the other hand, could be a product differentiation measure. By differentiating its product, the established firm will have less incentive to compete on prices against the Entrant. For a Cournot market, expanding one's production capacity is an exemplary *tough* investment opportunity, as the Incumbent prepares to increase its output, which yields a more profitable outcome in the next period. An exemplary *soft* investment opportunity could be a partial shift of capacity from the existing market to a new market, while keeping overall capacity equal. For the relevant (old) market, this would have a 'softening' effect, as the established firm would effectively decrease its output in the competing duopoly market. Alternatively, Fudenberg and Tirole (1984) use pre-entry R&D-

[14] A relatively recent example in an oligopoly market is the telecommunications market in Germany in 2014. After the takeover of fourth largest player E-Plus by its rival Telefonica (third largest player). The European Commission imposed a condition of approval, insisting that Telefonica rents out up to 30 percent of its network capacity and divests some of its frequency spectrums to allow potential of new operators in the future (Bartunek & Wolde, 2014).

investment as an example. Their model consists of a R&D-investment opportunity, while both firms compete post-entry on R&D as well (outcome stochastically defined based on magnitude of investment). Investing before entry would weaken the Incumbent's competitiveness after entry (as less cash would be available). The optimal behaviour of refraining from investing or underinvesting[15] is characterised as the '*lean-and-hungry look*' strategy (Fudenberg & Tirole, 1984). Specifically, by not investing, the established firm signals a readiness to compete on the post-entry R&D-investing, i.e., exhibits a lean and hungry look. Besanko et al. (2010) characterise the respective contrary behaviours, where investment behaviour leads to harmful strategic effects. The equivalent antipole to the lean-and-hungry look is the *suicidal Siberian*, inviting rivals to exploit the firm and may indicate an exit strategy (Besanko et al., 2010).

The following figure depicts the FT-framework on the basis of Fudenberg and Tirole's (1984) influential paper, which represents a significant share of the theoretical foundation of this research (further details with regards to the utilisation of this framework within the experimental context of this study is described in Chapter IV). Each of the resulting eight combinations (of the three aforementioned dimensions) includes the colourful animal characterisations (and ideal Incumbent behaviours).

		Slope of Reaction Curve			
		Upward		Downward	
Incumbent's Objective:		*allow* entry	*deter* entry	*allow* entry	*deter* entry
Investment makes Incumbent	*soft*	**Fat Cat** (overinvest)	**Lean & Hungry** (underinvest)	**Lean & Hungry** (underinvest)	**Lean & Hungry** (underinvest)
	tough	**Puppy Dog** (underinvest)	**Top Dog** (overinvest)	**Top Dog** (overinvest)	**Top Dog** (overinvest)

Figure 2.4: The holistic animal taxonomy as defined by Fudenberg and Tirole (1984)

In market models with strategic substitutes (downward-sloping reaction curve) the strategic effects are harmful for *soft* investments and beneficial for *tough* investments, rivals become less

[15] The terminology applied by Fudenberg and Tirole (1984) refers to 'underinvest' or 'overinvest'. Other papers discussing strategic Incumbent behaviour equivalently use 'refrain from investment' or 'make investment', respectively (e.g., Besanko, Dranove, Schaefer, & Shanley, 2010). These terms are used interchangeably throughout this thesis.

aggressive in the second stage. Hence, if the investment opportunity makes the established firm *tough*, the strategy should be to overinvest – known as the '*top-dog'* strategy[16].

While in markets with strategic substitutes playing more aggressively (i.e., overinvesting in *tough*, underinvesting in *soft* investments) is always beneficial (Besanko et al., 2010), strategic complements bear both behaviours as potentially beneficial (or harmful) – depending on the respective objective of the Incumbent. The underlying reason is that markets with upwards-sloping reaction curves yield mutual benefits from colluding (similar to a prisoner's dilemma dynamic). This is not the case for strategic substitutes, which is more comparable to a *zero-sum game* (if one party wins, the other one loses). Thus, the '*fat-cat*' strategy signals the Entrant no intention to compete (by lowering prices), but rather a more cooperative behaviour with higher, mutually beneficial prices. A typical example is creation of a captive market (due to high switching costs or advertising).

Beggs and Klemperer (1992), for example, illustrate this dynamic in their model with switching costs and a continuous arrival of new customers[17]. Fudenberg and Tirole (1984) develop a model where the Incumbent can invest in advertising in the pre-entry period (effectively creating its captive market, as their crucial assumption implies that customers do not read ads once reached). While demand in this captive market behaves as if the Entrant would price its product at $p_{Ent} = \infty$, overinvesting in advertising signals a less aggressive behaviour after entry (i.e., a *fat-cat* strategy). An alternative is investment into product differentiation, which might yield higher margins for the established firm and open a niche for the entering firm. However, if the Incumbent's objective is to deter entry, she should underinvest in pre-entry advertising and, thereby, signal a more aggressive behaviour in case of entry (i.e., a *lean-and-hungry look*).

Typical examples for *tough* investments in a market with strategic complements (e.g., price) are investing in productive machinery (e.g., Spence, 1979) or learning-by-doin1g (Fudenberg & Tirole, 1983b; Spence, 1981). Another example mentioned by Fudenberg and Tirole is the model of limit pricing (e.g., Milgrom & Roberts, 1982) under incomplete information. Here, the investment is characterised by foregoing some or all of the monopoly

[16] The contrary behaviour of underinvesting in the face of a *tough* investment is the *submissive underdog* strategy, accepting to follow rather than lead and avoid conflict (Besanko et al., 2010).

[17] Their model further assumed a duopoly with differentiated products, old customers to attrite, and new customers to bear diverse product preferences,

profit by pricing below the profit-maximising monopoly price p^m. To deter market entry, the Incumbent prefers the Entrant to believe that her costs are relatively high. Thus, she should overinvest in foregoing monopoly profits by setting a lower price in the pre-entry period, $p^{actual} < p^m$. This play is characterised as the '*top-dog*' strategy. Contrarily, to encourage entry, the established firm prefers the Entrant to believe that her costs are relatively high. Thus, underinvest in foregoing monopoly profits and charge the monopoly price in the pre-entry period, $p^{actual} = p^m$. This strategy is the '*puppy-dog ploy*', as it turns the Incumbent into a *"small, friendly, nonaggressive puppy dog"* (Fudenberg & Tirole, 1984).

Before closing this sub-section, it is worthwhile to mention that the FT-framework considers Incumbent behaviour in a two-stage game. Strategic interactions that might arise from multiple post-entry stages might alter the respective over- or underinvestment results of the two-stage model (Fudenberg & Tirole, 1983c).

While literature comprehensively identified a range of potential entry deterrence strategies (reviewed in the previous sub-section) and the FT-framework further investigated the circumstances defining optimal pre-entry investment behaviour, the arising question is to what extent these theoretical findings are applied by Incumbent firms.

II. 1.3 Empirical Evidence of Incumbent Behaviour

The objective of this sub-section is to review empirical findings on Incumbent behaviour in the face of potential entry and verify the theoretical foundations discussed above. This review of empirical research is following the structure of the previous sub-sections. First, empirical publications on *signalling* (i.e., limit pricing) as a mean to deter entry are discussed, before reviewing findings on the respective *pre-emtion* strategies (i)-(vii) from above. As shall be seen, empirical research on Incumbent behaviour is inconclusive (see also Brandts et al., 2007; Thomas, 1999). Thus, experimental research efforts trying to account for the inconsistency between theoretic models and empirical observations are discussed as well.

In order to verify **signalling** (i.e., limit pricing) as a measure to inhibit entry, Masson and Shaanan (1982) tested their empirical model on data from oligopolies in 37 manufacturing industries. While their study results did not yield any evidence to support the utilisation of

static limit pricing[18], they did find weaker support for dynamic limit pricing[18]. In a second study, Masson and Shaanan (1986) expand their empirical model and test it on a reduced sample of 26 industries[19]. They identified a link between price-cost margins and entry barriers, concluding support of their hypothesis that firms use limit pricing to deter entry (Masson & Shaanan, 1986). However, the alternative interpretation is that higher equilibrium profits obtain in industries with higher entry barriers (Mason & Nowell, 1998). A study investigating limit pricing in the face of asymmetric information, a model development and subsequent case analysis of the US cable industry found evidence for use of limit pricing (Seamans, 2013).

In a survey study conducted by Smiley (1988), a questionnaire has been sent out to product managers[20] in the US investigating what strategic entry deterrence strategies are used. Surprisingly, results indicated that limit pricing was the least frequently applied of the available strategies[21]. Furthermore, results suggest that a significant number of product managers in fact never apply limit pricing[22] at all. While the survey did distinguish between static and dynamic limit pricing, results were relatively similar for both types and the questionnaire yielded similar results for asking for the *overall* use of limit pricing (Smiley, 1988).

Singh, Utton, and Waterson (1998) conducted a similar questionnaire in a broader context for the food, electrical engineering, and chemicals industries in the UK. Marketing, product, and brand managers were asked to indicate priorities on a selection of strategic variables[23] (similar to Smiley [1988]), however not necessarily in the context of *entry deterrence*. Contrarily to the findings of Smiley (1988), Singh et al. (1998) found strong evidence that firms place great emphasis on their pricing policy – both when competing with existing as well as new products (68% and 63% of respondents placing high priority on pricing, respectively). While minor differences were detected between industries, findings concerning strategic use of pricing were consistent. The discrepancy between both studies on pricing can be explained by the

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[18] Static in the context of pricing refers to a non-changing, long-term price-level setting. Contrarily, dynamic pricing refers to continuously adjusting price levels as a response to change in endogenous or exogenous conditions.

[19] Excess capacity data was only available for 26 of the 37 industries, which was the second study focus (next to limit pricing).

[20] Survey recipients were members of the Product Development and Management Association (PDMA) and the American Marketing Association (AMA), business titles including Product Manager, Brand Manager, Director of Product Management, or Vice President Marketing (Smiley, 1988).

[21] Alternative deterrence strategies included excess capacity, advertising, R&D-patenting, reputation, learning, profit hiding, and niche filling.

[22] For new products 44% (35%) of respondents reported to 'never' use static (dynamic) limit pricing, while 34% (33%) reported to 'never-occasionally' use it. For existing products 25% (27%) of participants reported to 'never' use it, while 32% (32%) reported to 'never-occasionally' apply it.

[23] Alternative 'strategic variables' were comprehensive patenting, R&D, advertising, capacity creation, pricing policy, assured raw materials, selling network, and agreement with competitors.

different contextual settings (entry deterrence versus competing in general), which is also indicated by Singh et al. (1998), who reported that over 70 percent of respondents mentioned *'meeting the competition'* as the main factor in their pricing policy. Furthermore, only one percent of respondents said that their pricing policy was *mainly* directed at slowing the rate of entry. Thus, it seems that pricing is rarely used strategically in a very sophisticated fashion in order to deter or control new market entry[24] (Singh et al., 1998).

These empirical findings are inconclusive with respect to the utilisation of limit pricing strategies by Incumbents to deter potential entry. While Masson and Shaanan (1982, 1986) found *some* evidence supporting the use of limit pricing, the survey studies by Singh et al. (1998) and Smiley (1988) suggest no use of limit pricing to deter entry. While the different research methodologies (empirical versus survey) might account for the heterogeneous observations, the overall notion of these findings does not verify the theoretical models discussed in the previous sub-section. An important differing property these studies include – potentially explaining the inconsistency between theoretical and empirical finding – is the market structure. The studies investigate oligopoly settings, where the Incumbent has to worry about current competitors and related strategic effects (as opposed to monopoly settings). In addition to direct competition effects in oligopolies, signalling towards an Entrant is also fundamentally different in a multi-sender and single-sender game (Bagwell & Ramey, 1991). Thus, as a next step, I will review experimental market entry studies with limit pricing. Findings might shed further light on the utilisation of limit pricing strategies by Incumbents.

While Müller, Spiegel, and Yehezkel (2009) examine the behaviour of two Incumbent firms in a market entry setting with limit pricing (i.e., analyse an oligopoly setting)[25], Cooper, Garvin, and Kagel (1997) conducted an experiment with a single Incumbent and a single Entrant. In the first experimental study of entry limit pricing, results indicate that strategic limit pricing behaviour, as reported by the Milgrom-Roberts model (1982), does occur in the laboratory (Cooper et al., 1997). However, their experimental design bears a few caveats I would like to raise. While selection of output level indirectly implies respective price levels, the direct link between cost level and selected prices might be blurred. This is further emphasised by the fact

[24] Some firms reported, although being aware of setting 'correct' prices from a long-term perspective, that they were too occupied with day-to-day competition than aiming pricing at potential new competition. Also, low prices would be interpreted as a sign of competition and low costs, not necessarily the desired message they wanted to emit to current competitors (Singh et al., 1998).

[25] In a large number of cases, results do not support limit pricing in the asymmetric information setting, as Incumbents raise prices when costs are low.

that the profits of the two-period game were collapsed into one profit table and participants select a strategy based on the respective expected profits (given the Entrant's decision). This design resembled the *strategy method,* which, on the one hand, can reveal more information about motivations (Kübler & Müller, 2002). On the other hand, the disadvantage is that "*it removes the possible effects of the timing of decisions in the course of the game*" (Roth, 1995). Rapoport et al. (1998) observed in their experiments, for example, that decisions indicated by the strategy method were *not actually played*.

To the best of our knowledge, no further experimental limit pricing studies in the context of market entry were conducted. While the empirical studies found mixed results with regards to the use of limit pricing to deter entry, the only experimental research – while identifying limit pricing behaviour – did not yield any potential evidence or rationales for the discrepancy between theoretical and empirical research results.

Several **pre-emtion** strategies (to deter market entry) have been investigated in empirical studies. The structure of the following review incorporates the respective investigated pre-emtion strategies ((i) introduction of new product lines, (iii) advertising and (vii) installation of excess capacity) as well as an overarching empirical survey analysis of several deterrence strategies. Subsequently, results for the use of entry-encouraging strategies are discussed.

When investigating the (i) introduction of new product lines as an entry deterrence strategy, Johnson and Parkman (1983) did not find any empirical evidence for such behaviour in the US cement industry. Potentially, the rationale that easy withdrawal of new products reduces credibility (Judd, 1985), accounts for the missing evidence.

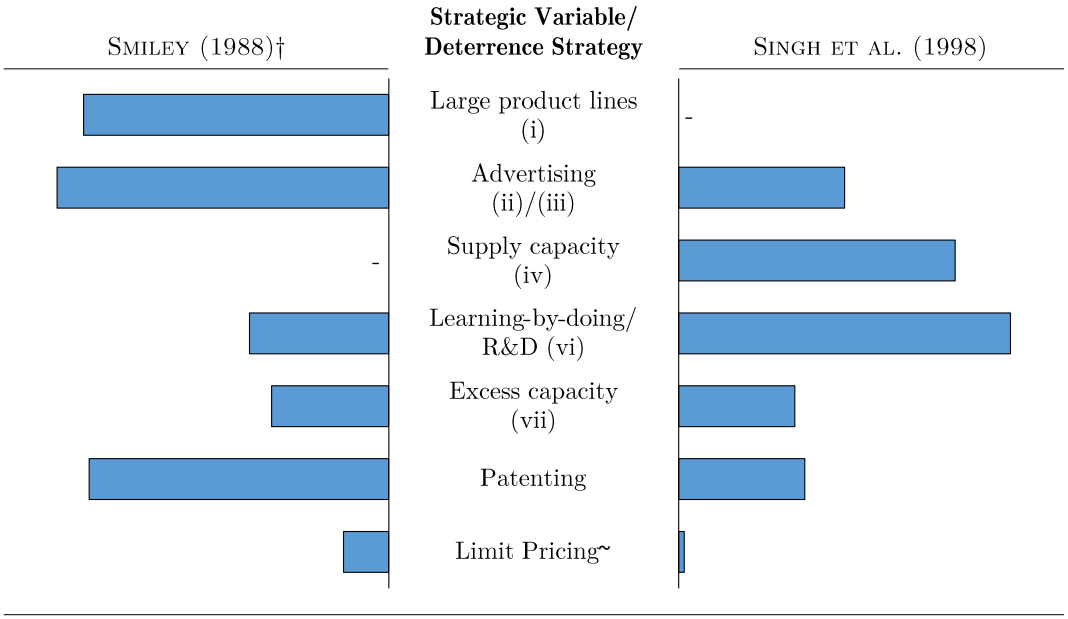
Empirical work done by Kessides (1986) on some 260 US manufacturing industries found that while investing in (iii) advertising impedes entry due to increased sunk costs, results also indicate that Entrants perceive a greater likelihood of success in industries where advertising is important. Roberts and Samuelson (1988) empirically investigate the US cigarette industry, concluding that advertising primarily affects the level of demand, i.e. actually increasing market size. While not explicitly focussing on market entry, Sutton (1991) finds empirical support for both effects, the increased operating costs as an entry deterring consequence and an increased market size due to newly acquired customers via advertising (Thomas, 1999). Cubbin and Domberger (1988) find that more than one third of their 42 consumer goods firms responded with advertising to new entrants. However, they also noted that in 61 percent of the cases they

were not able to detect any response (to entry). Thomas (1999) found advertising and aggressive price responses to be the only entry limiting strategies applied by Incumbents in the US ready-to-eat cereal industry. Results also indicated that Incumbents are more likely to respond to potential entry when the scale of entry is greater. A review of 70 empirical studies of entry and exit patterns found *"confusing evidence"* for advertising (Siegfried & Evans, 1994).

Investing in (vii) excess capacity is a prominent entry deterrence strategy in industrial research (e.g., Dixit, 1980). However, in an empirical study of some 40 chemical product industries Lieberman (1987b, 1987a) did not find any evidence that established firms use excess capacity to deter entry. In some cases, Lieberman (1987a) did find post-entry investments in capacity, which would rather support a predation strategy of driving out Entrants to build a reputation. Similarly, Masson and Shaanan (1986) did not find any support for such entry deterring behaviour (for their sample of 26 industries).

Smiley (1988) and Singh et al. (1998) both investigate in empirical survey studies to what extent entry deterring strategies are applied by product managers and compare the relative frequency of available deterrence strategies. While the two studies are not identical in their setup[26], the following figure depicts a comparison of their respective research results (since Smiley (1988) reported frequencies while Singh et al. (1998) used priority assignment, the comparison does not include absolute values and discussion should focus on relative results).

[26] While Smiley (1988) focused on entry deterrence strategies explicitly, Singh et al. (1998) investigated strategic variables for competition in a broader sense (in oligopolies). Furthermore, Smiley inquired in his survey about frequencies of utilization, while Singh et al. used a dichotomous 'high priority' vs. 'not high priority' as their option space. As visible from FIGURE 2.5, the available Incumbent actions or strategies are not entirely coinciding.



† Reported frequency corresponds to sum of 'frequently' and 'occasionally-frequently'
~ Singh et al. (1998) reported relatively high priorities on pricing (policy). However, pricing directed mainly towards new entrants was significantly lower (i.e., 1%)

FIGURE 2.5: Comparison of research results by Smiley (1988) and Singh et al. (1998)

While the empirical findings reported before do not suggest the use of (i) expansion of new product lines to deter entry, Smiley's (1988) results indicate a high frequency of use. Similarly, (iii) advertising is reported as the most frequently used strategy to deter entry. A questionnaire study by Bunch and Smiley (1992) confirmed these results, finding that filling all product niches and advertising are used 'most frequently to deter entry'. While the results reported Singh et al. are still the third 'high priority' strategy, the relatively lower score can be explained by the broader focus on oligopoly competition. Investing in advertising increases operating costs for the whole market, as competitors are likely to respond. Interestingly, the aforementioned empirical findings on non-utilised (vii) capacity expansion are confirmed by both survey studies. Except for limit pricing, investment in excess capacity is the least frequently applied deterrence strategy/competition variable.

Furthermore, several survey studies found that Entrants rarely perceived any active response from Incumbents (Biggadike, 1979; Robinson, 1988; Yip, 1982). Also, Robinson (1988) and Biggadike (1979) noted that Incumbents seem to rather react passively to market entry. A review of over 70 empirical studies covering 11 countries provided little support for excess capacity and scale economies to be effective deterrence strategies (Siegfried & Evans, 1994).

The discrepancy between theoretical models supporting these pre-emtion strategies to deter market entry and the empirical results within that field is one of the mysteries within

this field of research. Bagwell and Ramey (1996) provided a theoretical of this fact (in the case of excess capacity). In their model of sequential market entry with partially recoverable capacity and entry costs, *forward induction* can be used to account for the non-utilisation of pre-entry investment, as the Incumbent advantage is lessened (Bagwell & Ramey, 1996). Brandts et al. (2007) conducted an experimental study investigating forward induction in a Dixit- and a Bagwell-Ramey-style (henceforth BR-game) entry game. They do find evidence for forward induction in the simpler Dixit game where Incumbents use their strategic advantage to produce excess capacity. However, they do not find such evidence for the more complex BR-game, where capacity investments decrease by half (from 72 to 36 percent) but Entrants not take any advantage of the decreased first-mover advantage. A potential explanation could be that participants naturally attach an advantage to the first mover[27] (Brandts et al., 2007).

Mason and Nowell (1998) also conducted an experiment with an entry deterrence game, where payoffs and entry costs were common knowledge. While the focus of their study was to experimentally identify subgame perfect play, the entry deterrence setup provided evidence that Incumbent firms chose an entry deterring output in period 1 (which was part of the subgame perfect equilibrium causing the Entrant to not enter the market). However, while many participants played accordingly, a significant number of Entrants entered the market despite negative yielding payoffs. Furthermore, a noticeable number of Incumbents chose not to deter entry. While there is an overall tendency to convert towards equilibrium play (further supporting entry deterrence via excess capacity installation (Mason & Nowell, 1998)), a remaining share of non-deterrence play does not disappear. As a potential reason Mason and Nowell mention an altruistic attitude of negative reaction to asymmetric subgame payoffs.

In another experimental study by Mason and Phillips (2000), participants play a two-stage entry deterrence game with strategic pre-emtion. While one version bears a subgame perfect play with complete pre-emtion, the second one bears only partial pre-emtion. Results confirm strategic pre-emtion in the complete pre-emtion treatment. In the treatment where partial pre-emtion is privately optimal, a significant number of Incumbents chose not to pre-empt at all. Results indicate occasional irrational play after pre-emtive play (Mason & Phillips, 2000). In any case, this evidence does not support the theory that Incumbents strategically pre-emt competitors *"in a coldly manner"*. Similar findings are seen in classical, non-strategic Dictator

[27] This is supported by some observations where Incumbents that did not pre-capture the market, dominated it nonetheless.

Games, where behaviour is generous with an average giving rate of approximately 30 percent (e.g., Drozak, 2012; meta study by Engel, 2011). Accordingly, there remains some doubt towards the pervasiveness of strategic pre-emtion behaviour (Mason & Phillips, 2000).

In addition to the doubts raised by Mason and Phillips and the evidence from Brandts et al. (where investing behaviour drops by half in the more realistic BR-game), the complete information property of those games may make it difficult to extend observations to naturally occurring industrial behaviour (Mason & Nowell, 1998). While there is some evidence that Incumbents make use of pre-emtion investments, it seems that there is an additional factor affecting their decision-making.

A few studies pointed out that a potential explanation for heterogeneous Incumbent behaviour might lie within the Entrant characteristics, i.e. Incumbent firms react differently to different types of Entrants. Both Biggadike (1979) and Yip (1982) pointed out that Incumbents react more aggressively to medium than large entrants. The potential rationale for this observation is that large Entrants have a higher resistance to harmful strategies and entry deterrence would, thus, be not effective but unnecessarily costly. Karakaya and Yannopoulos (2011) surveyed marketing executives in simulated cases to understand what Entrant characteristics drive competitive actions by Incumbent firms. Out of the four examined characteristics, the Entrant's price is the most important factor for competitive reactions. Second was company size, followed by the entering firm's reputation and its innovativeness.

Before concluding the empirical findings on Incumbent behaviour, I review empirical literature on **entry-accommodating behaviour**, as elaborated by Fudenberg and Tirole (1984). While research on entry deterring is much more thorough, there is empirical evidence that established firms apply entry-accommodating behaviours. Coccorese (2012) developed an empirical two-stage model of price competition in the banking industry and investment in the form of branches. Using data from the Italian banking industry, results find that banks from the sample behave as 'fat-cats' by overinvesting in the branch network (as a mean of differentiation) to keep prices high and accommodate entry. However, Claussen, Trüg, and Zucchini (2011) investigated the 'fat-cat' effect in the German telecommunications industry and found mixed results, not necessarily supporting an entry accommodating behaviour.

To the best of my knowledge there seem to be no laboratory studies examining entry-accommodating behaviour by Incumbents. Thus, experimental findings would be an insightful addition to the limited and mixed empirical standpoint of entry-accommodating behaviour.

Summarising the literature findings on Incumbent behaviour, literature recognised early that Incumbent behaviour can deter potential entry (e.g., Bain, 1956). Literature tangibly flourished in the 1970s when extensive research efforts investigated different entry deterrence strategies as *signalling strategies* in the form of limit pricing (e.g., Milgrom & Roberts, 1982) or investing in excess capacity as a form of *strategic pre-emtion* (e.g., Dixit, 1980). Several publications independently observed that it can be more profitable for an Incumbent firm to accommodate entry as opposed to deterring it (e.g., Ware, 1984). Fudenberg and Tirole's (1984) influential framework defined optimal Incumbent responses more broadly, serving as a fundament for future analyses. Empirical studies on entry deterrence found very mixed results and do not support the theoretical findings for Incumbent behaviour (e.g., Thomas, 1999). Results from experimental studies investigating equilibrium play in entry deterrence games could not shed light on this discrepancy (e.g., Brandts et al., 2007). Thus, there seems to be another force driving Incumbent behaviour in the face of potential entry.

II. 2 Entrant Behaviour in Market Entry

Before discussing the field of personality research in game theoretic settings, which might serve as a potential explanation for the discrepancy between empirical and theoretical findings, this section reviews literature on the behaviour of entering firms. As the findings by Mason and Nowell (1998) already indicated, market entry does not seem to always follow entirely rational behaviour (i.e., Entrants entered the market despite negative payoffs). Thus, the aim of this section is to review theoretical and empirical findings of Entrant behaviour and potentially identify research areas that need further attention.

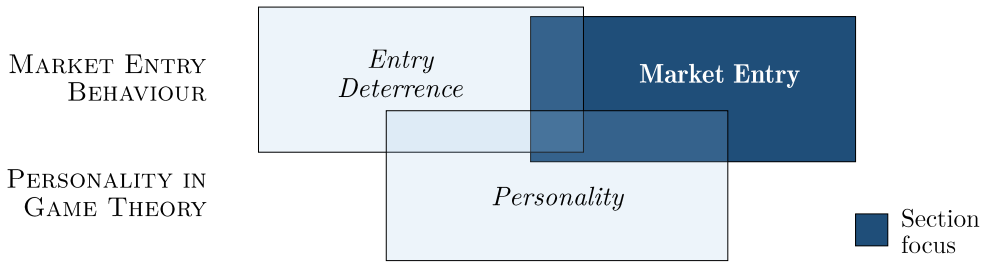


Figure 2.6: Focus of Section 2.2 within research framework

Theoretical literature on Incumbent behaviour (reviewed in the previous section), already included Entrant behaviour to some extent. That is, most studies and models discussed Incumbent actions assuming Entrants to behave as rational players that would make their entry decision based on expected payoffs (and mutual assumptions about the other's strategies). Specifically, the Entrant's role has been characterised in a passive manner.

A more active role was elaborated in the theoretical three-stage model by Ware (1984) and Bagwell and Ramey (1996) as well as the experimental investigation by Brandts et al. (2007). They described the increased power the Entrant gains due to sequential investments and forward induction. By making the entry investment, the entering firm not only signals the intention to entry, but actually commits an irrecoverable investment. By being able to do that, the entering firm diminishes the Incumbent's 'power' to deter entry by investing in the pre-entry period.

An earlier, broader research line has focussed for a number of years on the relationship between the density of organizational populations, i.e., the number of firms operating in an industry (e.g., Hannan & Carroll, 1992; Hannan & Freeman, 1977; Haveman, 1993). The model explains that density increases with organisational legitimacy and decreases with organizational competition. At high levels of density, the effects of competition are stronger than those by legitimation. Accordingly, in this model, organizational founding (or market entry) has *"an inverted U-shaped relationship"* with density. When density is low, organizational founding is low. As it increases, founding increases proportionally until the effect of competition (which is inversely proportional to density) outweighs legitimacy and found decreases (Haveman, 1993).

While research theoretically understood higher, market level factors driving entry and exit rates, e.g., level of competition (Haveman, 1993) or entry barriers and overall profitability of an industry (Porter, 1979; Siegfried & Evans, 1994), empirical studies had still to confirm these theoretical models (Hannan & Freeman, 1977). Accordingly, the following sub-sections are concerned with the respective empirical findings of market entry (SUB-SECTION II.2.1), followed by economic and experimental analyses that potentially explain the observed discrepancy between theoretical findings and empirical observations (SUB-SECTION II.2.2).

II. 2.1 Empirical Evidence of Entrant Behaviour

Finding early empirical evidence on market entry is relatively difficult (Hannan & Freeman, 1977). While a few studies indicated that failure rates of small business are high at figures

within double-digit figures (Bolton, 1971; Hollander, 1967), the first large-scale investigation of market entry was pursued two decades later. Dunne et al. (1988) investigated firm entry and exit patterns in the four-digit US manufacturing industries over the period of 1963-1982. They found that over 60 percent of all entrants exited within 5 years, while about 80 percent exited within 10 years, whereas most of these were failures. Further, results show a high heterogeneity in entry and exit patterns across the examined industries, where entry and exit are highly correlated. While this suggests that industries differ in their respective firm turnover, potential factors driving high turnover were not identified (Dunne et al., 1988).

Geroski (1995) reported that of his 87 classifications of manufacturing industries in the UK, each faces between 20 and 100 entries *each year* (over the period of 1974-1979). The respective *rates of entry*[28] per industry ranged between 2.5 and 14.5 percent. In a second, US-based example, Geroski (1995) reported entry rates to average between 41 and 51 percent. While results also indicate low *penetration rates*[29] (1-6% in the UK sample), this is explained by their respective smaller size, when compared to the Incumbent firms.

In an survey and interview based data collection by the US Small Business Administration, Dennis' (1997) analysis indicated that, in any year, between 10 and 12 percent of all firms are new entrants (supporting earlier research on failure of small businesses). They also conclude that the actual number of business entries in the United States is vastly higher than commonly believed (prior estimates of less than 1 million versus an estimated 4.5 million). While this study does not specifically analyse the respective success rates, the high Entrant rates and no documented growth of number of business suggest a similarly high exit rate (Dennis, 1997).

This conclusion is supported by several studies investigating the discontinuances of new ventures after entry. While reported figures fluctuate (due to sample selection and measurement), it appears that between one-third and half of business discontinue or change after two years, and 50 to 70 percent meeting these condition after five years (Bernardo & Welch, 2001; Cooper, Woo, & Dunkelberg, 1988; Dunne et al., 1988; Knaup, 2005; Shapero & Giglierano, 1982). This means that (at best) less than 50 percent of businesses prevail more than five years with a given owner or manager (Cooper et al., 1988).

[28] The number of new firms divided by the total number of Incumbent and Entrant firms producing that year (Geroski, 1995).

[29] Gross sales by Entrants divided by the total industry sales Geroski (1995).

It should be noted that discontinuation and failure are not necessarily congruent. In an investigation of this difference, Headd (2003) reported approximately 50 percent of firms exiting within their first 4 years, while two-thirds of these were unsuccessful at closure. This would imply an estimated failure rate of 33 percent after 4 years.

This 'phenomenon' of **excess entry** is consistently recorded throughout different industries and geographies. A review of over 70 empirical studies of entry and exit patterns (covering 11 countries) confirms this observation (Siegfried & Evans, 1994). This review further indicates that entry is even more frequent in more profitable and growing industries and slower for capital intensive and scale intensive industries (Siegfried & Evans, 1994). Interestingly, Geroski (1995) observed consistently high entry rates – despite high reported barriers to entry (in his sample of ~90 manufacturing industries in the UK).

To identify the root cause of the excess entry phenomenon, experimental game theory offers the opportunity to observe behaviour in a controlled environment and potentially isolate specific variables to clarify observations. Daniel Kahneman was first to study a market entry game with basic features of business entry situations (Brandts & Yao, 2010). He was surprised to observe a convergence towards equilibrium in each of their treatments[30], which varied in their respective equilibrium levels (Kahneman, 1988).

Amnon Rapoport subsequently investigated this line of research in several experimental studies with his colleagues. One consistent observation in the market entry experiments (where N players have to simultaneously make an 'entry' or 'stay-out' decision for a market with a given capacity), is a remarkable tacit coordination emerging over time on the aggregate level, which is accounted for by the Nash Equilibrium (Erev & Rapoport, 1998; Rapoport, 1995; Rapoport, Seale, & Ordonez, 2002; Rapoport, Seale, & Winter, 2000, 2002; Seale & Rapoport, 2000; Sundali, Rapoport, & Seale, 1995). Each of the studies emphasises coordination on the aggregate level, but not on the individual level, where recorded individual differences seem to not diminish over time (Rapoport et al., 1998). This heterogeneous behaviour is explained by an adaptive learning, where some participants reach equilibrium through trial-and-error adjustments based on the respective private histories (Rapoport, Seale, & Ordonez, 2002).

[30] For each treatment a randomly allocated ideal number of N* market participants was selected (payoffs for participants entering the market depended on the respective number of participants entering the market and N*, making a net loss if more entered, and a net win if less entered).

Erev and Rapoport (1998) examine the effect of available information on tacit coordination. Interestingly, when participants receive information about competitors, the entry rates increase. The authors hypothesise that this 'information effect' is affecting the player's reference point in line with existing learning models. Another potential driver for this effect of increased entries is potentially the phenomenon of *overconfidence* in one's abilities and skills compared to others (see Moore and Healy (2008) and Svenson (1981) as well as the discussion further below in Sub-Section II. 3.2). In a second experimental study investigating the impact of information, Duffy and Hopkins (2005) report that, while coordination *does* occur in treatments with minimal information (after approximately 100 periods), coordination occurs significantly quicker in setups with full information.

Despite the overwhelming evidence for convergence to equilibrium play, Zwick and Rapoport (2002) and Pograbna and Schade (2009) observe no convergence to equilibrium, which effectively resulted in financial losses by the participants. Zwick and Rapoport (2002) refer to the non-linear payoff function that their experiment entailed as the potential factor. While previous experiments used linear payoff functions depending on the number of Entrants, the applied payoff function decreased sharply even resulting in negative payoffs when capacity was exceeded by one firm. In the experiment conducted by Pograbna and Schade (2009), participants entered simultaneously *several* heterogeneous markets. While participants fail to coordinate, observations show excess entry in the majority of the rounds. Interestingly, they detected a relationship between market capacity and excess entry. The lower capacity of the innovative market and the higher the capacity of the less innovative market, the higher the propensity to observe excess entry (Pograbna & Schade, 2009).

While these recent results indicate that market characteristics influence the convergence to equilibrium, experiments with linear demand and a single market to enter all indicated entry behaviour to reach the equilibrium over time (detected factors affecting time to converge to equilibrium included availability of information (Duffy & Hopkins, 2005) and experience of participants (Rapoport, 1995)). Thus, there seems to be a thoroughly reported discrepancy between empirical observations in real markets and behaviour in laboratory experiments. Potential explanations for the observed phenomenon of excess entry are discussed in the following sub-section.

II. 2.2 Potential Explanations of the Excess Entry Phenomenon

The discrepancy between theoretical and experimental evidence on the one hand and empirical evidence of excess entry on the other hand is a phenomenon that has been occupying research for a significant time. Several publications discussed potential **economical rationales** and psychological explanations for this discrepancy, or, the phenomenon of excess entry.

Stinchcombe (1965), referring to the high failure rate of small businesses, hypothesises that it is the entering firm's *liability of newness* that drives this effect. In particular, new Entrants try to fill promising market niches, but do not realise that these are most of the time already filled with bigger, Incumbent companies, which can leverage their size and resources to outplay these new Entrants.

Camerer and Lovallo (1999) claim that failures might be as frequent as observed, as Entrants only have brief opportunities to make profits. Thus, 'hit-and-run' Entrants enter the market to exploit these short-term opportunities, which are profitable but not of longevity. This occurrence is less common in markets with high entry barriers.

Another line of argumentation is that market entry represents an expensive lottery ticket with high-skewed (positive) returns. Accordingly, most firms expect not to succeed and lose money, but outweigh those losses by the significantly larger payoff in case of success (Camerer & Lovallo, 1999; Grieco, Hogarth, & Karelaia, 2007). This dynamic is known from multi-armed bandit problems[31], where sampling from unknown distribution might be profitable as i) profits outweigh the losses, and ii) might give insights for future market entries. A second variant to explain the positive returns is mentioned by Camerer and Lovallo (1999), stating that small-business owners get psychic income[32] from running businesses, which causes expected utility to be high even when profits are low or non-existent.

Further potential explanations for excess entry involve **psychological factors**. Camerer and Lovallo (1999) mention *mistakes* done by a rational decision-makers as potential drivers. One possibility is that entrepreneurs know their own skills but not the actual number of competitors they are going to face (the effect is also referred to as the 'reference group neglect', discussed in more detail in the next sub-section). The alternative cause is an accurate forecast of

[31] In brief: the multi-arm bandit problem refers to slot machines (multi referring to several machines). While each of these 'arms' yields different rewards and the decision-maker sequentially plays any of the N arms, the decision-maker benefits from spreading his first few pulls to learn about the respective payoffs.

[32] I.e., a non-monetary or non-material satisfaction that accompany an economic activity.

competition, but an overestimation of their own skills, thus, leading to an unprofitable entry decision. The notion of overconfidence has been in the centre of psychological explanations for excess entry, as Cooper et al. (1988) reported that, for example, more than 80 percent of their sample of ~3000 entrepreneurs believed their chances of success were "at least 70%". Of this sample, 39 percent even believed their chances of succeeding were "100%".

The second line of research for psychological explanations involves the *uncertainty* related to market entry and respective attitude to risk by decision makers. While economic decision mostly involve some uncertainty (at least the majority), market entry typically involves a high uncertainty often linked to high individual stakes dependent on the outcome. Knight (1921) was the first to distinguish between risk (involving known probabilities) and uncertainty (involving unknown or imperfect probabilities). Ellsberg (1961) later suggested that the presence of imprecise of ambiguous information about probability can affect decision making contradicting standard models of behaviour in uncertainty. Several studies investigating general human preferences indicate a degree of ambiguity-aversion when compared to risk (Camerer & Karjalainen, 1994; Chen, Katuscak, & Ozdenoren, 2007).

As for excess entry, the notion of entrepreneurs bearing risk-seeking characteristics and, thus, being accountable for excess entry has persisted for some time. However, Wu and Knott (2006) indicated that empirical records do not provide evidence for such an anomaly among entrepreneurs. In fact, in instances where differences were recorded, data indicate entrepreneurs exhibit greater risk aversion. In an experimental market entry game, Brandts & Yao (2011) reported over-entry in both the risky and the ambiguous market. Results even suggest that entry is higher under ambiguous than risky information. Thus, it does not seem that risk attitude of entrepreneurs is driving excess entry.

Summarising, early line of research concerned with market entry focussed either on the respective Incumbent actions and the Entrant being a rational decision-maker (e.g., Dixit, 1980; Ware, 1984) or on the respective industry densities, which would have a concave relationship with market entry (e.g., Haveman, 1993). The latter explains the decline by increased competition, which in turn reduces profitability – an important driver of market entry (Porter, 1979). These findings suggested each market to have an equilibrium that is reached by market entrants, allowing all competitors to realise non-negative profits.

Experimental investigations of market entry games confirm this equilibrium state, which is consistently reached in market entry games with linear demand and multiple entrants (e.g., Kahneman, 1988; Rapoport et al., 1998).

However, as striking as this congruency of both fields were (Kahneman, 1988), empirical studies provided evidence against these theoretically and experimentally proven equilibria. Specifically, many empirical studies observe a phenomenon of excess entry throughout industries and geographic locations (e.g., Dunne et al., 1988; Geroski, 1995). Literature discussed several potential reasons as potential factors driving this discrepancy (between empirical and experimental or theoretical findings). While the economical explanations mostly seem sensible, it is unlikely that they explain the excess entry phenomenon single-handedly (especially, more than 50% of exits, within a few years, are due to failure [Headd, 2003]). The psychological explanations offer an intriguing field of research, as, for example, a study of ~3000 entrepreneurs suggested that these typically are overconfident towards their likelihood to succeed (Cooper et al., 1988), which might drive excess entry. The next section reviews literature concerned with these psychological influences.

II. 3 Personality in Experimental Economics

As the previous sub-section indicate, there seems to be an additional factor affecting Incumbent and Entrant behaviour in market entry. As noted by several studies, if empirical observations are not well explained by rational assessment or developed underlying theory, research of individual differences might shed light on predictors of economics behaviour (Almlund et al., 2011; Bergstrom et al., 2016; Caplan, 2003). Accordingly, the aim of this sub-section is to review experimental findings for the role of personality in game theoretic settings and decision-making.

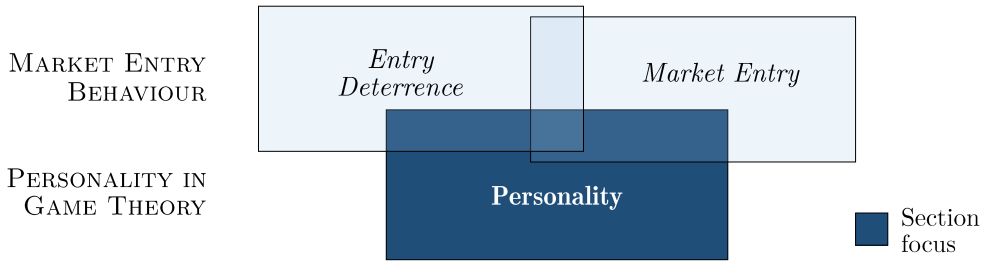


FIGURE 2.7: Focus of SECTION 2.3 within research framework

First, the role of personality in game theory is discussed in a broader context, followed by a review of findings on behaviour in the popular dictator, ultimatum, and prisoner's dilemma

games. Subsequent analysis of market entry specific findings should shed light on the current standpoint of literature concerning behaviour in market entry (for Incumbents and Entrants).

II. 3.1 Linking Behaviour in Economics Games to Personality

While behavioural economics have always been an important part of economics (e.g., Adam Smith (1759) already proposed psychological explanations of individual behaviour, including concerns about fairness), research began to flourish with the beginning of prospect theory[33] as developed by Kahneman and Tversky (1979). With the emergence of sound personality models in the 1990s (e.g., Goldberg, 1990), a significant effort was pursued to link economic decision making in game theoretic settings to personality. While the body of literature on experimental research in behavioural economics is huge and understanding of determinants of cooperative behaviour remain limited (Boone, Brabander, & van Witteloostuijn, 1999a), the following paragraphs focus on the personality aspect in economic decision-making. I review the results that emerged from research focussing on popular economic games such as the *dictator* and *ultimatum game*, as well as the *prisoner's dilemma game.* Besides their popularity in the field of behavioural economics, the ultimatum game and especially the prisoner's dilemma represent the core predicament of a market entry situation, i.e., *signalling* and *cooperative play* (e.g., represented by the fat-cat strategy). At the end of this sub-section, I summarise these findings with respect to potential implications for behaviour in market entry situations.

II. 3.1.1 Dictator & Ultimatum Games

The *dictator game*[34] (Kahneman, Knetsch, & Thaler, 1986) and *ultimatum game*[35] (Güth, Schmittberger, & Schwarze, 1982) represent – with over one hundred experiment over the past ~30 years – the most researched games in the field of experimental economics (Cooper & Dutcher, 2011; Engel, 2011). While rational play involves not giving anything (in the DG) or the minimal possible amount (in the UG), meta studies prove consistently irrational play by participants. In the following, I review publications investigating the impact of personality on

[33] One of the most popular economic behaviour theories describing how individuals make economic decisions including risks. Specifically, expected values of losses and wins are treated differently.

[34] The *dictator game* is a two-player game. The 'dictator' or 'allocator' determines how to split the endowment (mostly a cash value) between him and the 'recipient'. The role of the recipient is completely passive.

[35] The *ultimatum game* is a two-player game, where the 'proposer' can make an offer of how to split the endowment (mostly a cash value) between him and the 'responder'. If the responder accepts, both receive the endowment according to the proposed split. However, if the recipient does not accept the offer, both get nothing.

dictator giving and ultimatum offering. The structure follows the respective personality frameworks[36] and individual dimensions.

In an UG, the five global dimensions of the **16PF framework**[37] (Catell & Catell, 1995) were investigated. Results indicated that proposers with high scores on the *independence* and *tough-mindedness* dimensions demand higher return shares and responders with high scores on the *reciprocity orientation* reject the offers more often (Brandstätter & Königstein, 2001). *Reciprocity orientation* was further examined in DG and UG by Brandstätter and Güth (2002), who confirm these results by finding it to induce recipients in the UG to set higher acceptance thresholds.

Scheres and Sanfey (2006) examine the **Behavioral Activation System**[38] (Gray, 1987), in UG and DG. Higher scores on the *BAS drive* and *BAS reward responsiveness* dimensions were associated with higher offers in the UG and lower offers in the DG. The third, *BAS fun seeking*, dimension not found to impact decision making. These findings suggest a more conservative play by these types in order to ensure *some* reward (as opposed to *none*).

MBTI scores (Myers, 1962) were examined in an UG by Schmitt, Shupp, Swope, and Mayer (2008). On the *thinking-feeling* dimension, *thinking* types made lower offers than *feeling* types, which suggests that *feeling* judgment is measuring to some degree altruistic preferences (Schmitt et al., 2008). *Extraversion* types accepted lower offers than *introverted* subjects did.

The popular **Big-Five**[39] personality framework (Costa & McCrae, 1988; Goldberg, 1990) was investigated in several experimental studies. *Agreeableness* was consistently found to have a positive relationship with giving in a DG (Ben-Ner, Kong, & Putterman, 2004; Ben-Ner, Kramer, & Levy, 2008; Ben-Ner, Putterman, Magan, & Kong, 2004; Wischniewski & Brüne, 2013). In the UG, individuals with high scores of *agreeableness* and its sub-dimension *trustworthiness* were more likely to accept offers in general (Nguyen et al., 2011). Contrarily, several studies found a negative relation between *extraversion* and giving in the DG (Ben-Ner

[36] For a brief review and discussion of popular personality frameworks and their applicability please refer to SECTION IV.3..

[37] The 16PF framework identified 16 distinct personality dimensions, which are sometimes summarised by five global factors. The 16 dimensions include: A warmth, B reasoning, C emotional stability, E dominance, F liveliness, G rule-consciousness, H social boldness, I sensitivity, L vigilance, M abstractedness, N privateness, O apprehension, Q1 openness-to-change, Q2 self-reliance, Q3 perfectionism, & Q4 tension Catell (1973).

[38] The Behavioral Activation System (BAS) is one of two systems developed by Gray (1987), which is activated by stimuli of reward (composed of the three sub-scales *BAS drive*, *BAS fun seeking*, & *BAS reward responsiveness*). The opposite BIS scale (behavioural inhibition system), is related to anxiety and being concerned with preventing or stopping punishment.

[39] A review of the two five-factor personality models, the Five-Factor-Model (FFM) and the Big-Five, is included in SECTION IV.3.

et al., 2008; Ben-Ner, Kong et al., 2004; Ben-Ner, Putterman et al., 2004). Results on the impact of *neuroticism* were mixed, with Ben-Ner, Putterman et al. (2004) reporting a negative relationship, Ben-Ner, Kong et al. (2004) reporting such a negative effect only for female subjects, and other studies no finding any significant effects. For *conscientiousness* and *openness-to-experience* none of the studies found any significant influential effect. While reporting mixed results in a DG, Ben-Ner and Kramer (2011) identified a non-linear relationship of personality dimensions on giving.

Personality research extended the five factor personality theory to a six-factor model known as **HEXACO**[40] (Ashton, Lee, Perugini et al., 2004), which was compared to the Big-Five in a DG in an experimental study by Hilbig, Thielmann, Hepp, Klein, and Zettler (2015). While their results indicated that the Big-Five *agreeableness* positively predicted DG giving, the HEXACO *honesty-humility* dimension predicted giving more strongly. They also concluded that the HEXACO model provides a higher explanatory resolution of altruistic and pro-social behaviour – *honesty-humility* representing the pro-active aspect and *agreeableness* the reactive aspect of altruistic behaviour.

Other personality dimensions that were experimentally investigated in UG and/or DG include *benevolence*, *intelligence*, *Machiavellianism, negative affect* and *testosterone levels* (the latter one not necessarily a personality dimension, but often linked to aggressive, dominating personality types). While *benevolence* was found to impact offers in the DG, results did not indicate so in the UG (Brandstätter & Güth, 2002). While some results indicate that *intelligence* bears no significant effect on decision making (Brandstätter & Güth, 2002), others indicate a negative relationship, i.e., more rational behaviour (Ben-Ner, Kong et al., 2004). *Machiavellianism* was found to be related to selfish behaviour in the DG (Wischniewski & Brüne, 2013). *Negative affect*, defined as a variety of aversive affective states as fear, anger, contempt or disgust (Watson, Clark, & Tellegen, 1988), were found to more likely reject unfair offers in the UG (Nguyen et al., 2011). Similarly, Burnham (2007) found men with high *testosterone levels* to reject low offers in an UG.

[40] The HEXACO model is comprised of six dimensions, namely Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness-to-Experience.

II. 3.1.2 Prisoner's Dilemma Game

The *prisoner's dilemma* game[41] is another very popular game in experimental economics, as it simulates typical market dynamics (e.g., Bertrand competition) with minimal complexity. While the optimal strategy is to defect (i.e. 'betray'), participants often choose to cooperate (Pothos et al., 2011). Research findings on personality affecting play in a prisoner's dilemma (PD) like game might yield valuable implications for market entry situations.

Cooper, DeJong, Forsythe, and Ross (1996) examine *reputation building* and *altruism* in a one-shot and finitely repeated PD to investigate cooperative play. While *altruism* predicts cooperative play in the one-shot PD, it did not in the repeated treatment. Overall, they concluded that neither reputation nor altruism alone explain their observations.

Pothos et al. (2011) examine the **Behavioral Activation System (BAS)** in a one-shot PD. If the optimal strategy was to defect and the strategy of the opponent was known, subjects with high scores on *BAS reward responsiveness* were more likely to choose to defect. However, this effect was not observed, when i) the opponent's strategy was unknown, or the optimal strategy was to cooperate. These results suggest that task context determines whether a particular trait influences behaviour (Pothos et al., 2011).

In one-shot and repeated PDs (in the form of duopoly pricing), Boone et al. (1999a) examined the link between cooperative behaviour and the **locus of control**[42] (LoC) construct (Rotter, 1966). In the repeated form, they found *internal LoC* to be associated with cooperative behaviour, not in the one-shot PD. Since cooperative behaviour is not an optimal strategy in the one-shot version, but can pay off in a repeated setting (if both players cooperate), *internal LoC* suggests a strategic approach, not necessarily an altruistic one. Boone, Brabander, and van Witteloostuijn (1999b) conclude that *internal LoC* individuals have *"an adaptive capacity to instrumentally switch between cooperative and competitive behaviour"*.

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[41] The prisoner's dilemma (PD) game is a two-player game, where both players simultaneously select between a 'cooperating' and 'betraying' strategy. It is based on the story of two prisoners, who were arrested for a crime, yet, the police cannot prove it. If both stay quiet (i.e. cooperate), both get a minimal jail time. However, if one betrays the other, he gets off without any jail time while the other has to serve a severe time. If both betray each other, both serve severe times. While the magnitudes of respective jail times (or returns) might differ, the game always yields one Nash equilibrium, that is, when both select the betraying strategy.

[42] The LoC construct refers to the individual's generalised belief in internal versus external control of reinforcements (Rotter, 1966). Those believing in *external control* believe that the events in their life occur due to uncontrollable forces, i.e., their goals depend on luck, chance, and powerful persons or organisations. They do not believe that they can control their lives by their actions or efforts. *Internals*, on the other hand, see themselves as active agents, who can influence the outcome of their goal achievements by their actions and efforts (Boone et al. (1999a).

In a follow-up study, Boone et al. (2002) test this hypothesis, arguing that it is the learning effect that makes participants behave more cooperatively as they understand the interplay of cooperativeness and payoffs. While they find that learning and repetition reduce the impact of individual differences, their results suggest that *internal LoC* participants learn faster to cooperate than *external LoC* participants.

Findings on the **Big-Five** personality traits as a predictor for behaviour in PDs are somewhat mixed. While Hirsh and Peterson (2009) find *neuroticism* to predict cooperative behaviour in their repeated PD experiment, Lönnqvist et al. (2011) find the opposite effect and Pothos et al. (2011) find no relation at all in their one-shot PD games. Furthermore, cooperative behaviour was found to correlate with *openness-to-experience* in a one-shot PD (Lönnqvist et al., 2011), with *enthusiasm* (sub-facet of *extraversion*) in a repeated PD (Hirsh & Peterson, 2009), and with *agreeableness* in a one-shot setup (Pothos et al., 2011). In the latter study, Pothos et al. (2011) report – in a 'puzzled manner' – that *agreeableness* was only associated with cooperative behaviour, when cooperating was the optimal strategy, not when defecting was the optimal strategy. A potential explanation may be found when combining these observations with the previously reported association of re-active cooperation with *agreeableness* in the DG (Hilbig et al., 2015). Thus, *agreeable* individuals are more cooperative, but not at all costs (i.e., not when expected returns are negative).

Before moving on to review personality research in market entry games, this paragraph aims to briefly reflect the main implications of the above results with respect to market entry behaviour. On a more macro level, it seems that the influence of personality traits on behaviour is – at least partly – dependent on the respective situational setting (Lönnqvist et al., 2011; Pothos et al., 2011). Thus, traits driving cooperativeness are not necessarily *always* related to cooperative behaviour (as seen in the case of *agreeableness* or *internal LoC* [Boone et al., 1999b; Pothos et al., 2011]). Furthermore, it seems that learning has a substantial effect on behaviour, that is, participants playing 'smarter' over time (Boone et al., 2002). Personality effects might therefore diminish over time – whether a repeated or one-shot setup is more applicable to market entry games is debatable[43]. Also, relationships between personality dimensions and behaviour in economic settings might be non-linear, but quadratic (Ben-Ner & Kramer, 2011).

[43] The presence of market entry threat is very dependent on the respective industry. Capital-heavy, branding-focussed or economies-of-scale-reliable industries typically experience threat of market entry less often than the respective counter-poles.

When investigating behaviour with respect to a holistic personality framework as the Big-Five, use of the six-factor HEXACO framework is worth considering, due to its property of distinguishing between re-active (*agreeableness*) and pro-active (*honesty-humility*) cooperativeness (Hilbig et al., 2015). Research on personality in economic decision-making seems to have shifted – in parallel to personality research – towards factor-analysis-based five- and six-factor models.

Agreeableness was consistently found to be associated with pro-social, more altruistic behaviour (e.g., dictator giving in several studies [e.g., Ben-Ner, Kong et al., 2004]) – keeping in mind that this effect sometimes depends on a self-interest (e.g., in the PD game by Pothos et al. [2011]). Combining the aforementioned findings for *extraversion* might indicate that *extroverted* individuals behave more rational than *non-extroverts*[44] – as *extroverts* i) gave lower amounts in DG (Ben-Ner et al., 2008), while ii) being more cooperative in a repeated PD (Lönnqvist et al., 2011) and iii) accepting lower offers in an UG (Schmitt et al., 2008). In addition, Hirsh and Peterson (2009) mention that *extroverts* might experience greater personal reward from cooperative behaviour, potentially increasing chance of cooperation. *Neuroticism* results seem to relatively mixed, which suggests to examine this trait on its sub-facets level to understand the respective driving factors. While the remaining two dimensions of the six- or five-factor models, *openness-to-experience* and *conscientiousness*, did not reveal any potential effects, the former one might play a role for Entrant behaviour in market entry games.

While results on *intelligence* were mixed (Ben-Ner, Putterman et al., 2004; Brandstätter & Güth, 2002), research on *internal LoC* in PD games indicated to explain more rational play, or, quicker conversion to rationally optimal play (Boone et al., 2002).

Both *reciprocity oriented* and *high-testosterone* individuals seem to expect some altruistic behaviour by their counterparts, by rejecting low UG offers (Brandstätter & Güth, 2002; Brandstätter & Königstein, 2001; Burnham, 2007) – while both groups potentially have different views on their own behaviour (*reciprocal* versus *exploitive*).

II. 3.2 Experimental Findings on Personality in Market Entry Games

In accordance with the sections on Incumbent and Entrant behaviour in market entry games, respective actions or decisions about actions differ in their very nature. Thus, I review relevant

[44] The differentiation between *non-extroverts* and *introverts* could potentially be of relevance, as Ben-Ner and Kramer (2011) reported non-linear relationships between personality traits and DG giving.

literature findings on personality in market entry games for both 1) Entrant and 2) Incumbent behaviour.

II. 3.2.1 Personality as a Predictor for Entrant Behaviour

A significant amount of entrepreneurial literature focussed on psychology and organisational behaviour, as it studies the characteristics of those who enter the market (Olson, 2000). The aim of the following paragraphs is to review findings of experimental literature on the impact of personality on market entry behaviour.

The phenomenon of excess-entry reported by several studies (e.g., Geroski, 1995) lead to investigation of several explanations. While early literature discussed "hit-and-run" Entrants (Grieco et al., 2007) or risk attitudes and ambition as potential drivers for excess entry, more recent literature investigated the field of *optimistic biases* and *confidence*.

Camerer and Lovallo (1999) experimentally study **optimistic biases** and **confidence** as potential explanations for excess entry. They find that it is a combination of those two that results in *overconfidence* in own skills, which leads to excess entry. They refer to this effect as the "reference group neglect", as those self-selected subjects volunteered to participate when outcome would depend on skills. What those subjects neglected, was the fact that they would compete against a reference group, which also thought that they are skilled (Camerer & Lovallo, 1999). Grieco et al. (2007) claim that entrepreneurs rely on imperfect, but not necessarily overconfident, assessments of their abilities, which may explain excess entry (or non-entry when entry should have occurred). Specifically, their claim entails that the population of entrepreneurs imperfectly assesses their skill level, some over-assess it, while others under-assess it, that is. Thus, entrepreneurs equally consist of *overconfident* and '*underconfident'* individuals – while only excess entry can be recorded. Nonetheless, the net effect of their model and experiment results implies excess entry due to *overconfidence*.

Recently, Moore and Healy (2008) provided useful distinguishing concepts of confidence-types. For the following discussion of literature, those terms are briefly defined as follows.

Overestimation Individuals being overconfident in estimating *their* ability to do something (e.g., run a marathon within a certain time), which is not necessarily universal. That is, people tend to overestimate their own skill on hard tasks but underestimate it on easy tasks (e.g., Moore & Cain, 2007).

OVERPLACEMENT A person might express overconfidence in her ability *relative* to others (e.g., run a marathon faster than all team members). This phenomenon is also referred to as 'better-than-average' effect, where people judge their abilities in familiar domains as driving a car as better than average (Svenson, 1981).

OVERPRECISION People might be overconfident when estimating future uncertainty (e.g., in the next marathon race the winner will run within 30 seconds of the course record).

Interestingly, in an empirical study, Wu and Knott (2006) found that, where entrepreneurs can accurately assess market demand (i.e., no *overprecision*), they tend to overestimate their ability to manage their start up successfully (i.e., *overplacement*).

Building on the Camerer-Lovallo experiment, Moore and Cain (2007) examine how over- and underconfidence impact entry behaviour. While they confirm the findings of *overplacement* by Camerer and Lovallo ('reference group neglect') in some situations, they point out that this effect depends on the type of competition. Specifically, subjects tend to *overplace* themselves in easy-task competition, but *underplaced* themselves in difficult tasks, which led to staying out of the market (Moore & Cain, 2007). These findings are in line with prior research on people *overplacing* themselves in easy tasks where absolute performance is high (e.g., driving a car or ability to get along with others), and *underplacing* themselves in difficult tasks where absolute performance is low (Hoelzl & Rustichini, 2005; Moore & Kim, 2003). Thus, entry and 'confidence' depend on how difficult entrants see the task (Moore & Cain, 2007).

This 'myopic self-focus' was further investigated in an experimental study by Moore, Oesch, and Zietsma (2007). They show that this self-focus extends to the acquisition of information (decisions made based on search of easily accessible data, information about one's own and one's firm capabilities), which leads to access entry in some (easy) markets and insufficient entry in other (difficult markets). In line with Grieco et al. (2007), their findings imply that entrepreneurs are not universally overconfident.

Interestingly, in an experiment comparing *overestimation* (i.e., 'absolute confidence') and *overplacement* (i.e., 'relative confidence'), Bolger, Pulford, and Colman (2008) find that – when skill is involved – *overestimation* is responsible for excessive entry rather than *overplacement*.

This contrasts with the above findings by Moore and Cain (2007), who found stronger influence of *overplacement* (potentially explained by the differing experimental designs of both studies[45]).

Another study (Charness, Rustichini, & van de Ven, 2011) finds evidence for the *overplacement* theory (a stated by Moore & Cain [2007]). Furthermore, while generally being overconfident (more than 50 percent of the sample indicated to be in the top 50 percent), participants are very reluctant to adjust their beliefs downward after negative feedback. Thus, information processing seems to differ when concerning own abilities rather than neutral information.

In a recent study, Cain, Moore, and Haran (2015) pursued several questions that emerged from the hitherto research: i) How do entrepreneurs maintain confidence in difficult tasks (as evidenced by empirical observations (Cooper et al., 1988) in contrast to recent experimental evidence (Moore et al., 2007; Moore & Cain, 2007))? ii) Is it *overplacement* or *overestimation* that explains excess entry? iii) Is this 'overconfidence' driven by neglecting competitors (Camerer & Lovallo, 1999) or by systematic error made when considering them (Moore et al., 2007)? From their two experiments, they find that i) self-selection of entrepreneurs (whether to enter easy or difficult markets) might account for entrepreneurs remaining confident (as they correctly place themselves). Furthermore, results confirm ii) that *overplacement* drives market entry (as opposed to *overestimation*). While results seem to iii) support the 'competition neglect' effect, even when forced to think about the competition, participants had failed to correct the bias, findings suggest that underestimation of competition is the more significant driver (Cain et al., 2015). However, in a study conducted by Moore et al. (2007), findings suggested that entrepreneurs are not necessarily universally overconfident and the authors noted that *'excess entry seems to be more complicated than simple overconfidence'*.

Besides the relatively thorough investigations of confidence and optimistic biases as explanations for excess entry, personality dimensions as defined by holistic personality frameworks were – to the best of my knowledge – only examined in one experimental study. In a market entry game, the **MBTI** types as well as the **Big-Five** dimensions were examined as

[45] Moore and Cain's (2007) experiment i) administered a mini-quiz between each round and provided direct feedback of one's performance on the blackboard, which could have driven the attention to relative performance. Also, ii) their study used groups of seven, whereas Bolger et al. (2008) used larger groups (more than twice the size) and iii) *overplacement* and *overestimation* are not measured in the same way in both study. Most importantly, Bolger et al. (2008) use decision makers as their proxy, not actual entry decisions (in the experiment by Moore & Cain).

potential predictors for willingness to 'open a restaurant' (Bergstrom et al., 2016). While results suggest that both low Sense-Intuition and high Think-Feel scores increase likelihood of entering the market, no significant indications were found for the Big-Five traits. Furthermore, Olson (2000) found that **locus of control** might explain market entry behaviour, as those with higher *internal LoC* tended to enter the market, which resemble the findings about general 'confidence' about own skills, as *internals* believe that outcomes in life are dependent on their effort, not on chance.

II. 3.2.2 Personality as a Predictor for Incumbent Behaviour

As opposed to experimental research investigating personality-related drivers for Entrant behaviour in market entry, research on Incumbent behaviour is very limited. While hypotheses and experiments on forward induction could not explain the discrepancy between theoretical frameworks and empirical observations, it seems that no research has tried explaining Incumbent behaviour through underlying personality characteristics.

The only study that recorded observations on Incumbent behaviour in market entry settings is the one discussed before by Charness et al. (2011). While they find that *overplacement* explains excessive market entry (by Entrants), they also report that male participants use reported significantly higher confidence levels in the strategic tournament setting, effectively serving as an entry deterrent. However, it remains unclear whether this behaviour was pursued deliberately (strategically inflating reported confidence levels) or unconsciously. They also noted that is remains unclear why this effect was not observed for female Incumbents.

The following table provides an overview of the aforementioned publications focussing on personality in economic games. The table illustrates that research has not linked market entry games with holistic personality constructs (except for the publication by Bergstrom et al. [2016]), merely the concept of over- and underconfidence has been investigated.

	Personality Concepts & Traits		
	Big-5/HEXACO	**MBTI/16PF/BAS**	**Selective characteristics†**
Market Entry	▪ Bergstrom et al. (2016)	▪ Bergstrom et al. (2016)	▪ Camerer & Lovallo (1999) ▪ Olson (2000) ▪ Moore & Cain (2007) ▪ Moore et al. (2007) ▪ Charness et al. (2011) ▪ Cain, Moore, & Haran (2015)
Prisoner's Dilemma	▪ Hrish & Peterson (2009) ▪ Lönnqvist et al. (2011) ▪ Pothos et al. (2011) ▪ Hilbig et al. (2015)	▪ Pothos et al. (2011)	▪ Boone et al. (1999a, 1999b) ▪ Boone et al. (2002)
Dictator & Ultimatum Games	▪ Ben-Ner, Kong, et al. (2004) ▪ Ben-Ner, Putterman, et al. (2004) ▪ Ben-Ner, Kramer & Levy (2008) ▪ Wischniewski & Brüne (2013) ▪ Nguyen et al. (2011) ▪ Hilbig, Thielmann, et al. (2015)	▪ Brandstätter & Königstein (2001) ▪ Scheres & Sanfey (2006) ▪ Schmitt et al. (2008)	▪ Brandstätter & Güth (2002) ▪ Ben-Ner, Kong, et al. (2004) ▪ Burnham et al. (2007) ▪ Nguyen et al. (2011) ▪ Wischniewski & Brüne (2013)

† Including: *benevolence, intelligence, Machiavellianism, negative affect, testosterone levels, confidence, locus of control, & self-esteem*

Table 2.1: Overview of publications on personality in economic games

II. 4 Interim Conclusion & Proposed Research Framework

The aim of this section is to, first, formulate an interim conclusion and summarise which gaps are still present in the literature, and, secondly, to close this section by describing the proposed research framework, which serves as the structure for the following chapter.

II. 4.1 Interim Conclusion & Research Gap

In a market entry situation, an **Incumbent firm** can effectively deter entry by a new competitor by strategically investing its resources. Literature findings consistently support the fact that this investment has to represent an irreversible commitment. While theoretical literature discussed several of these deterrence strategies (e.g., investment into excess capacity or advertising), some studies have emphasised that in some situations it can be profitable for the Incumbent to allow entry to happen, instead of deterring it. The influential framework by Fudenberg and Tirole proposes – along three dimensions – a colourful animal taxonomy to describe respective optimal strategic behaviour by the Incumbent.

While the entry deterrence (or allowance) strategies were thoroughly examined and represent sound theoretical concepts, empirical literature yields very mixed results and does not support predicted Incumbent behaviour in practical settings. Experimental investigations

for potential explanations of this discrepancy, e.g., forward induction, were also inconclusive. Potentially, the experimental design, in hitherto studies, with strongly reduced complexity (i.e., sequential models folded into single strategy-decision based on a payoff-table) accounts for some of the missing explanation.

The **Entrant firm** represents the mentioned entry threat in a market entry situation. While early literature defined market entry as a function of an industry's density, later efforts extended this function to overall market attractiveness, which is a product of several forces as market profitability, entry barriers, or current competition. Nevertheless, literature findings consistently argued that market entry is attracted up to an equilibrium point, beyond which it is repelled and even drives exit of existing competitors. Experimental efforts supported these findings in a surprising incontrovertibleness, providing evidence for relatively rapid coordination among competitors to reach the equilibrium and realise non-negative profits.

However, respective empirical studies did not provide any evidence in favour of these theoretical and experimental results. Instead, a consistent phenomenon of excess entry was detected by several studies throughout numerous industries and geographies. While a few potential economical explanations were hypothesised for this phenomenon (e.g., high return in case of – low-probability – success), it is unlikely that they account for the entire discrepancy between theoretical or experimental predictions and empirical observations.

After having reviewed research on **market entry behaviour**, by the Incumbent as well as the Entrant firm, this chapter has approached these discrepancies from a psychological angle, i.e., personality research in economic decision-making. While ultimatum and dictator games, one of the most popular economic games in game theory, represent economic settings where participants behave irrationally, the prisoner's dilemma (or similar games) simulates market dynamics even closer to realistic settings (i.e., where cooperation can yield higher payoffs but competing is tempting due to increased short-term payoffs). The chapter subsequently reviewed market entry games – for both the Incumbent and the Entrant firm. The following figure illustrates the approach of this chapter, reviewing relevant research fields.

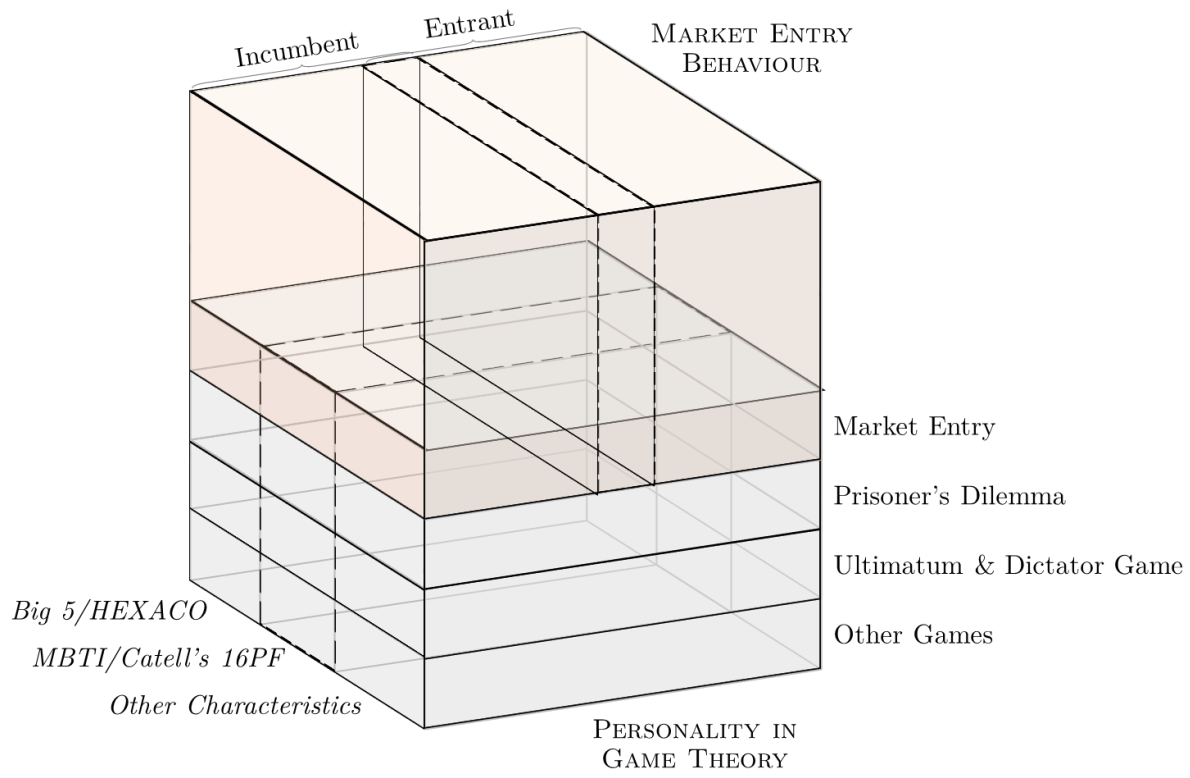

Figure 2.7: Illustration of the literature review approach for this thesis

For the Incumbent firm, research on individual differences might shed light on predictors of economic behaviour in the face of potential entry. Surprisingly, individual differences have not been investigated in the context of Incumbent behaviour so far. Equivalent research in dictator or ultimatum games and the prisoner's dilemma has helped to predict economic decision-making based on the individual differences. This supports a promising investigation towards an explanation of the discrepancy between empirical and theoretical Incumbent behaviour.

As observed, specific dimensions of personality frameworks exhibit an intensified influence on economic behaviour in certain settings, while featuring only marginal impact in other settings. This suggests that the underlying FT-framework – with different pre-entry actions – might serve as a promising fundament for the projected research.

In search for potential rationales for the phenomenon of excess entry by the Entrant firm, psychological explanations (especially the concept of *overconfidence*) provided a promising outlook, which was subsequently investigated in several experimental studies. It seems that *relative overconfidence* in decision-makers accounts for a good deal of irrational entry decisions. Interestingly, beyond the concept of *confidence* experimental efforts in investigating individual

differences as predictors for entry behaviour are very limited. The following figure, which zooms in on the interface between market entry behaviour and personality in economic settings, illustrates the limited coverage in the sub-fields.

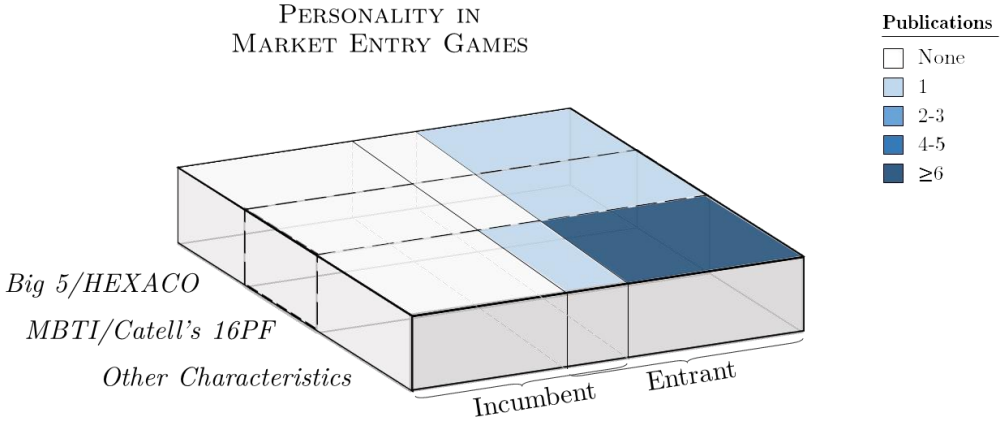

FIGURE 2.8: Research coverage of personality research in market entry games

Furthermore, experimental literature on entry behaviour has not considered potential pre-entry activities by the Incumbent firm(s)[46]. While the utilisation of those represent effective deterring or encouraging means, the question regarding their effectiveness (i.e., how respective Entrant firms react to these) arises. Simulating a sequential market entry situation with both the Incumbent and Entrant firm should not only shed light on respective reactive behaviour of the entering firm, but also on the long-term behaviour by the established firm (i.e., if Entrant firms do not react to pre-entry activities, the non-utilisation of these activities observed by empirical studies might be explained).

In summary, the core research areas, which were largely left uninvestigated in hitherto research and this research aims to investigate, inbclude:

- Utilisation of Incumbent *strategies that 'allow' market entry* in laboratory settings (prior research focussed on exclusively deterrence)
- Entry deterring (encouraging) strategies in a *sequential market entry design* (prior research designs included highly reduced complexities, limited to a single payoff table) in experimental studies
- Experimental studies on the *impact of individual differences on Incumbent behaviour* in a market entry game

[46] Except for the study by Bergstrom et al. (2016), which observed that male participants in the Incumbent role used inflated confidence reports to deter potential entry.

The thesis' objective is to contribute towards filling these gaps by providing evidence for the relationship between specific personality dimensions from established personality frameworks and respective Incumbent and Entrant behaviour in a simulated sequential market setting reflecting the influential taxonomy by Fudenberg and Tirole (1984).

II. 4.2 Proposed Research Framework

In order to shed some light on the outlined research objective, the applied research framework approaches the terminal empirical data analysis and interpretation from two directions – personality research on the one side, and market entry behaviour on the other side. FIGURE 2.8 illustrates the proposed research framework that this thesis follows in its structure (see the according chapter references, respectively).

This chapter, CHAPTER II, has outlined theoretical findings concerning behaviour in market entry situations, comprising entry deterrence and allowance strategies. Based on situational circumstances, the theoretical model hypothesises economically 'ideal' behaviour. These hypothesised behaviours are subsequently modelled in an experimental setting in order to measure the respective actions as well as their respective magnitude (see CHAPTER IV).

As for the opposite direction, the field of personality research, previous studies proved that despite situational alternations, certain personality dimensions consistently predict economic behaviour (CHAPTER II). In order to develop accurate hypotheses, CHAPTER III builds upon findings from research on conflict (as most economic situations comprise some sort of conflict[47]). Conflict research identified different conflict handling styles, which have been linked to personality characteristics. In line with the developed hypotheses, suitable assessment modes are reviewed and selected for the experimental study (CHAPTER IV).

[47] See CHAPTER III for a detailed definition of *conflict*.

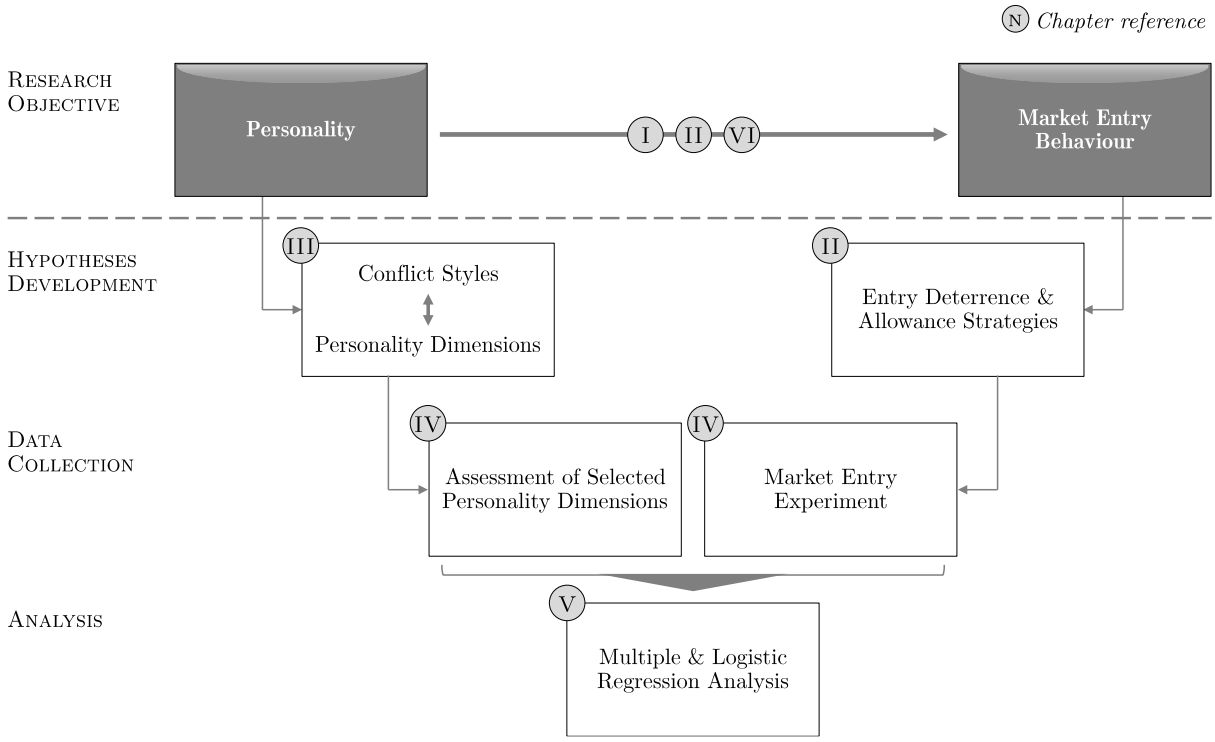

FIGURE 2.8: Proposed research framework of thesis

After the collection of data (via an experimental setup), CHAPTER V analyses the data through multiple and logistic regressions, ultimately linking the two research directions. Besides a discussion of the collected data and analysis results, CHAPTER V also imbeds the respective findings in the existing literature discussed above.

Closing, CHAPTER VI draws conclusions based on the main findings, discusses associated implications, and outlines limitations of this thesis along with an outlook for upcoming research efforts.

III Development of Propositions

This chapter's goal is the formulation of research propositions and underlying hypotheses. Beforehand, potential propositions are derived from respective theoretical foundations and existing literature in Section III.1. Then, Section III.2 outlines the developed propositions and formulates the underlying hypotheses supporting the respective proposition. Table 3.1 at the end of this chapter summarises all propositions and hypotheses for this study.

III. 1 Derivation of Propositions from Theoretical Foundations on Conflict

The methodology to derive the research proposition for this study incorporates analysing theoretical work on conflict and conflict management and deducing according propositions from that. The underlying rationale is that any market entry situation naturally involves a conflict and analysing conflict approaches might give an insight towards the interrelation of personality and conflict or market entry behaviour.

Before proceeding, the definition of conflict needs to be specified to set a base for the subsequent analysis. While organizational literature is generally ambiguous about the definition of conflict (Schmidt & Kochan, 1972; Thomas, 1992), there were efforts to agree on a broadly accepted and used definition (e.g., Pondy, 1967). Nevertheless, different research fields or areas of application require more specific and tailored definitions. In line with Thomas' definition, I defined conflict for this research as *'the process which begins when once party perceives that another has frustrated, or is about to frustrate, some concern of his'*, especially as it specifies the point at which the conflict process begins (Thomas, 1992).

III. 1.1 Conflict Management Framework & Resolution Styles

In the context of this research, particularly the handling modes of conflict are of interest. Blake and Mouton (1964) were the first to define a hierarchy of responses for handling conflict (i.e. *conflict strategies, conflict styles* or *conflict resolution styles*) based on a two-dimensional model – concern for results and concern for people. This hierarchy of conflict styles was accredited and subsequently applied and modified by other works (Berkowitz, 1972; Hall, 1969; Pruitt & Rubin, 1986; Rahim & Bonoma, 1979; Thomas, 1971), whereas the modifications focus on the specifications of the two dimensions (see Figure 3.1).

From these two-dimensional models (also known as *dual-concern model*), five similar conflict styles have been derived, namely *competition, collaboration, avoiding, accommodation,* and *compromising* (Thomas, 1976). Note that the main assumption states that, while everyone uses all conflict styles, personal preferences and behavioural dispositions define favoured reactions to conflict, i.e. a hierarchy of responses (Hall, 1973). FIGURE 3.1 below illustrates the dual-concern model, its according conflict styles, and the differing dimension specifications.

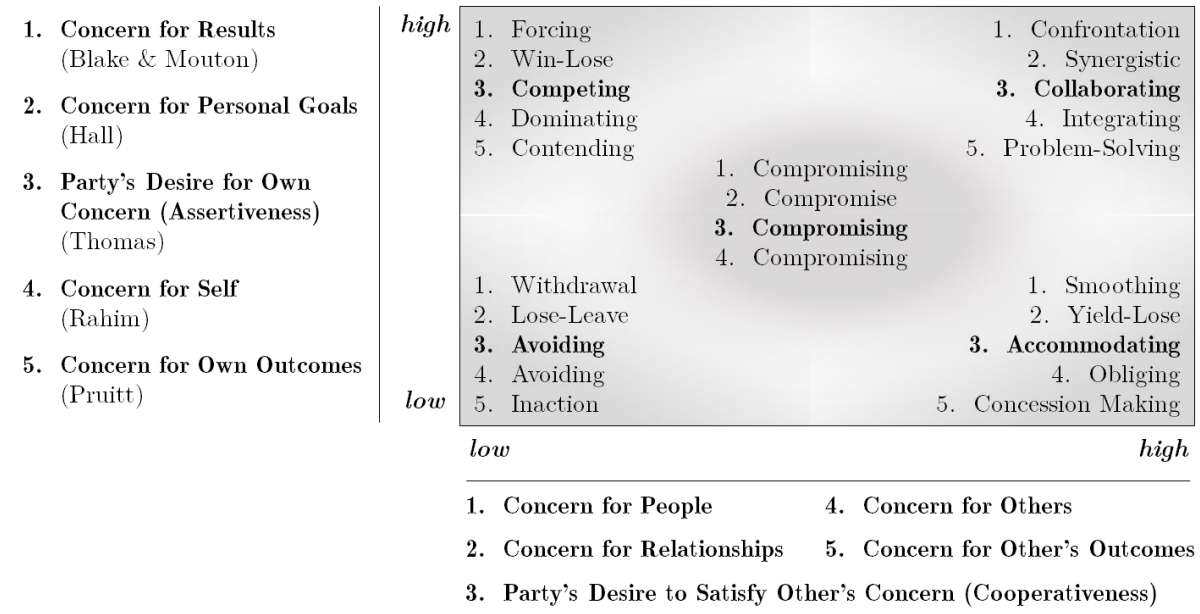

FIGURE 3.1: Overlay of the Dual-Concern Models by Blake & Mouton (1964), Hall (1969), Thomas (1976), Rahim (1983), and Pruitt (1983)

Despite their interpretational distinctions, each model includes two similar dimensions (high-low) defining four conflict styles: i) facing the conflict directly (in a problem-solving fashion), ii) smoothing/minimizing differences and focussing on areas of agreement, iii) trying to maximise one's outcome at other's expense, iv) avoiding conflict altogether, and potentially v) searching for a middle ground solution (Moberg, 2001; Schneer & Chanin, 1987). As one can notice, Pruitt (1983) does not include the fifth *compromising* dimension in his model. The rationale is that factor analysis locates *compromising* at a considerable distance from *contending* and *inaction*, between *problem-solving* and *concession making* (van de Vliert & Prein, 1989). This suggests that compromising results from a moderate concern for own outcomes and a high concern for other's outcomes, i.e. a balance between *problem-solving* and *concession making* (Carnevale & Pruitt, 1992). Henceforth, the terms as described by Thomas (1976) will be applied (see bold conflict styles in FIGURE 3.1).

The dual-concern model was also criticised for (i) not accounting for win-win outcomes when there was little concern for the other, (ii) ignoring other goals a negotiator might have (e.g., a fair outcome), or (iii) failing to explain why strategies are shifted during a negotiation (Carnevale & Pruitt, 1992; Thompson, 1990). Countering the latter (iii), the model indicates a negotiator's preferred strategy, but practical circumstances or simply the realisation that a strategy is not successful leads to a change in strategy. The former two (i-ii) are valid statements (experimentally confirmed by Sorenson, Morse, & Savage, 1999), as the model was not designed as a comprehensive theory, but rather a heuristic device (Carnevale & Pruitt, 1992). In line with that, the model was criticised to not account for the amount of risk one is willing to take for her outcome (Mesquita, 1981) or the competitive motivation on negotiation (Carnevale & Pruitt, 1992). Furthermore, factor analyses conducted for the available instruments assessing conflict styles[48], none of the four instruments provided evidence for the factorial independence of the five scales (Rahim, 1983). Thus, some research differentiates between four (Pruitt, 1983) or three[49] (Putnam & Wilson, 1982) distinct conflict styles.

Since this study does not employ the mentioned instruments, the lack of statistical soundness of these is not relevant. The dual-concern model itself serves its purpose as it represents a heuristic device, which gives an insight how concerns for oneself and others majorly define preferred conflict styles (excluding other factors). This study's methodology foregoes the conflict styles (which are a product of several factors) and focusses on the personality dimensions associated with the dual-concern model (see FIGURE 3.2).

The figure illustrates the relationship between the dual-concern model and conflict styles, as well as additional influencing factors. These include factors impacting conflict styles beyond the two concerns (e.g., (ii) other goals [Thompson, 1990]), previous conflict experience, external factors (e.g., setting makes collaborative resolution impossible [Carnevale & Pruitt, 1992]), or the opponent's strategy (e.g., both start with *competing* style). In line with our methodology, the next section links conflict styles from the dual-concern model to personality dimensions.

[48] The instruments to assess conflict styles include the Hall Conflict Management Survey/CMS (Hall, 1969) Shockley-Zalabak(1988), Rahim Organisational Conflict Inventory/ROCI-II (Rahim, 1983) Weider-Hatfield(1988), Putnam-Wilson Organisational Conflict Instrument/OCCI (Putnam & Wilson, 1982; Wilson & Waltman, 1988), Thomas-Kilmann MODE Survey (Thomas & Kilmann, 1974), Rosenthal–Hautaluoma Instrument (Rosenthal, 1983), Lawrence-Lorsch Instrument (Lawrence & Lorsch, 1969) and Conflict Management Message Style/CMMS (Ross and DeWine, 1988).

[49] The conflict styles defined by Putnam and Wilson (1982) are *non-confrontational, solution-oriented,* and *control*.

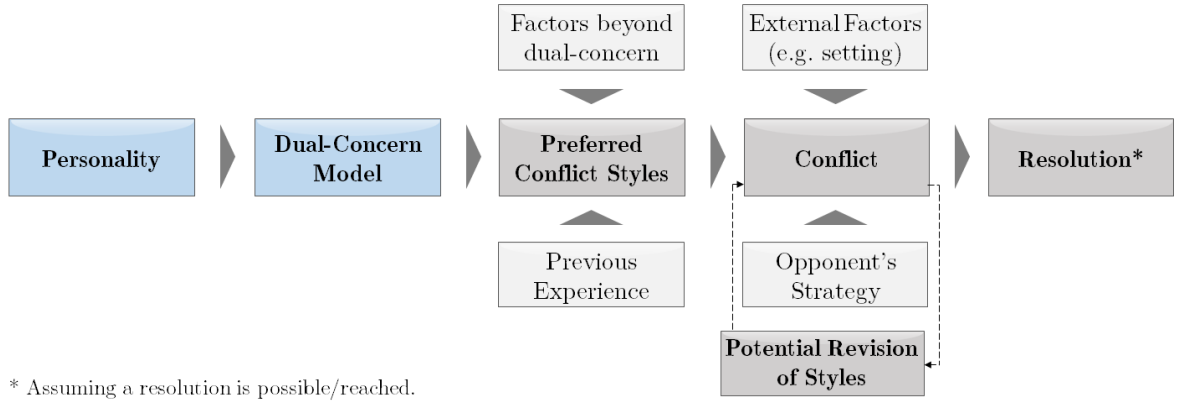

FIGURE 3.2: Personality, the dual concern model, and conflict styles

III. 1.2 Linking Conflict Styles to Personality

In order to deduct meaningful insights from literature linking conflict styles to personality, the focus lies on the two 'extreme' conflict styles (similar to Bell & Blakeney, 1977; Jones & Melcher, 1982; Jones & White, 1985). Namely, the conflict styles with (A) *high* concern for own and *low* concern for the other's results (*competing*) and (B) *low* concern for own and *high* concern for the other's results (*accommodating*).

Conflict resolution is a widely researched field in organizational and behavioural literature. While one objective has been to assess the impact of situational variables on the conflict styles (e.g., Pilkington & Richardson, 1999; Sternberg & Soriano, 1984), another objective has been to identify variables that might explain preferences in conflict styles beyond situational variables, which leads one to the field of personality (Wood & Bell, 2008). Terhune (1970) even concluded that „personality effects were greater than situational effects".

Several research studies have investigated the link between conflict styles and personality (see FIGURE A3.1 in the appendix for an extensive overview). Early literature focussed on analysing the relationship between conflict styles and Jung's (1923) personality types[50] (Chanin & Schneer, 1984; Kilmann & Thomas, 1975; Mills, Robey, & Smith, 1985) as well as Murray's (1938) Manifest Needs[51] (Bell & Blakeney, 1977; Jones & Melcher, 1982; Jones & White, 1985; Schneer & Chanin, 1987; Utley, Richardson, & Pilkington, 1989). Other significant findings on selective dimensions include *Machiavellism* (Jones & Melcher, 1982), *Reciprocity* (Park &

[50] Composed of four dimensions: *orientation, perception, decision-making,* and *approach.* Typically administered by and known as the Myers-Briggs type indicator/MBTI (Myers, 1962).

[51] Murray (1938) distinguished more than 25 different 'psychogenic' needs, where the overarching needs were: *ambition, materialistic, power, status defense, affection,* and *information.*

Antonioni, 2007), and *Self-Esteem* (King & Miles, Edward, W., 1990). Together with the field of personality, the examination of personality and conflict styles subsequently moved towards the five-factor theory[52] (e.g., Antonioni, 1998; Moberg, 2001) developed Costa and McCrae (1992) and Goldberg (1990).

Jung's personality types (commonly known as *MBTI*) were excluded from the following in-depth investigation, as they are unusual among personality assessment devices. Reasons include the fact (i) that they measure rather types than traits or continuous variables and (ii) that they are used to explain the personality characteristics and behaviours to the individuals themselves, their friends, family or their co-workers (McCrae & Costa, 1989). In line with the latter (ii), the MBTI measure represents the most popularly used measure in the professional training context (Furnham, 1996). The following analysis, therefore, focusses on the Manifest Needs and the Big Five.

I analysed five studies (Bell & Blakeney, 1977; Jones & Melcher, 1982; Jones & White, 1985; Schneer & Chanin, 1987; Utley et al., 1989) investigating the relationship between **Manifest Needs**[53] and conflict styles[54], findings regarding the (A) *competing* and (B) *accommodating* styles are not entirely congruent. A potential explanation can be differing conflict style or personality instruments, as well as deviating sample characteristics or instructions. The imposed requirement (to ensure consistency) for extracting any findings to this study implied that results of mutually coherent correlations are confirmed in at least two studies. This yielded the following findings:

- a negative correlation of *affiliation* and (A) *competing*
- a positive correlation of *affiliation* and (B) *accommodating*
- a positive correlation of *aggression* and (A) *competing*
- a positive correlation of *dominance* and (A) *competing*

Whereas for both, *aggression* and *dominance*, also a negative correlation was found with (B) *accommodating* (for an extensive overview of the respective study findings see FIGURE A3.2 in the appendix). Furthermore, Terhune (1970) reported that *"characteristics as aggressiveness, dominance or suspiciousness tended to escalate conflict"* (Utley et al., 1989).

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[52] The five personality factors are: *extraversion, openness-to-experience, conscientiousness, agreeableness,* and *neuroticism.*

[53] In 1938, H. A. Murray published "*Explorations in personality"* Murray (1938) describing personality in the form of needs. A list of these needs can be found in FIGURE A3.2 in APPENDIX A3.

[54] Except for selective conclusions, the study conducted by K. W. Terhune (1970) was not available.

The recent shift of personality research towards the five-factor theory is similarly reflected by several research studies linking conflict styles to the **Big Five** (Ahmed, Nawaz, Shaukat, & Usman, 2010; Antonioni, 1998; Komarraju, Dollinger, & Lovell, 2012; Ma, 2005; Moberg, 2001; Park & Antonioni, 2007; Wood & Bell, 2008). While not all findings of the six analysed studies are coherent, the following congruent findings could be extracted:

- a negative correlation of *agreeableness* and (A) *competing*
- a positive correlation of *agreeableness* and (B) *accommodating*
- a positive correlation of *extraversion* and (A) *competing*

Interestingly, the significant findings on the correlation of *extraversion* and (B) *accommodating* contradict each other (see Komarraju et al., 2012; Wood & Bell, 2008). While only observed by Ma (2005), *openness-to-experience* can have a positive correlation with (A) *competing*, which is particularly interesting in the context of the Entrant behaviour (for an extensive findings overview of the analysed studies please see FIGURE A3.3 in the appendix).

Abstracting the above findings, I have extracted three main personality trait categories to serve as fundamental pillars for the formulation of research propositions. These are (i) *conflict-seeking traits* (aggression, dominance), (ii) *harmony-seeking traits* (affiliation, agreeableness), and (iii) *action-seeking traits* (extraversion, openness-to-experience). Especially the distinction between (i) conflict-seeking and (iii) action-seeking – while coherently correlated with (A) *competing* and (B) *accommodating* – is sensible in the context of analysing Incumbent versus Entrant behaviour.

III. 2 Formulation of Research Propositions

The propositions formulated in this section as well as the personality dimensions they are referring to are based on the conclusions from CHAPTER II and the previous paragraphs (SUB-SECTION III.1.2). Propositions are higher-level conceptions of regularities synthesising more granular, supporting hypotheses. While the hypotheses support the respective propositions, they are not an identical representation of those. Accordingly, the objective of formulating propositions is to make the collection of hypotheses more graspable (see TABLE 3.1 at the end of this section for an overview of the propositions and their respective hypotheses).

Before formulating the respective propositions, the respective (i) conflict-seeking, (ii) harmony-seeking, and (iii) action-seeking personality dimensions are described in more detail to establish a sound and uniform understanding. The (ii) harmony-seeking traits are taken from the a six-factor model, in accordance to the suggestion of recent cross-cultural and –lingual research to define personality by a six-factor (instead of the five-factor) model. This six-factor HEXACO model was introduced by Ashton, Lee, Perugini et al. (2004). The additional *honesty-humility* scale is a empirically and theoretically valid addition to the model (Ashton & Lee, 2005, 2007; Ashton, Lee, & Goldberg, 2004). Furthermore, Hilbig, Zettler, Leist, and Heydasch (2013) point out that the addition of the sixth scale distinguishes behaviours to be re-active (agreeableness) or pro-active (honesty-humility). Accordingly, the applied harmony-seeking traits include both, agreeableness and honesty-humility. Affiliation, on the other hand, was excluded from the final set of harmony-seeking traits. The rationale is that Murray's list of needs only represented a *"rough, preliminary plan"* (Murray, 1938) and personality research is meanwhile aware of the limitations of alphabetical lists (Costa & McCrae, 1988), e.g., the fact that they do not reduce complexity of information about traits (Buss & Finn, 1987).

The (i) **conflict-seeking dimensions** *aggression* and *dominance* are characterised as follows:

AGGRESSION[55] Typical behaviour involves forcefully overcoming/attacking or controlling opponents, taking revenge, punishing or injuring them. Individuals scoring high on this scale are being easily provoked, while more likely to provoke themselves as well. They also embody a propensity to violent behaviour.

Aggressive behaviour is often distinguished between physical and non-physical (e.g., verbal or social) aggression and potentially other sub-dimensions (e.g., anger or hostility).

DOMINANCE[56] Typical behaviour includes the urge to control, influence or direct another individual's environment. This may involve forceful, dominant, persuasive, assertive, sometimes aggressive, stubborn, bossy/authoritative behaviour.

Individuals scoring low on this scale are described as cooperative, humble, submissive, accommodating, easily led, conflict-avoidant, or obedient.

[55] As described by Murray (1938) and Buss & Perry (1992).

[56] As described by Catell (1973, 1957).

The (ii) **harmony-seeking dimensions** *agreeableness* and *honesty-humility* are described as:

AGREEABLENESS[57] Characterised as the factor most concerned with interpersonal behaviour expressing a pro-social orientation towards the group. Individuals are typically described as cooperative, patient, tolerant, likable, peaceful, mild, helpful, lenient, generous, gentle, and/or agreeable. Contrarily, low scorers are described as ill-tempered, stubborn, choleric, and/or quarrelsome. Absence of agreeableness is associated with a lack of concern for others.

The HEXACO model defines four sub-facets, namely, forgiveness, gentleness, flexibility, and patience.

HONESTY-HUMILITY[58] Similarly to agreeableness, this factor is associated with interpersonal behaviour. High scorers are described as sincere, trusting, honest, faithful/loyal, modest, unassuming, fair-minded. Low scorers are typically sly, greedy, pretentious, hypocritical, boastful, sceptical and/or pompous.

The equivalent HEXACO sub-facets are: sincerity, fairness, greed-avoidance, and modesty.

The (iii) **action-seeking dimensions** *extraversion* and *openness-to-experience* are defined:

EXTRAVERSION[59] Individuals are typically known to prefer social interaction, be outgoing, lively, extraverted, sociable, talkative, cheerful, and/or active. Contrarily, introverted individuals are described as shy, passive, withdrawn, quite, and/or reserved.

The HEXACO model defines four sub-facets: social self-esteem, sociability, social boldness, and liveliness.

OPENNESS-TO-EXPERIENCE[59] High scorers are described as intellectual, creative, unconventional, ironic, innovative. They typically have a high willingness to experience novelty. Contrarily, low scorers are typically shallow, unimaginative, and/or conventional and tend to emphasise riles, order and conformity. They also exhibit a difficulty to understand others' views.

The respective four HEXACO sub-facets are: aesthetic appreciation, inquisitiveness, creativity, and unconventionality.

[57] As described by Ashton & Lee (2007), Graziano & Eisenberg (1997), Barrick & Mount (1991), and Moberg (2001).

[58] As described by Ashton & Lee (2007) and Ashton & Lee (2005).

[59] As described by Ashton & Lee (2007) and Moberg (2001).

Whereas this study aims to investigate the impact of the outlined personality traits on the respective Incumbent or Entrant behaviour, the respective sub-facets will also be analysed for potential influences. This will be done while considering the fact that the number of variables increases quickly and results need to be interpreted with caution and tested for robustness (as discussed in detail in Sections V.1 and V.3).

III. 2.1 Effects of Personality Dimensions on Incumbent Behaviour

Chapter II described the influential market entry framework developed by Fudenberg and Tirole (1984) and the respective animal taxonomy for Incumbent behaviours. While this study focusses on competition with upward-sloping reaction curves[60] (i.e., price setting; see more detailed discussion in of strategic commitments in Section IV.1 and IV.2), the respective parameters investment type (*tough* versus *soft*) and Incumbent objective (*allow* or *deter* market entry) yield four distinct combinations, e.g., *soft* investment and *deter* entry (see Figure 3.3).

		Incumbent's Objective	
		allow entry	*deter* entry
Investment makes Incumbent	*soft*	**Fat Cat** (overinvest)	**Lean & Hungry** (underinvest)
	tough	**Puppy Dog** (underinvest)	**Top Dog** (overinvest)

Figure 3.3: *Taxonomy model* for upward-sloping reaction functions as developed by Fudenberg & Tirole (1984)

The type of investment refers to the effect the investment has on his appearance towards competitiveness in the post-entry period. Investment into cost reduction is a typical example for a tough investment, as it signals the potential Entrant a readiness to lower prices post-entry (and deters entry). Thus, an investment into a tough measure as cost reduction signals readiness for conflict. A soft investment, on the other hand, is exemplified by investment into differentiation. Investing into differentiation signals the Entrant a low incentive to lower prices

[60] The rationale for focussing on duopolies with upward-sloping reaction functions (typically represented by price setting competition) has several reasons. First, incorporating downward-sloping markets to this research project would imply going beyond the scope of a dissertation thesis and/or an experimental study. Second, the developed propositions are especially intriguing in the downward-sloping markets, since conflict- or harmony-seeking personality dimensions are hypothesised to affect behaviour so that Incumbent firms deviate from theoretical frameworks or rationally ideal behaviours. Third, including both types of competitions in the experimental study would i) either imply subjects to compete in both types of markets (which, given the limited exposure to microeconomics and/or game theoretical settings, would risk the overall comprehension), or ii) increase the participant size by a factor of two (which would be difficult given this study's budget constraints).

post-entry (hence, encourages entry). Accordingly, a soft investment, which represents a win-win situation, is linked to a harmony-focussed behaviour.

Depending on the respective circumstances (i.e., one of the four combinations), the 'consistent' Incumbent investment behaviour can be to invest (heavily) or not invest at all into the given investment opportunity. For instance, given the Incumbent wants to encourage market entry and the investment opportunity is cost reduction (i.e. *tough*), then the decision should be to not invest at all (or underinvest). Should the Incumbent – 'wrongly' – (heavily) invest (into cost reduction), this would signal the Entrant a less attractive market to enter and, hence, deter entry (i.e., resulting in not meeting the objective).

III. 2.1.1 Conflict-seeking Personality Dimensions

In line with the findings from the previous SUB-SECTION III.1.2, we hypothesise that Incumbents with high conflict-seeking personality traits tend to invest into conflict-oriented measures (i.e. *tough* investments). Based on the respective objective, this can either hinder or reinforce a 'consistent' investment decision. Furthermore, Incumbents with high conflict-seeking traits are hypothesised to be more reluctant to invest into win-win investments or investments that make themselves soft in the post-entry period, as they typically show very low concern for others (Utley et al., 1989). Again, depending on the context the specified investment behaviour can either fortify or prevent a 'consistent' investment decision. These hypotheses are coherent with the findings by Terhune (1970), who reported that individuals with conflict-seeking traits (i.e., *aggressiveness* and *dominance*) "*tend to escalate conflict*".

PROPOSITION ***P1***: *Conflict-seeking personality traits hinder Incumbents to select the best available strategy when the objective is to allow market entry and reinforce their best-strategy selection when the objective is to deter entry.*

The underlying hypotheses for this proposition are outlined in TABLE 3.1 at the end of this chapter. Empirically, both conflict-seeking dimensions will be assessed as well as their respective sub-dimensions (or sub-facets).

III. 2.1.2 Harmony-seeking Personality Dimensions

Harmony-seeking personality traits, *agreeableness* and *honesty-humility,* are the dimensions most concerned with interpersonal relationships and described as one's tendency to be pro-social, cooperative, considerate and generous (Barrick & Mount, 1991; John & Srivastava, 1999). A study by Graziano, Jensen-Campbell, and Hair (1996) reported that high-agreeable

individuals preferred negotiation over power assertion. Accordingly, we hypothesise that Incumbents with high scores on harmony-seeking personality dimensions are reluctant to invest into conflict-oriented measures (i.e., *tough* investments). Furthermore, those Incumbents are believed to prefer investing into mutually advantageous, win-win measures (i.e., *soft* investments). As exhibited by the animal taxonomy in FIGURE 3.3 before, depending on the respective objective regarding market entry (*deter* vs. *allow*), this can either fuel or prevent an Incumbent to make a 'theory-consistent' investment decision.

PROPOSITION ***P2***: *Harmony-seeking personality traits hinder Incumbents to select the best available strategy when the objective is to deter market entry and reinforce their best-strategy selection when the objective is to allow market entry.*

III. 2.1.3 Emotionality-loaded Personality Dimensions

The action-seeking personality dimensions are purposely omitted in the context of Incumbent behaviour, as the Incumbent is already fully involved in the 'actions' of the market entry game (already active within the market, about to make the investment decisions, and will be active in the post-entry period in any case). Thus, action-seeking traits are hypothesised to not have any significant impact on the investment behaviour itself.

The HEXACO dimension *emotionality,* however, is per definition an potential trait to drive irrational decision making. It should be pointed out that *emotionality* in the HEXACO framework is pejorative term than *neuroticism* (or *emotional instability*) as defined by the Big Five framework (Ashton & Lee, 2007). The respective definition is described as:

EMOTIONALITY[61] Individuals with high scores on this dimensions are typically characterised as emotional, oversensitive, empathetically concerned, sentimental, anxious, fearful, emotionally attached and/or vulnerable. Low-scorers are described as being brave, tough, independent, emotionally detached from others, self-assured, and/or stable.

The respective four HEXACO sub-facets are: fearfulness, anxiety, dependence, and sentimentality.

Especially, the sub-dimensions *fearfulness* and *dependence,* seem prospective in the context of market entry, where the Incumbent's profits are (partly) dependent on the Entrant's decision

[61] As described by Ashton & Lee (2007) and Ashton & Lee (2005).

(e.g., Entrant has to enter the market if *allowing* market entry is the objective). Individuals with high scores on the respective scales potentially overinvest in respective measures to ensure the Entrant makes the 'right' – according to the Incumbent – decision.

PROPOSITION ***P3***: *Strongly pronounced emotionality sub-traits impact the magnitude of the Incumbents' investment decisions positively in the context of potential market entry.*

III. 2.2 Effects of Personality Dimensions on Entrant Behaviour

Before formulating the propositions for the Entrant behaviour, this paragraph briefly reflects upon the context of the Entrant's decision making. The Incumbent taxonomy model exhibited by FIGURE 3.3 above focusses on the Incumbent behaviour. Specifically, the dimension of the Incumbent's objective (*deter* or *allow* entry) is not of concern for the Entrant (who, as a matter of fact, is not aware of it). Contrarily, the second dimension, the type of investment (*soft* or *tough*), is very relevant for the Entrant – that is, the investment's implications. While the respective market models and investment types are described in detail in CHAPTER IV, the principal implications of the investment are broached in the next paragraph to provide the required background for the formulation of propositions.

The *tough* Incumbent investment opportunity, which is observed by the Entrant before his entry decision, is represented by foregoing monopoly profits by pricing below the profit-maximising monopoly price: $p^{actual} < p^{m}$. Since the underlying unit costs are private information, this market entry model involves some uncertainty with regards to the observations. The Incumbent action is not binding (for the post-entry period) and 'merely' represents a signalling (please note, that this is a costly signal and therefore credible). Contrarily, the *soft* investment represents an investment into a form of product differentiation, here, embodied by a shift of a capacity percentage x to a new market. Correspondingly, the Entrant – when making his entry decision – is *fully aware* of the binding consequences on the profits for period 2. According to the two investment types and their different implications, the following Entrant propositions are formulated for the respective market entry situation (i.e., *signalling* or *complete information*).

As discussed in detail in CHAPTER II, game-theoretic literature has investigated entry behaviour in the context of *confidence* (Bolger et al., 2008; Cain et al., 2015) or *self-esteem*

(Charness et al., 2011). However, except for the study conducted by Bergstrom et al. (2016), who investigated the Big Five and MBTI dimensions, no other research – to the best of our knowledge – has been conducted on Entrant behaviour and personality traits. While their study did not find any significant relation between Entrant behaviour and the Big Five, it will be very insightful to verify these findings and assess the implication of availability of information. Accordingly, the propositions were extracted from the above findings on conflict behaviour and personality research in general.

III. 2.2.1 Market Entry Behaviour in the face of Signalling Investments

As described above, the Incumbent sets a price in the pre-entry entry period, which the Entrant observes. While only the personal unit costs are known (and homogeneous products are sold by both firms), the Entrant cannot infer the Incumbent's unit costs from his pre-entry price with certainty. Thus, the remaining uncertainty leaves room for (different) interpretation. We hypothesise that, while the observed pricing behaviour certainly plays a role, conflict-seeking personality traits will drive market entry nonetheless, as those traits "*tend to escalate conflict*" (Terhune, 1970).

PROPOSITION ***P4***: *Beyond the Incumbent's signalling, conflict-seeking personality traits drive market entry positively when facing remaining uncertainty.*

The respective supporting hypotheses are listed in TABLE 3.1 at the end of this section. Also, we expect harmony-seeking personality traits not to have any impact on entry behaviour beyond the observed pre-entry price. The rationale is that especially *honesty-humility* is described as honest, unassuming, and trusting. Hence, an Entrant scoring high on this trait is not expected to react with scepticism, but rather trusts that the price was honestly set.

Furthermore, action-seeking personality dimensions, which are described as preferring social interaction and a high willingness to experience novelty, are believed to positively drive market entry beyond the observed price in the pre-entry. These are especially relevant for the Entrant role, as a non-entry (or stay-out) decision implies no participation in the post-entry period, i.e. no further action in the game. Therefore, action-seeking individuals are expected to enter the market more often in the context of remaining uncertainty with regards to pre-entry signalling.

PROPOSITION ***P5***: *Beyond the Incumbent's signalling, action-seeking personality traits drive market entry positively when facing remaining uncertainty.*

III. 2.2.2 Market Entry Behaviour in the face of Complete Information

The second market entry model (i.e., *soft* investment) represents a market entry decision while the Entrant is fully aware of the implications of the preceding investment on profits for both players in period 2. Assuming that both firms set post-entry prices according to the Nash Equilibrium, for any foregoing Incumbent investment x and respective entry costs A_{Ent} an 'appropriate' market entry response $E(x, A_{Ent})$ can be calculated, with $E(x, A_{Ent}) = \{0,1\}$. Hence, all entries that are observed in the dyads[62], can be classified as '*NE-rational*' or '*NE-irrational*'. Likewise, all decisions to stay-out can be classified as '*NE-rational*' or '*NE-irrational*'. Respectively, it is interesting to investigate whether personality influences *NE-irrational* entries or stay-outs. As mentioned, the investment threshold of the Incumbent determines how an entry decision is classified. While the detailed derivation and explanation of this threshold follows in CHAPTER IV, the predicted default behaviour for participants can be defined based on the investment magnitude (i.e., whether it is above the threshold or below).

In that context, we hypothesise that action-seeking personality dimensions potentially positively drive *NE-irrational* entry decisions. In that sense, scoring high on action-seeking personality dimensions can hinder the Entrant to choose the best available strategy, i.e. not to enter the market as the preceding investment suggested – assuming Nash Equilibrium play in the second stage – that an entry is not worthwhile.

PROPOSITION ***P6***: *Despite full awareness of the investment's implications on profits, action-seeking personality traits drive market entry positively, potentially hindering them to select the best available strategy.*

III. 2.3 Overview of Research Propositions

TABLE 3.1 summarises the formulated propositions along with the supporting hypotheses. The overview is structured along the respective Incumbent and Entrant roles in the market entry game. The underlying hypotheses are empirically assessed, analysed, and discussed in CHAPTER V.

[62] I.e., paired participants in one market entry game.

Domain	*Propositions* & Supporting Hypotheses
Incumbent behaviour	***P1*** ***Conflict-seeking personality traits hinder Incumbents to select the best available strategy when the objective is to allow market entry and reinforce their selection of the best available strategy when the objective is to deter entry.***
	H1.1: Aggression & dominance endorse 'theory-deviating'[a] decisions when facing a ***tough*** investment opportunity and **allowing** market entry is the underlying objective.
	H1.2: Aggression & dominance endorse 'theory-deviating'[a] decisions when facing a ***soft*** investment opportunity and **allowing** market entry is the underlying objective.
	H1.3: Aggression & dominance affirm 'theory-consistent'[a] decisions when facing a ***tough*** investment opportunity and **detering** market entry is the underlying objective.
	H1.4: Aggression & dominance affirm 'theory-consistent'[a] decisions when facing a ***soft*** investment opportunity and **detering** market entry is the underlying objective.
	P2 ***Harmony-seeking personality traits hinder Incumbents to select the best available strategy when the objective is to deter market entry and reinforce their selection of the best available strategy when the objective is to allow entry.***
	H2.1: Honesty-humility & agreeableness endorse 'theory-deviating'[a] decisions when facing a ***tough*** investment opportunity and **detering** market entry is the underlying objective.
	H2.2: Honesty-humility & agreeableness endorse 'theory-deviating'[a] decisions when facing a ***soft*** investment opportunity and **detering** market entry is the underlying objective.
	H2.3: Honesty-humility & agreeableness affirm 'theory-consistent'[a] decisions when facing a ***tough*** investment opportunity and **allowing** market entry is the underlying objective.
	H2.4: Honesty-humility & agreeableness affirm 'theory-consistent'[a] decisions when facing a ***soft*** investment opportunity and **allowing** market entry is the underlying objective.
	P3 ***Strongly pronounced emotionality sub-traits impact the magnitude of the Incumbents' investment decisions positively in the context of potential market entry.***
	H3.1: Dependence reinforces 'theory-consistent'[a] investing behaviour when the decision maker is dependent on the opponent to enter the market (i.e., **allowing** market entry is the underlying objective).
	H3.2: Fearfulness amplifies 'theory-consistent'[a] investing behaviour as the decision maker fears standard behaviour might not be enough (to **allow** or **deter** market entry).
Entrant behaviour	***P4*** ***Signalling setting: Beyond the Incumbent's signalling, conflict-seeking personality traits drive market entry positively when facing remaining uncertainty.***
	H4.1: The opponent's signal (i.e., price in pre-entry period) impacts market entry decisions negatively.
	H4.2: Aggression & dominance impact the market entry decision positively.
	[**H4.3:**] Honesty-humility & agreeableness have no impact on the entry decision.
	P5 ***Signalling setting: Beyond the Incumbent's signalling, action-seeking personality traits drive market entry positively when facing remaining uncertainty.***
	H5.1: The opponent's signal (i.e., price in pre-entry period) impacts market entry decisions negatively.
	H5.2: Openness-to-experience & extraversion impact the market entry decision positively.
	[**H5.3:**] Honesty-humility & agreeableness have no impact on the entry decision.
	P6 ***Complete information setting: Despite full awareness of the investment implications, action-seeking personality traits drive entry positively, potentially hindering them to select the best available strategy.***
	H6.1: The preceding investment (i.e., capacity shift) impacts market entry decisions positively.
	H6.2: Openness-to-experience & extraversion impact market entry decisions positively.
	H6.3: Entries: Openness-to-experience & extraversion drive 'NE-irrational'[b] market entry decisions positively.

a) Based on the market entry framework by Fudenberg & Tirole (1984)

b) Assuming Nash-Equilibrium play and profits in post-entry period

TABLE 3.1: Overview of research propositions & supporting hypotheses

IV DEVELOPMENT & IMPLEMENTATION OF EXPERIMENT

This chapter's goal is to present the experimental foundation of this research project. Hence, the following sections describe the development of the respective market entry models – with *soft* and *tough* investments (SECTIONS IV.1 and IV.2, respectively). Subsequently, in SECTION IV.3, I specify the applied methodology to test the selected personality dimensions, followed by the implementation of the experiment in SECTION IV.4. Closing, I summarise in SECTION IV.5 the statistical considerations in the design of this experimental setup.

Before commencing with the conception of the market entry model with a soft-making investment opportunity, I briefly introduce the structure of a typical market entry deterrence game, which is also applied in this experimental study. The following illustration is based on the entry deterrence game described by Tingley and Walter (2011).

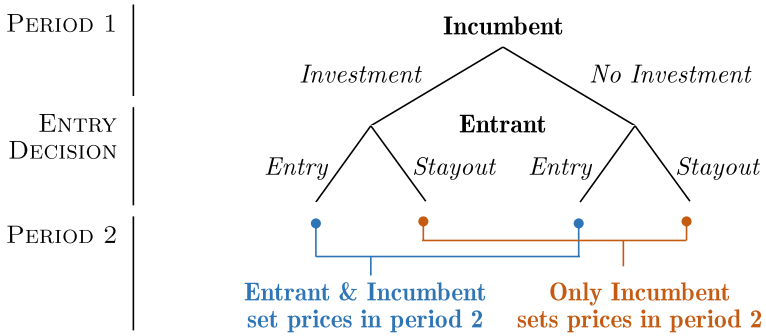
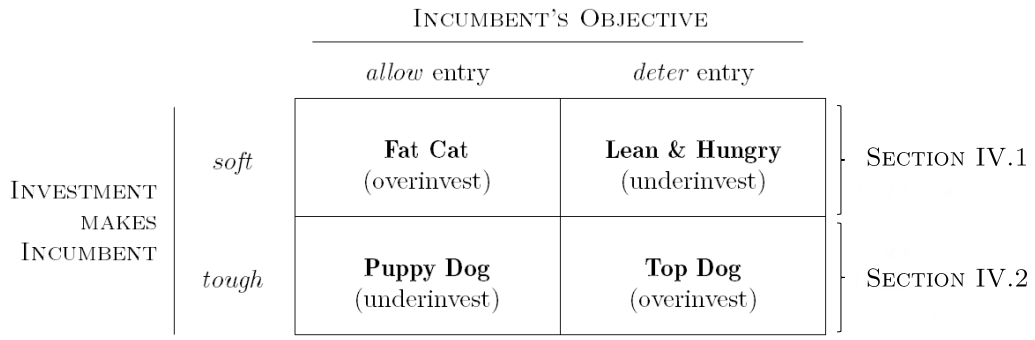


FIGURE 4.1: Structure of market entry games applied in this experimental study

After the Incumbent made his decision on whether to invest or not in the pre-entry period (i.e., period 1), the Entrant makes his entry decision. Please note, that the above figure is a simplified illustration, since the Incumbent cannot only decide whether to invest or not, but also how much to invest. Secondly, the underlying taxonomy framework by Fudenberg and Tirole (1984) – as illustrated by the below recap of FIGURE 3.3 – induces another factor, which is omitted in the above game structure. Namely, whether the Incumbent's objective is to *allow* or *deter* the market entry. As described in Chapter II, it can be advantageous for the Incumbent to allow the market entry in several contexts. Therefore, the experimental setup induces both scenarios (allow and deter market entry) by informing the Incumbent at the beginning of each game about her objective as well as incentivising her accordingly (as participants are expected to naturally assume that deterring entry is more beneficial than allowing entry). The following sections will describe the operationalisation of this incentivisation in detail.



Recap Figure 3.3: *Taxonomy model* by Fudenberg & Tirole (1984)

As indicated in the above figure, the following sections (IV.1 and IV.2) describe each the market models for a soft and tough investment. Both sections follow the same structure.

IV. 1 Conception of the Market Entry Model with a Soft Investment

Before being able to investigate the aforementioned hypotheses, a corresponding market model is required, which embodies the essential characteristics of the respective market in an experimental environment. The following paragraphs will define the overall model requirements, describe the characteristics of the model, quantify the respective parameters for the experimental study, give an overview of the information structure within the model, and describe the incentivisation and compensation scheme.

IV. 1.1 Definition of Model Requirements

By definition, a model represents a compromise – a compromise between its degree of reality replication and complexity reduction. Stachowiak (1973) describes the fundamental properties that define a model[63]:

- *Mapping* describes the characteristic that a model has to be a *replication of something* (i.e. the original). The originals mostly embody conditions in the real world, however, can also be of artificial nature or be models themselves.
- *Reduction* refers to the fact that models are not composed of *all*, but only *all relevant attributes* – according to the model creator.

[63] Stachowiak (1973) authored his work in German. The corresponding original terms of the properties are: Abbildungsmerkmal, Verkürzungsmerkmal, and pragmatisches Merkmal.

- *Pragmatism* states that a model is developed to serve a *specific purpose*, and is, hence, not to be uniquely assigned to its original. Furthermore, the model should be understood as a model for *someone*, for a specific *time-frame*, and with a *purpose*.

In the context of this research project, the superordinate property, leading the model development, is the latter mentioned *pragmatism*. Notably, the purpose of the model and the target group, which in this case are the participants of the experimental study. Ensuing, the main challenge of the model development is to find an accurate balance between the model's *mapping* and *reduction* properties, which function contrarily. A higher weight on *mapping* leads to a more realistic or accurate representation of the original, while reducing the model's *reduction* features. A higher focus on *reduction*, however, yields a broader applicability of the model as well as a higher comprehensibleness of the (target) audience. The latter one being especially relevant for this model's *purpose* – being developed for the experiment participants. This means, limiting any potential additional effects resulting from non-essential model properties. Furthermore, it is important for the model to be derived from and supported by relevant literature and theory, and not to be completely independently created.

In line with the developed hypotheses described in the previous chapter, the focus of this study is to investigate the Incumbent and Entrant behaviour. Respectively, the Incumbent's behaviour in the context of a potential market entry and the Entrant's behaviour after the Incumbent's possibility to make an investment, which makes the Incumbent appear *soft*. Fudenberg and Tirole (1984) have developed a market model themselves in their animal taxonomy paper, which will serve as the reference for the model creation of this study.

Fudenberg and Tirole (1984) describe investigate their 'Advertising and Goodwill' model in the context of a *soft* making investment. Here, a customers can only buy from a company, if they know of its existence – achieved via ads that the Incumbent and Entrant can place in a newspaper. In the first period only the Incumbent is in the market, whereas the Entrant can observe the Incumbent's actions. In period 2, the Entrant may enter the market. The main assumption that Fudenberg and Tirole are making in this model is that customers that have read an ad in period 1, will not do so in period 2 – hence, buying from the Incumbent in the second period as well.

Although the model, naturally, illustrates the *fat-cat* and *lean-and-hungry-look* effects perfectly well, it is connected with some limitations with regards to its operationalization and implementation in an experiment, as will be explained in the following.

The underlying differentiated[64] Bertrand competition model features standard assumptions as differentiable revenues (concave with respect to its own price) as well as (marginal) revenues that increase with the competitor's price (Fudenberg & Tirole, 1984). Fudenberg and Tirole (1984) propose as a plausible exemplary model where goods are differentiated by their location on the unit interval with linear transportation costs – one of the more famous examples being Hotelling's linear city model, or just *Hotelling* model[65] (Hotelling, 1929).

The respective demand function for the two firms, located at points a and *(1-b)* on the unit interval [0;1], and linear transportation cost t (for the customer) is[66]:

$$Q_i(p_i, p_j) = \frac{(1-b)+a}{2} + \frac{p_j - p_i}{2t}$$

In case that customers are only aware of the Incumbent (i), the demand is defined as $Q_i(p_i, \infty)$, i.e. as if the Entrant firm (j) charged an infinitely high price. It is needless to point out that the *Hotelling* model was not designed to accommodate such assumptions, or, to model a monopoly market. One would have to make major assumptions regarding the market demand of the linear city duopoly – without the second firm being present. Thus, the *Hotelling* model was used to define the market dynamics of the duopoly, however, not these of a potential monopoly (i.e. the fraction of customers that is only informed of one firm).

Accordingly, the model mentioned by Fudenberg and Tirole (1984) was partly alternated, while its main properties were maintained. These essential model properties for the market are:

- Product heterogeneity (i.e. differentiated)
- Strategic complements (i.e. companies compete on prices – simultaneous setting)
- 2 Periods – Entrant to decide whether to enter for second period
- Incumbent can make observable (*soft*) investment in the first period

[64] There are two types of product differentiation – horizontal and vertical product differentiation. The one referred to above and throughout this chapter is horizontal product differentiation. Effectively, customers would have product preferences even if they were equally priced (e.g., cars, real estate, watches, or famously Coca-Cola vs. Pepsi).

[65] In the *Hotelling* model, both firms differentiate their products by their (store) location, whereas the customers incur transportation costs (reducing their utility the product). Customers are distributed evenly along a street (i.e. linear city) on the unit interval. Firms would simultaneously choose the location in period 1, followed by simultaneous price setting in period 2. Since the strategic choice of location is not relevant for this research, the focus will lie on the simultaneous price setting, whereas the predefined location represents the product differentiation.

[66] For a more detailed derivation of the demand function please refer to other literature as, for example, Shum (2011).

In line with Stachowiak's (1973) *reduction* attribute, the above list excludes any non-essential properties for the market model, while retaining all necessary characteristics (*mapping*).

IV. 1.2 Description of Characteristics of the Market Model

The following paragraphs concretise the market characteristics defined along the guiding properties from the previous section. Firstly, this section will describe the overall market and game properties, followed by the specific Incumbent investment and its implications for Incumbent and Entrant profits.

IV. 1.2.1 Overall Game & Market Characteristics

The market entry game in this experimental study consists of two periods, whereas the Entrant makes his/her entry decision between both periods. In period 1, the Incumbent is the only player in the market and can make a certain investment (detailed in the next section). The Entrant observes the investment actions by the Incumbent and, subsequently, makes his entry decision for period 2. In case of entry, Incumbent and Entrant simultaneously compete on prices.

The overarching market characteristics underlying the described game properties include:

- Strategic commitments
- Number of competitors
- Product differentiation
- Cost structure

As mentioned in chapter 3, when the research hypotheses were defined, the adequate **strategic commitments** to this experimental study are strategic complements. In economic and game theoretic contexts, strategic complements represent the decisions that two or more players make (in order to compete with each other), if they mutually reinforce one another (Bulow et al., 1985). The equivalent opposite concept of strategic substitutes accordingly embodies decisions that mutually offset one another.

The mutual reinforcement of strategic complements can be best illustrated by the derivation and examination of the best response function (or reaction function) of each player[67].

[67] The reaction function is derived by taking the derivative of the firm's profit function and setting it equal to zero (while holding the other firms parameter variable constant). Solving for the firm's own parameter variable yields the reaction function dependent on the other firm's variable.

For strategic complements, the reaction functions for both firms are upward sloping (i.e., have a positive gradient). Although prices almost always represent strategic complements, this is not necessarily true in all cases (Bulow et al., 1985). Furthermore, quantities can also represent strategic complements – opposed to their usual effect of strategic substitution – as shown in the context of labour-managed firms (Ohnishi, 2012). Other examples of strategic complements include tax rates in the context of large tax cuts (Parchet, 2014), investments are product market choices affecting the future, i.e. *learning by doing* (Athey & Schmutzler, 2001), or investments in quality (Vives, 1990).

The strategic commitment chosen for this model are prices, as they represent the most common form of strategic complements and are also applied in the model described by Fudenberg and Tirole (1984). Markets where firms compete on prices are referred to as Bertrand competition – a market model developed by Joseph Bertrand (1883).

The **number of competitors** in this market is limited to two – an Incumbent that is in the market already and a potential Entrant that may decide to enter that market. A market entry situation could potentially also involve more Incumbents or Entrants. In order to limit any noise from undesirable strategic or tactical side effects, the underlying oligopoly form is a duopoly. Furthermore, in addition to the underlying model by Fudenberg and Tirole (1983c), previous theoretical research on entry deterrence (Bagwell & Ramey, 1996; Dixit, 1980; Ware, 1984) and experimental research (Andersson, O. & Holm, H. J., 2010; Brandts et al., 2007; Mason & Nowell, 1998) investigate market entry behaviour in the context of two firms competing against each other.

Naturally, in the pre-entry period where the Incumbent is the only firm in the market, the market form is a monopoly. The assumption $p^m > p^{NE}$ holds true for the respective profit-maximising prices for both market forms (where p^m represents the monopoly price and p^{NE} the price level at the Nash Equilibrium).

In the Bertrand duopoly, Incumbent and Entrant set prices simultaneously. Opposed to the original Bertrand assumptions of homogenous products (Bertrand, 1883), this market model sells **heterogeneous products** (Fudenberg & Tirole, 1984). Such variation is also known as a differentiated Bertrand market. The respective type of product differentiation applied in this

model is horizontal product differentiation[68]. As explained above, the *Hotelling* model with linear transportation costs served as the underlying demand characterisation model. While the *Hotelling* model investigates how firms differentiate their products (by positioning themselves along the linear unit interval in the first period), this study pre-defined the respective firm locations symmetrically, so that locations a and b were equal[69]. The resulting demand function for firm i is

$$Q_i(p_i, p_j) = \frac{1}{2} + \frac{p_j - p_i}{2t},$$

where t represents the linear transportation costs. Alternatively, it can also be displayed as

$$Q_i(p_i, p_j) = \alpha + \beta(p_j - p_i),$$

where α represents half of the market's demand and $\beta = \frac{1}{2t}$ the inversed linear transportation costs, or, the translated effect of a price change on the firms' demand. Accordingly, the derived demand function fulfils the property of horizontal product differentiation in a Bertrand market – existing demand for both products at the same price level, that is.

Another assumption of the (differentiated) Bertrand market are **equal constant unit costs** (Bertrand, 1883). While Fudenberg and Tirole (1984) include fixed costs in their model, they are one-off costs detached from production volume and do not affect the *fat*-cat or *lean-and-hungry-look* effects (from over- or underinvesting, respectively). Thus, the model assumes constant marginal costs. In order to further limit the model's complexity as much as possible (*pragmatism*), the model applies the simple case of constant marginal costs being equal to zero (for both firms). Excluding any costs limits any potential of misinterpretation of its impact by participants, while fulfilling the essential cost structure implications from the original model.

IV. 1.2.2 Incumbent Investment & Profit Implications

In the first period, the Incumbent is the only active player in the market, while the Entrant observes his actions. In this case, the actions are the opportunity to make an investment (and

[68] Products are horizontally differentiated if customers have different preferences at equal price levels (e.g., Coca-Cola vs. Pepsi). Vertical product differentiation refers to an objective ranking of products, i.e., when products are priced equally, customers agree on which is the more preferred product (e.g., Economy vs. Business Class ticket).

[69] The underlying rationale for setting the strategic location parameters equal is that none of the firms should have an unjustified advantage (as overall payoffs would be higher for one firm if *a≠b)*. While it can be argued that the Incumbent firm typically has a strategic advantage (e.g., economies of scale or knowledge) and accordingly also yields higher profits, this could lead to undesired side effects in an experimental study (where roles are assigned by chance). Participants might feel treated unfairly and make decisions biased by these subjective perceptions. In our view, a symmetric setup eliminates these potential effects and thus simulates original conditions more realistically.

if so, how much). The following paragraphs will compare the investment type as described by Fudenberg and Tirole (1984) with the slightly adapted investment defined for this experiment, including their respective implications on firms' payoffs.

The main property of the Incumbent investment is that it makes him appear *soft* – that he appears to have less incentive to compete aggressively in the second period, that is. Fudenberg and Tirole describe an *Advertising* model, where customers can only buy the product if they are aware of it. Since their crucial assumption defines that customers do not read ads twice, by investing in advertising in period 1, the Incumbent can create a captive market of consumers and charge the monopoly price. As mentioned in the above section $p_K^m > p_{1-K}^{NE}$ which makes the Incumbent more *soft* in period 2 (less incentivised to set a low price) as the Entrant competes with the Incumbent in the remaining market $(1-K)$. Accordingly, the higher the investment $A(K)$[70] or the fraction K of the market, the higher the incentive for the Incumbent to set a higher price (as compared to the profit-maximising Nash Equilibrium price p^{NE}), also written as

$$\frac{\partial p_{Inc}^*}{\partial K} > 0,$$

where p_{Inc}^* is the profit-maximising price of the Incumbent. This is the essential property of the *fat-cat* effect (Fudenberg & Tirole, 1984), since in a differentiated duopoly the Entrant's profits increase with the Incumbent price,

$$\frac{\partial \Pi_{Ent}}{\partial p_{Inc}} > 0.$$

In the adapted model for this experiment, the Incumbent investment is not in advertising but market expansion (shifting a fraction C of the capacity to a new market, where the Incumbent would be the only firm). It is important to note, that the properties explained above remain in this model. Accordingly, the investment makes the Incumbent *soft* for period 2, since $p_{new}^m > p_{old}^{NE}$. The respective investment cost function $A(C)$ is also convex.

The adaptation of the investment properties does not affect the investment implications on the **Incumbent profits**, as the Incumbent's profits for period 2 (in case of entry) are

[70] Where the cost function $A(K)$ is convex, with $A(1) = \infty$.

$$\Pi^{E}_{Inc} = \gamma\, R_{Inc}(p_{Inc}[;\infty]) + (1-\gamma)\, R_{Inc}(p_{Inc}; p_{Ent}),$$[71]

where γ represents customer fractions K or C, for the *Advertising* or *Market Expansion* models respectively. In the *Advertising* model, the demand for the captive market K is defined as $D_{Inc}(p_{Inc}; \infty)$, whereas the adapted *Market Expansion* model simply uses a new market, which is a monopoly with demand $D_{Inc}(p_{Inc})$.

For the **Entrant profits** in period 2, however, affected by the model alternation. While the *Advertising* model decreases the market size by K,

$$\Pi^{E}_{Ent} = (1-K)\, R_{Ent}(p_{Inc}; p_{Ent}),$$

the opposing *fat-cat* effect has to offset the market shrinkage. While it is possible to find plausible examples for functions to fulfil these properties, the net effect on the Entrants profit (or the participants payoffs) are relatively small. The respective Entrant profit in period 2 in the *Market Expansion* model is correspondingly

$$\Pi^{E}_{Ent} = R^{old}_{Ent}(p_{Inc}; p_{Ent}),$$

where the Incumbents capacity shift C is only indirectly notable in the price setting behaviour by the Incumbent.

Summarising, TABLE 4.1 depicts an overview of the original *'Advertising & Goodwill'* model (Fudenberg & Tirole, 1984) as well as the adapted '*Market Expansion*' model for the experiment and their main characteristics.

[71] Note that $R_i(p_i; p_j)$ represents the respective revenues given prices p_i and p_j. Also, the superscript E denotes the case of entry.

Area	Characteristic	*"Advertising and Goodwill"*	*"Market Expansion"*
Overall Market Properties	Number of firms	*Monopoly/Duopoly* [E]	*Monopoly/Duopoly* [E]
	Type of product	*Differentiated*	*Differentiated*
	Competition	*Bertrand (Prices)*	*Bertrand (Prices)*
	while	$p^m > p^{NE}$	$p^m > p^{NE}$
	Costs	*Constant marginal; one-off fixed*	*Constant marginal*
Game Specifics	Periods	*1: Inc. invests, Ent. observes* *- : Ent. makes entry decision* *2: Inc & Ent. set prices* [E]	*1: Inc. invests, Ent. observes* *- : Ent. makes entry decision* *2: Inc & Ent. set prices* [E]
	Period 2	*Firms set one price (no discr.)*	*Firms set one price (no discr.)*
	Investment makes Incumbent appear …	*Soft* *(for play in period 2)*	*Soft* *(for play in period 2)*
Incumbent Investment	Type	*Advertising*	*Market Expansion (new market)*
	Description	*Reached fraction K of customers to represent monopoly in period 2*	*Shifted capacity C to new market where Incumbent is the only firm*
	Period 2 Properties	$p_K^m > p_{(1-K)}^{NE}$ $\frac{\partial p_{Inc}^*}{\partial K} > 0$	$p_{new}^m > p_{old}^{NE}$ $\frac{\partial p_{Inc}^*}{\partial C} > 0$
	Investment cost	*Costs A(K) are* ***convex*** *where A(1)=∞*	*Costs A(C) are* ***convex***
Resulting Profit Composition Period 2	Incumbent	$\Pi_{Inc}^{2\|E} = K\, R_{Inc}(p_{Inc}; \infty) + (1-K)\, R_{Inc}(p_{Inc}; p_{Ent})$	$\Pi_{Inc}^{2\|E} = C\, R_{Inc}^{new}(p_{Inc}) + (1-C)\, R_{Inc}^{old}(p_{Inc}; p_{Ent})$
	Entrant	$\Pi_{Ent}^{2\|E} = (1-K)\, R_{Ent}(p_{Inc}; p_{Ent})$	$\Pi_{Ent}^{2\|E} = R_{Ent}^{old}(p_{Inc}; p_{Ent})$

[E] *In case of entry* [NE] *Nash Equilibrium in Duopoly* [m] *Profit-maximising price in Monopoly* * *Combined, profit-maximising price*
R ≙ Revenue (dependent on prices set)

TABLE 4.1: Characteristics of the '*Advertising & Goodwill*' & '*Market Expansion*' models

It becomes visible that all essential properties from the original model were retained. The only alteration made is the type of investment and its respective implication on the period 2 profit composition of the Entrant. The rationale here is *pragmatism* – as the reduction does not affect the *fat-cat* or *lean-and-hungry-look* effects, while it significantly decreases the upside of the Entrant's profits (from the Incumbent's investment), or in this case, the participant's payoff.

IV. 1.3 Parameterisation of the Model

After having defined the overall market and game characteristics, the following section quantifies the parameter of the hitherto defined market model. The main objective of this parameterisation is to define a reasonable framework, which mirrors realistic market dynamics and avoids any unrealistic or extreme outcomes. The parameterisation applied experience from relevant literature, insights from the test run, and Stachowiak's pragmatism property. At the end of this section, TABLE 4.2 provides an overview of all defined parameters.

For the parameterisation of the market model it is not the absolute figures that are of importance, but their relative proportions. Specifically, the relative proportions of the following four elements of the derived model:

- Duopoly demand
- Monopoly demand (i.e., new market)
- Investment cost
- Entry cost

In order to keep the experiment graspable the co-domain (possible range of prices) has been defined single digit, i.e. $p_i \in [0.00, 9.00]$, as also seen in the duopoly experiment by Kübler and Müller (2002). Parameterising the **demand function of the duopoly** (as mentioned above),

$$Q_i(p_i, p_j) = \alpha + \beta(p_j - p_i),$$

is about defining the relation between α and β – since it also defines the Nash Equilibrium of the duopoly[72]. Since the Nash Equilibrium price has to fulfil $p^{NE} < p^m$ and their respective difference drives the *fat-cat* effect, the p^{NE}-defining proportion of α and β have been set so that the Nash Equilibrium price is located in the lower area of the co-domain. In this case

$$\frac{\alpha}{\beta} = \frac{10}{3},$$

which implies a Nash Equilibrium price $p^{NE} = 3.33$ for the duopoly, accordingly.

The **monopoly demand function** that the Incumbent will be facing in the new market,

$$Q(p_{Inc}) = \varepsilon - \lambda p_{Inc},$$

[72] The firms in the duopoly face symmetric demand curves. Hence, taking the first derivatives of their profit functions and setting the result equal to 0 yields the respective reaction functions. Due to symmetry, the other firm's price in the reaction function can be substituted with the own one, yielding the Nash equilibrium price $p^{NE} = \frac{\alpha}{\beta}$.

incorporates the parameters ε and λ, whose relation determines the profit-maximising price $p^m = \frac{\varepsilon}{2\lambda}$. Here, the profit-maximising price is preferred to be around the higher end of the co-domain. Since the profit function is concave, impact of price unit changes around the profit-maximising price point are relatively small. Thus, the parameters were chosen so that $p^m = 10$, so slightly outside the co-domain. The underlying relation of the parameters is equivalently

$$\frac{\varepsilon}{\lambda} = \frac{20}{1}.$$

In addition, an appropriate overarching **relation between the profits** of the duopoly (old market) and the monopoly (new market) needs to be set. The underlying reason is that the new market model simulates the monopoly demand $D_{Inc}(p_{Inc}; \infty)$ described by Fudenberg and Tirole (1984). Accordingly, (i) the total market size should not exceed the one of the duopoly market (i.e., 2α), while (ii) resulting in higher demand for any price level (assuming $p_i = p_j$). The former condition (i) translates into

$$2\alpha \geq \varepsilon - \lambda p_i\,, \qquad \text{or,} \qquad 2\alpha \geq \varepsilon\,,$$

when $p_i = 0$ for total monopoly market size. In this case, the relation was set to $2\alpha = \varepsilon$. The latter condition (ii) can be written as

$$\alpha < \varepsilon - \lambda p^{max}\,,$$

whereas $p^{max} = 9.00$ (maximum price that can be charged). Inserting additionally the previously defined parameter conditions $\frac{\alpha}{\beta} = \frac{10}{3}$ and $\frac{\varepsilon}{\lambda} = \frac{20}{1}$ equivalently gives

$$\frac{10}{33} < \frac{\lambda}{\beta}.$$

For simplicity, the equivalent relation has been set to $\frac{\lambda}{\beta} = \frac{1}{3}$, hence, fulfilling the above condition.

Furthermore, the **investment cost function** is parameterised in the following paragraphs. While the original model by Fudenberg and Tirole (1984) describes the cost function $A(K)$ as convex, with $A(1) = \infty$, the applied cost function $A(C)$ for this model is also convex, but with a concrete maximum value for $A(1)$. While $A(1)$ also represents a significantly high value, so that investing $A(1)$ results in a net negative outcome when compared to the conservative Nash Equilibrium play at $C = 0$,

$$\Pi_{Inc}^{NE}(C = 0) > \Pi_{Inc}^{max}(C = 1).$$

The equivalent convex investment cost function for the experiment, with dependence on capacity C, is

$$A(C) = 200C^2.$$

Lastly, the respective parameterisation conditions for the **entry costs** (for the Entrant) are derived. The entry cost is operationalised by defining an available budget, which the Entrant could spent or keep. The budget is equal to the respective entry cost $A(E)$. The underlying rationale for defining $A(E)$ is

$$\Pi_{Ent}^{NE}(C = 0) < A(E),$$

so that entry is not sensible when the Incumbent fully competes in the duopoly, i.e. $C = 0$. The capacity threshold C^T is at $C^T = 20\%$, as of which it is more profitable to enter the market.

The following table summarises the resulting parameterisation values employed for this experimental study (note: the above parameterisation proportions have been multiplied with a factor, in order to yield manageable values[73] in the experimental currency unit, henceforth *points*). The experimenter paid the participants based on the earned number of points (exchanged to the local currency at a fixed exchange rate).

Parameterisation	Elements	Defined Parameters
Market Dynamics	Duopoly demand	$Q_i(p_i, p_j) = 25 + 7.5(p_j - p_i)$
	Nash-Equilibrium	$p^{NE} = \frac{10}{3}$
	Monopoly profit	$Q(p_{Inc}) = 50 - 2.5p_{Inc}$
	Profit-maximising price	$p^m = 10$
Costs	Incumbent investment	$A(C) = 200\ C^2$
	Entrant entry costs	$A(E) = 100$
	Capacity threshold	$C^T = 20\%$
Initial Values	Incumbent budget	$B_{Inc} = 0$
	Entrant budget	$B_{Ent} = 100$

*Note: The respective unit for all parameters is **'points'** (except for Capacity)*

TABLE 4.2: Overview of parameterisation values for *soft* investment model

[73] Manageable implies that values were neither chosen to be very large nor very small (e.g., several decimal places). Furthermore, the factor ensured to align profits from both market entry games (with *soft* and *tough* investments respectively).

The utilisation of a fictional experimental currency unit (ECU), here *points*, is a popular method applied in several oligopoly experiments (Dufwenberg & Gneezy, 2000; Huck, Normann, & Oechssler, 1999; Offerman, Potters, & Sonnemans, 2002). Whereas Davis and Holt (1993) argue that very extreme exchange rates (e.g., 1000 ECUs equal 1 unit of local currency, e.g., Euro) supports a more accurate approximation of theory, Drichoutis, Lusk, and Nayga (2015) found no significant effect of exchange rate size. Nevertheless, a potential risk remains that participants might discretise the importance of their actions, as it, for example, 'only makes a difference of 0.50€'. Furthermore, it makes scalability much more flexible from the administrative point of view.

IV. 1.4 Information Structure of the Soft Investment Setting

This section describes the information structure of the *soft* investment game and, towards the end of this section, the means by which the information is presented. As for *which* information are disclosed, this section structures the information along three stages of the experiment:

- ex-ante information – information (un)available before the game
- ad interim information – information (un)available during the game
- ex-post information – information (un)available after the game

The relevant information is classified into one of the following categories, describing their respective availability (Athey & Bagwell, 2008): public information (available to all stakeholders), private information (available to a limited number of stakeholders), and unknown information (not available to any of the stakeholders). Since the derived market entry game involves only two player – the Incumbent and Entrant – private information will equivalently refer to information that is only available to either one of the players. Whereas duopoly studies evaluate the degree to what available information affects market dynamics and outcomes (Dolbear et al., 1968), it is not the focus of this research project. Hence, the purpose of the following section is to give a better understanding of the game (information) structure.

The **ex-ante availability** of information in this market entry setting simulates realistic market dynamics as much as possible. Hence, generally public information as market dynamics and demand are available, where typically private information as budgets are not available to every player. As discussed before, several studies investigate market entry behaviour in the context of perfect information (Brandts et al., 2007; Dixit, 1980; Ware, 1984), however, do not represent realistic market model assumptions (Dolbear et al., 1968). While this model

incorporates some assumptions implicating their respective information content to be publicly available (e.g., marginal or unit costs), remaining private information is kept limited. The following table exhibits all relevant ex ante information and their respective availability to the two market players (i.e., the respective participants).

Information Structure	**Information**	**Availability**
Market Dynamics	Number of players	*Public*
	Duopoly demand	*Public*
	Monopoly demand	*Public*
	Price co-domain	*Public*
	No price discrimination	*Public*
	Incumbent objective[a]	*Private*
Cost Structure	Fixed costs	*Public*
	Unit costs	*Public*
Initial Values	Incumbent budget	*Private*
	Entrant budget	*Private*
Game Structure	Opponent identity	*Unknown*
	Number of periods	*Public*
	Decision time per period	*Public*
	Excehange rate of points	*Public*

a) Whether the objective is to deter or allow market entry

TABLE 4.3: Ex-ante information availability of the *soft* investment market model

The table above presents all information available before the game has started. Once the game commences, there are further information given to the market players during the game. These **ad interim information** are essential for an interactive market model. Since the research focusses on the impact of personality dimensions on the market entry behaviour of the players, the respective information given during the *soft* investment game is limited to the very few information related to the investment signalling and entry response. The entry cost have been kept private in order to avoid potential forward induction affect some of the observations, as observed for example by Brandts et al. (2007). TABLE 4.4 provides an overview of the availability of the ad interim information.

Information Structure	Information	Availability
Period 1	Incumbent investment cost	*Public*
Post Period 1	Incumbent investment decision	*Public*
	Entrant entry cost	*Private*
Period 2	Entrant entry decision	*Public*
	Price setting	*Private*

TABLE 4.4: Ad interim information availability of the soft investment market model

Since the market model represents simultaneous price setting, price are private during the respective period (i.e. period 2). The prices are however crucial concerning the individual profits in period 2 and contribution to the overall profit of the game. Accordingly, the set prices are communicated after the game has been completed as part of **ex post information**. The following table equivalently reports the information supplied after the game has been completed. Overall game profits per player are private information as budgets or potential fines could imply a bias for games to follow.

Information Structure	Information	Availability
Period 2	Price set	*Public*
	Profit duopoly	*Public*
	Profit monopoly	*Public*
Overall Game	Overall game profit *(including budget, invests, & potential fines)*	*Private*

TABLE 4.5: Ex post information availability of the soft investment market model

Participants received the respective information via one (or several) of three applied means, namely, the on-screen computer software *z-Tree*, physical hand-outs including the demand curves as well as payoff tables (or matrices, used interchangeably in the following) for selected values, and a profit calculator in the form of an Excel sheet (see APPENDIX A2.3 for further detailed description).

While the use of the experiment software is indispensable for data recording and interactive information exchange (e.g., entry decision), the use of payoff tables and/or profit calculators have been widely discussed in experimental literature. Several oligopoly experiments have relied on the use of payoff tables (Andersson, O. & Holm, H., 2010; Bosch-Domenech & Vriend, 2003; Mason & Nowell, 1998; Tingley & Walter, 2011). The underlying rationale is evident – participants can quickly understand the implications of their decisions, especially participants unfamiliar with economic settings and experiments or from different study backgrounds. Other

papers (Altavilla, Luini, & Sbriglia, 2003; Davis, 2011; Huck, Normann, & Oechssler, 2000; Müller, 2006), in contrast, let participants choose their prices or quantities from finite grids (mostly in the form of profit calculators). They argue that payoff tables induce potential framing effects (as some strategies are never played) and, hence, lead to faster convergence (Ostmann & Selten, 2000), or, that multiple Nash Equilibrium arise (Holt, 1985). Contrariwise, Requate and Waichman (2011) conducted a Cournot duopoly experiment yielding 'indistinguishable' results between a payoff table and profit calculator[74].

Since convergence is not a central topic of this research and participants' comprehension of their actions has a high priority, the experimental design of this study incorporated both, the payoff tables (for quick understanding of the market dynamics) as well as the profit calculator (ensuring a continuous option space for price setting).

IV. 1.5 Incentivisation & Compensation of Participants

The main objective of participant incentivisation is to create a system, which induces realistic behaviour by participants. An appropriate incentive system has to comprise specific properties to fortify realistic participant behaviour. Smith (1976) developed his *induced-value methodology* stating that incentive systems need to embody two essential elements, (1) avoidance of saturation and (2) explicit incentives. The former (1) implies that a participant prefers a higher pay-out at any point during the experiment, in contrast to being satisfied with what they earned. Waiving upper pay-out limits or avoiding reciprocal knowledge of earnings are effective means to ensure saturation avoidance in the experimental design. The latter (2) embodies a causal connection of the incentives to the participants' actions and decisions. Accordingly, the previous section described that profits of each respective game are displayed to participants (so that participants can retrace their actions and resulting profits). Also, profits for each game are calibrated so that the incentives for the games are as similar as possible.

Furthermore, Almlund et al. (2011) and Cassar and Friedman (2004) point out a (3) third property referred to as dominance, meaning that the compensation has to be higher than any other potential preferences or motivations of the participants. Accordingly, the expected compensation for participation at the experiment was defined so that it reflects the current

[74] Interestingly, the addition of a best-response function to the profit calculator lead to the observation that aggregate output increased to the Cournot level and decreased tacit collusion (Requate & Waichman, 2011).

hourly wage for students[75] (Croson, 2005; Holt, 1995). As mentioned before, potential altruism can be limited by excluding information on competitors' profits (Cassar & Friedman, 2004).

Typically, the success-related compensation component (defined along the above pillars) is extended by a success-unrelated element, also known as the *show-up fee*. The rationale to incorporate this element is to (a) keep participants motivated for future experiments and (b) make sure participants are compensated partially for their time. The *show-up fee* was set at 3.00€ (since the expected compensation was set at 12.50€, the fixed element should not be too high). Correspondingly, the respective participant compensations (in the local currency Euro) are calculated as:

$$Compensation = 3 + \nu \sum_{g=1}^{4} (\Pi_i^g)^+ ,$$

where ν is the exchange rate and Π_i^g the profit for each game g played by role $i = \{Inc, Ent\}$ in that game[76]. Accordingly, the experimental design prevents cross-influences by different games (as, for example, risk averse participants might behave differently in latter stages of the experiment).

In the context of the underlying taxonomy framework by Fudenberg and Tirole (1984), this market entry game (*soft* investment) yields four different period 2 combinations based on the pre-defined objective of the Incumbent as well as the market entry decision. One of the original framework dimensions is the Incumbent's objective concerning the Entrant's entry (*allow* or *deter* entry). Since the Incumbent's objective is a pre-defined requirement for the framework, it has to be accordingly reflected in the experimental design. In order to induce a specific objective for each participant[77], we defined respective rules concerning the Incumbents' compensations. For the four different combinations in period 2, FIGURE 4.2 summarises the defined rules.

[75] As experiment duration was approximated at 75 minutes, the respective expected compensation was communicated at 12.50€ (which was slightly exceeded with an overall compensation average of 12.70€).

[76] Note that $(x)^+ = \max\{x, 0\}$.

[77] Participants are likely to differ in their natural objectives, i.e. altruistic individuals might favour market entry where subjects familiar with microeconomics might naturally conclude that deterring entry yields more favourable outcomes for themselves.

		Entrant decides to: Enter	Entrant decides to: Stay-Out
Incumbent's objective	**Allow Entry**	both play period 2	no period 2
	Deter Entry	both in period 2, fine for Incumbent	only Incumbent in period 2

FIGURE 4.2: Period 2 game rules for possible objective-entry combinations in *soft* model

In order to avoid altruistic participants to naturally prefer to allow entry, a fine was introduced in the *deter entry* and *enter* combination. Accordingly, if the Entrant decided to enter despite the Incumbent's objective to deter entry, the Incumbent faced a fine f_{Inc}^{dE}, which was set at $f_{Inc}^{dE} = \frac{\Pi_{old}^{NE}}{2}$. Summarising, the resulting individual profits (in *points*) per game g with a *soft* investment are

$$\Pi_i^g = B_i - A_i + (1 - C_i)R_i^{old}(p_i, p_j) + C_i R_i^{new}(p_i) - f_i^{\tau} ,$$

where by definition $C_{Ent} = 0$, $f_{Ent}^{\tau} = 0$, $f_i^{\tau}(\tau \neq dE) = 0$[78], R_i represents the revenue in a market in period 2, and A_i embodies the respective investment made by the Entrant or Incumbent[79].

IV. 2 Conception of the Market Entry Model with a Tough Investment

In line with the above structure and methodology[80], this section derives the second market model applied in this experimental study – the market entry game with a *tough* investment, that is. Accordingly, the following paragraphs will define the overall model requirements, describe the characteristics of the model, quantify the respective parameters for the experimental study, give an overview of the information structure within the model, and describe the incentivisation and compensation scheme.

[78] τ represents the possible period 2 combinations (of Incumbent objective and Entrant decision), where $\tau \in \{aE, aSO, dE, dSO\}$.

[79] As defined in previous sections, the remaining terms are: B_i represents the respective budget of Incumbent or Entrant, C_{Inc} the capacity shifted to the new market by the Incumbent, and f_{Inc}^{dE} the Incumbent fine when the Entrant entered the market while entry was supposed to be deterred (accordingly in all other combinations $f_i^{\neg dE} = 0$).

[80] While this section applies and references underlying theory or methodology approaches – in line with the above section – it does not duplicate the respective descriptions (please refer to the above section for further details or references).

IV. 2.1 Definition of Model Requirements

Contrarily to the previous market model, the investment in this model makes the Incumbent appear *tough* – for competing against the potential entrant in period 2, that is. Fudenberg and Tirole (1984) point out that "classical" models with investment in productive machinery or 'learning by doing' illustrate the context when substituting quantity with price competition (Fudenberg & Tirole, 1983a; Gelman & Salop, 1983). They also refer to a "more novel example" for modelling the *tough* investment context, namely, the model of *limit pricing* under incomplete information as described by Milgrom and Roberts (1982). That is, if the assumption is removed that the Entrant is informed of the Incumbent's unit costs after entry.

Limit pricing typifies charging prices below the monopoly price to make a market entry appear less attractive, where the basic idea of limit pricing goes back to Clark (1940) and (Bain, 1949). The major assumption, for limit pricing to be effective, is that payoff relevant information is private, i.e. the Entrant has not access to the Incumbent's unit costs (Milgrom & Roberts, 1982). In that case, foregoing some of the (monopoly) profit in period 1 (by charging a lower price) would make the Incumbent appear more *tough* (i.e., competitive due to a lower unit price) and potentially deter entry. Milgrom and Roberts (1982) investigate two examples, one involves only two possible levels of unit costs and the other involving a continuum of possible price levels, which is the one applied in this experiment (*mapping*).

The respective market model requires the following essential model properties (*reduction*):

- Product homogeneity (i.e. undifferentiated)
- Strategic complements (i.e. firms compete on prices – simultaneously set)
- 2 Periods – Entrant to decide on entry before second period
- Incumbent makes observable move in period 1 (i.e. set price while Entrant observes)

The following section concretises the market model characteristics along the required guiding model properties, further including more detailed market model characteristics.

IV. 2.2 Description of Characteristics of the Market Model

Similarly to the model explained above, the market entry game employed in this experimental setting involves two periods, where the Incumbent is the only player in period 1 and the Entrant decides before period 2 – having observed the Incumbent in period 1 – whether he/she wants to enter or not. The major difference in this model is that the investment appears in the

form of foregoing some (or all) of the monopoly profit in order to accommodate or deter entry. If the entrant decides to enter, both firms will be setting prices simultaneously in period 2.

The overarching characteristics underlying the market model and game, which are described in the following paragraphs, are (TABLE 4.6 at the end of this section summarises all main market properties):

- Strategic commitments
- Product differentiation
- Number of competitors
- Cost structure

In line with the research hypotheses and the model described above, the **strategic commitments** used in this game and market model are strategic complements, which are characterised by their mutual reinforcement (Bulow et al., 1985). As before, the strategic variable representing strategic complements in this game is price[81] – as also proposed by Fudenberg and Tirole (1984). Markets with prices as the strategic variable that firms compete on are known as Bertrand markets (Bertrand, 1883).

Contrarily to the model discussed before, this market model represents a 'typical' Bertrand market by having both firms sell **undifferentiated products** (or homogenous products). The theoretical market model developed by Milgrom and Roberts (1982) also considered homogenous products. Customers cannot distinguish homogenous products (from different suppliers) from each other[82]. The major implication is that customers buy from the cheapest supplier, even if the prices differ by the smallest observable value possible.

The equivalent (linear) demand for the **two firms competing**, the established firm (referred to as the Incumbent) and the potential entrant (i.e. the Entrant) in the Bertrand duopoly in period 2 (if entry occurred) is expressed equivalently as

$$Q_i^2(p_i, p_j) = \left\{ \begin{array}{ll} 0 & if\ p_i > p_j \\ \frac{\alpha - \beta p_i}{2} & if\ p_i = p_j \\ \alpha - \beta p_i & if\ p_i < p_j \end{array} \right\},$$

where $i = \{Inc, Ent\}$, α embodies all effects on demand other than price, and β denotes the effect that price has on demand. In the case of $p_i = p_j$ customers are indifferent between both

[81] See chapter 4.1.2 for alternative examples of strategic complements.

[82] Illustrative examples are electricity, petrol, or gold.

products or suppliers and it is assumed that the market demand is divided equally between both firms. The Bertrand market's assumption of equal constant unit costs c and above demand leads to the equilibrium outcome of $p_i = p_j = c$, i.e. the competitive outcome where prices are equal to marginal costs (Bertrand, 1883).

Before examining the composure of the respective profits for both firms, it is necessary to investigate the model's **cost structure**. The central property of the *limit pricing* model is the reciprocal ignorance of the competitor's unit costs. The unit costs of both firms are constant, however, not necessarily equal. The unit costs[83] are defined as $c_i \in [\underline{c_i}, \overline{c_i}]$, where $\underline{c_i}$ and $\overline{c_i}$ are the respective lower and upper limits. While general fixed costs are excluded from this market model (*reduction*), there are one-off entry costs A_{Ent} associated with the market entry of the entrant[84]. Contrarily to the model above, the Incumbent investment A_{Inc} in period 1 is here represented by foregoing the maximum possible profit in period 1, or monopoly profit, defined as

$$A_{Inc}(p^1_{Inc}) = \Pi^1_{Inc}(p^m, c_{Inc}) - \Pi^1_{Inc}(p^1_{Inc}, c_{Inc}),$$

where p^m is the profit-maximising monopoly price given unit costs c_{Inc} and p^1_{Inc} the actual price charged in period 1. Since p^m is the profit-maximising price, $\Pi^1_{Inc}(p^m, c_{Inc}) > \Pi^1_{Inc}(p^1_{Inc}, c_{Inc})$ for any $p^1_{Inc} \neq p^m$.

The Entrant's entry probability of entry $P(E = 1)$ depends on her overall expected payoff when entering the market, which is

$$\Pi^E_{Ent} = \Pi^2_{Ent}(p^2_{Inc}, p^2_{Ent}, c_{Ent}) - A_{Ent},$$

where the first term is positive if $p^2_{Inc} \geq p^2_{Ent}$ and $p^2_{Ent} > c_{Ent}$. For simplicity, we will assume that the latter also holds true for the Incumbent, $p^2_{Inc} > c_{Inc}$[85]. Consequentially, the entry probability $P(E = 1)$ depends on the Entrant's believe about $\hat{c}_{Inc}$, where $\frac{\partial P(E=1)}{\partial \hat{c}_{Inc}} < 0$. To deter entry, the Incumbent would accordingly want the Entrant to believe that her unit costs are as low as possible and make market entry seem unattractive. The only way the Incumbent can do that is by behaving accordingly in period 1, when setting her price for period 1, where

[83] The profits are dependent on the unit costs, as $\Pi = Q \times (P - c)$.

[84] Examples of initial entry costs are investments in machinery, production facilities or upfront marketing and advertising costs.

[85] While the Incumbent could charge a price below her unit costs c_{Inc}, it would result in a negative profit for period 2. Since the game ends after period 2 and no reward is connected to having $Q^2_{Inc} > 0$, pricing below cost would only decrease hitherto profits. Please note, while this holds true for period 2, it does not for period 1 (i.e., the loss from pricing below cost in period 1 can be offset by a potential reward (for inducing entry) or period 2 profits).

$$\frac{\partial P(E=1)}{\partial p_{Inc}^{1}} > 0\,.$$

In other words, the lower the price set by the Incumbent in period 1, the lower the probability of entry.

In a Bertrand market with unit costs, the profit-maximising monopoly is dependent on the unit costs with $\frac{\partial p^m}{\partial c} > 0$. Hence, in the context of entry deterrence and private information about unit costs, the following intuitive[86] condition for the Incumbent behaviour in period 1 applies: $p^m > p_{Inc}^1$. Building on this, the following holds true for the Entrant's probability to enter and the Incumbent's investment:

$$\frac{\partial P(E=1)}{\partial A_{Inc}} < 0\,.$$

This expression captures the core of the *tough* property in the Incumbent investment in this market model, as it makes the Incumbent appear *'tougher'* for competing in period 2 and, hence, deters entry.

We should mention the potential concerns one might have relating to the credibility of the Incumbent's price setting in period 1. Since prices in period 1 and period 2 are detached from each other, the Entrant might infer that the Incumbent is only setting a lower price $p_{Inc}^1 < p^m$ in order to make entry seem less attractive. Congruously, the Entrant could simply disregard the information completely. In the context of game theory, such communication that has not necessarily any meaning as it is not binding is also known as *cheap talk*. In the following, we will discuss two lines of reasoning that debilitate this concern to some extent. The first refers to cheap talk not being cheap in the transferred sense (i.e. that the information is worthless as communication is not binding). The second focusses on the literal sense of cheap talk – the associated actual cost of communication, that is.

There is a vast amount of literature on the impact of cheap talk, being costless and non-verifiable (Farrell & Gibbons, 1989b), on bargaining and gaming outcomes. Since the work by Crawford and Sobel (1982), who first showed formally that such cheap talk can be credible in equilibrium outcomes if the parties have some shared interest (Farrell & Gibbons, 1989a). Farrell (1987), however, also points out that complete coordination cannot be achieved if there

[86] Setting a lower price – when deterring entry in order to make market entry appear less attractive – is the only logical deviation from p^m. By definition, setting the actual price p^1 above the monopoly price, $p^m < p^1$, would also lead to foregoing some profit.

is even a small conflict (of interest). Experimentally (here a variant of the *stag hunt game*), the effectiveness of pre-play cheap talk was illustrated by leading to much more successful (i.e. coordinated) outcomes (Charness, 2000). Duffy and Feltovich (2002) investigated experimentally whether observation of past behaviour or cheap talk were more successful, it depends on the type of game which of the two makes coordination and cooperation more likely to happen and increase payoffs. While both were found to have a positive effect on coordination and payoffs, their relative success depends on the type of game played (Duffy & Feltovich, 2002). Furthermore, Tingley and Walter (2011) showed that non-binding communication – in a market entry game – can have substantial impact on the behaviour of both firms. They observed that Incumbents were able to deter entry (in early stages of the game) by issuing threats to potential entrants.

The literal sense of cheap talk considers the fact that "talk is cheap" – meaning that it does not directly affect payoffs (Farrell & Rabin, 1996). In our market model, the pricing behaviour of the Incumbent in period 1 is therefore not *cheap* or costless, as it does affect the Incumbents payoffs. The Incumbent's payoffs are composed of the profits from period 1 and period 2[87]:

$$\Pi_{Inc} = \Pi^1_{Inc}(p^1_{Inc}, c_{Inc}) + \Pi^2_{Inc}(p^2_{Inc}, c_{Inc}[, p^2_{Ent}]) .$$

Although it is difficult to define the exact impact that period 1 profits have on the total payoff (as several assumptions would have to be made about unit costs, the entry decision and respective pricing strategies), Π^1_{Inc} represents nonetheless a significant portion of the total payoffs. Thus, the more adequate term for the price setting in period 1 is *signalling* as opposed to *cheap talk*, as is a costly action that the Incumbent has to take (Farrell & Rabin, 1996).

The following table (TABLE 4.6) gives an overview of the main market model characteristics defined for this market model and market entry game.

[87] For simplicity reasons (*pragmatism* and *reduction*), we have excluded a discount factor for the profits from period 2.

Area	Characteristic	*Limit Pricing Market Model*
Overall Market Properties	Number of firms	*Monopoly/Duopoly* [E]
	Type of product	*Undifferentiated (i.e. homogeneous)*
	Competition	*Bertrand (Prices)*
	Costs	*Constant unit costs* $c_i \in [\underline{c_i}, \overline{c_i}]$
Game Specifics	Periods	*1: Inumbent sets price, Entrant observes* *- : Entrant makes entry decision* *2: Incumbent & Entrant set prices* [E]
	Period 2	*Firms set prices simultaneously*
	Investment makes Incumbent appear …	*Tough* *(for play in period 2)*
Incumbent Investment	Type	*Signalling Unit Costs*
	Description	*Incumbent foregoes monopoly profit in period 1 by setting* $p^1 < p^m$
	Investment cost	$A_{Inc}(p^1_{Inc}) = \Pi^1_{Inc}(p^m, c_{Inc}) - \Pi^1_{Inc}(p^1_{Inc}, c_{Inc})$
Profit Composition Period 2	Incumbent	$\Pi^{2\|E}_{Inc} = Q^2_{Inc} \times (p^2_{Inc} - c_{Inc})$
	Entrant	$\Pi^{2\|E}_{Ent} = Q^2_{Ent} \times (p^2_{Ent} - c_{Ent})$
	where	$Q^2_i(p_i, p_j) = \left\{ \begin{array}{ll} 0 & if\ p_i > p_j \\ \frac{\alpha - \beta p_i}{2} & if\ p_i = p_j \\ \alpha - \beta p_i & if\ p_i < p_j \end{array} \right\}$

[E] *In case of entry* P^m *Profit-maximising price in Monopoly*

TABLE 4.6: Main characteristics of the *Limit Pricing* market model

IV. 2.3 Parameterisation of the Model

The following section quantifies the above defined market model characteristics. Again, the objective is to define a reasonable framework to mirror realistic market dynamics, while keeping the experimental context in mind (*pragmatism*). At the end of this section, TABLE 4.7 provides an overview of all defined parameters.

In parallel to the above approach, the parameterisation of this model will focus on the respective relations of the parameters *to each other*, as opposed to their absolute values. Namely, the following three elements require parameterisation in this market model:

- Duopoly/monopoly demand
- Variable cost structure
- Entry cost (*one-off*)

In order to keep the experiment graspable for all participants[88] and have a significant impact of unit cost changes (detailed below), the respective price co-domain has been defined as $p_i \in [0.00, 5.00]$, similarly seen in the duopoly experiment by Kübler and Müller (2002) or Abbink and Brandts (2005)[89]. The **linear demand function** (as derived above) for the market clearing firm i[90], with $p_i < p_j$, is

$$Q_i = \alpha - \beta p_i \, .$$

While α defines the total market size[91], the ratio of α and β defines the impact that price has on demand. In order to utilise the entire market range (i.e. $[0, \alpha]$), we defined the ratio based on the respective co-domain values. Accordingly, we set $\frac{\beta}{\alpha} = p_i^{max}$, which in this case results in

$$\frac{\alpha}{\beta} = \frac{1}{5}.$$

The respective profits that can be realised by both firms are furthermore dependent on the **variable cost structure**, denoted as $c_i \in [\underline{c_i}, \overline{c_i}]$. While the respective unit costs c_i are allocated at random, the respective co-domain limits need to be defined in relation to the potential price levels of p_i. Since we wanted to ensure a high impact of unit costs on the profits[92], co-domain levels of c_i were defined within the price co-domain, with $\underline{c_i} > p_i^{min}$ and $\overline{c_i} < p_i^{max}$. The respective co-domain levels within the above limits were set at

$$\frac{\underline{c_i}}{p_i^{max}} = \frac{2}{5} \quad and \quad \frac{\overline{c_i}}{p_i^{max}} = \frac{4}{5} \, .$$

The resulting potential profit functions $\Pi_i(p_i, c_i)$ for firm i – given exemplary levels of unit costs c_i – are illustrated in the following figure.

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[88] Especially for participants from other fields of studies and are, thus, unfamiliar with market dynamics and/or functions in general.

[89] While Abbink and Brandts (2005) use a bigger scale of [0,99], they do not allow for decimal places.

[90] Note that in period 1 only the Incumbent is present in the market (monopoly). The demand function applies respectively as well.

[91] Respectively at $p_i = 0$.

[92] Significantly different profit-maximising prices p^m for any unit cost c_i as well as the possibility of negative profits for any c_i.

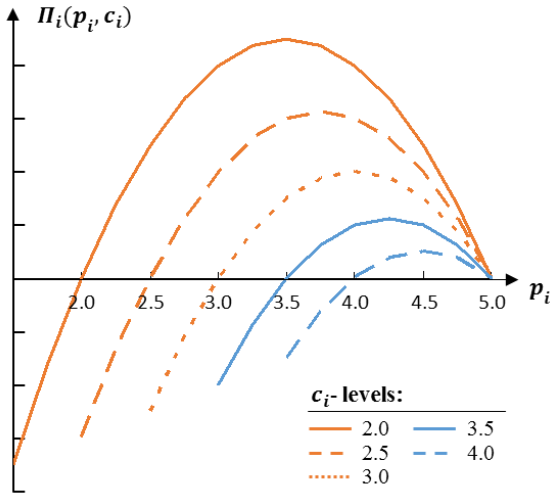

FIGURE 4.3: Potential profit functions for exemplary unit cost levels c_i

The profit graphs shown in the figure illustrate the different profit-maximising prices for different unit costs as well as the high sensitivity to price changes. To make the market model more realistic[93] (*mapping*) and limit the risk that participants feel treated unfairly (*pragmatism*), the respective unit cost levels were defined as $c_i = c_j$[94].

Lastly, the respective **entry costs** that the Entrant faces in combination with a positive market entry decision are defined. The underlying rationale is that the Incumbent needs to invest a significant amount of his potential monopoly profits in period 1, in order to make entry appear attractive for the Entrant. Thus, the entry cost A_{Ent} were defined as

$$A_{Ent} = \frac{2}{3} \times \Pi^1_{Inc}(p^m, c_{Inc}) .$$

This implies that the Incumbent needs to forego at least one third of his monopoly profits in period 1 in order to deter entry, as the Entrant needs to be convinced that she can earn profits that are at least as high as A_{Ent}. Although the Entrant can conjecture the Incumbent to be *bluffing*, observing $\Pi(p^1_{Inc}) < A_{Ent}$ in period 1 would make entry highly risky.

The following table summarises the resulting parameterisation values defined for the second market entry game (with a *tough* investment). Again, the above parameterisation proportions have been multiplied with a factor to align profits of both games (*pragmatism*).

[93] The respective unit cost levels have a relatively high impact on absolute profits. Thus, a secondary condition of c_i and c_j being *relatively similar* was defined. This would ensure a more realistic market model (as firms cannot compete with each with homogenous products, while having significantly different unit costs [see Bertrand, 1883]).

[94] The rationale for setting the costs equal is that i) the level of unit costs is not the focus of this research (rather the uncertainty of not knowing the opponent's exact costs), as well as ii) the fact that this makes the following analyses easier.

Parameterisation	Elements	Defined Parameters
Market Dynamics	Demand for duopoly and monopoly†	$Q_i(p_i,p_j) = \left\{ \begin{array}{ll} 0 & if\ p_i > p_j \\ \frac{500-100p_i}{2} & if\ p_i = p_j \\ 500-100p_i & if\ p_i < p_j \end{array} \right\}$
	Profit	$\Pi_i = Q_i(p_i,p_j) \times (p_i - c_i)$
	Price co-domain	$p_i \in [0.00, 5.00]$
Costs	Unit costs	$c_i \in [2.00, 4.00]$
	- Deter entry treatment	$c_{Inc}^d = c_{Ent}^d = 2.50$
	- Allow entry treatment	$c_{Inc}^a = c_{Ent}^a = 2.65$
	Entrant entry costs	$A_{Ent} = \frac{2}{3} \times \Pi_{Inc}^1(p^m, c_{Inc})$
	- Deter entry treatment	$A_{Ent}^d = 103$
	- Allow entry treatment	$A_{Ent}^a = 91$
	Incumbent investment	$A_{Inc}(p_{Inc}^1) = \Pi_{Inc}^1(p^m, c_{Inc}) - \Pi_{Inc}^1(p_{Inc}^1, c_{Inc})$
Initial Values	Incumbent budget	$B_{Inc} = 0$
	Entrant budget	$B_{Ent} = A_{Ent}$
	- Deter entry treatment	$B_{Ent}^d = 103$
	- Allow entry treatment	$B_{Ent}^a = 91$

†*For monopoly set* $p_j = \infty$ *Note: The respective unit for all parameters is* ***'points'*** *(except for Capacity)*

TABLE 4.7: Overview of parameterisation values for *tough* investment market model

The unit cost levels c_i^a and c_i^d for the *deter entry* and *allow entry* settings were initially defined by random selection[95] and kept henceforth for all deter or allow setups. A brief discussion of the utilisation of experimental currency units, i.e., *points*, is outline above (IV.1.3).

IV. 2.4 Information Structure of the Tough Investment Settings

The following paragraphs describe the respective information the firms (i.e. participants) receive during the *tough* investment market entry game. In line with the logic applied above, I will present the information along the three stages of the experiment:

- ex-ante information – information (un)available before the game
- ad interim information – information (un)available during the game
- ex-post information – information (un)available after the game

For each stage, all relevant information is categorised by its availability. The respective availability classifications are *private, public,* or *unknown* (Athey & Bagwell, 2008). The

[95] Microsoft Excel was used to generate the two unit cost levels (between 2.00 and 4.00).

underlying rationale of the information structure is to provide participants as much information as necessary (*pragmatism*), while ensuring an accurate replication of the original model by Milgrom and Roberts (1982).

The ex-ante availability of information is summarised in the following table. The respective availabilities attempt to mirror a realistic setting as much as possible, where generally public information as demand are available to all participants and typically private information as investments or unit costs are kept private.

Information Structure	**Information**	**Availability**
Market Dynamics	Number of players	*Public*
	Market demand	*Public*
	Price co-domain	*Public*
	Incumbent objective[a]	*Private*
Cost Structure	Fixed costs[b]	*Public*
	Unit cost co-domain	*Public*
	Unit costs	*Private*
	Incumbent investment	*Private*
	Entry costs	*Private*
Initial Values	Incumbent budget	*Private*
	Entrant budget	*Private*
Game Structure	Opponent identity	*Unknown*
	Number of periods	*Public*
	Decision time per period	*Public*
	Excehange rate of points	*Public*

a) Whether the objective is to deter or allow market entry
b) Other than Incumbent investment and Entrant entry costs

TABLE 4.8: Ex-ante information availability of the *tough* investment market model

After the game has started, participants receive further information in order to effectively interact with each other. Again, these **ad interim information** are relatively limited in this market entry game and mainly limited to the price setting in period 1 as well as the entry decision. TABLE 4.9 summarises the respective availabilities.

Information Structure	**Information**	**Availability**
Period 1	Incumbent investment cost[a]	*Private*
Post Period 1	Incumbent price period 1	*Public*
	Entrant entry cost	*Private*
Period 2	Entrant entry decision	*Public*
	Price setting	*Private*

a) Dependent on the respectve (private) unit costs and (public) price set

TABLE 4.9: Ad interim information availability of the soft investment market model

Prices are classified as *private*, as prices are set simultaneously in period 2. Once the game has been completed, the respective prices are revealed. Profits are kept *private* in the **ex-post information**, as unit costs are not revealed at any point during the *tough* investment market entry game[96].

Information Structure	Information	Availability
Period 2	Price set	*Public*
	Profit period 2	*Private*
Overall Game	Overall game profit *(including budget, invests, & potential fines)*	*Private*

TABLE 4.10: Ex-post information availability of the *tough* investment market model

Parallel to the *soft* investment market entry game, information were provided via z-Tree, physical hand-outs and a profit-calculator in the form of an Excel spreadsheet (see APPENDIX A2.3 for detailed description of the materials). Please refer to SUB-SECTION IV.1.4 for a brief review of the utilisation of payoff matrices and profit calculators.

IV. 2.5 Incentivisation & Compensation of Participants

In order to make participant behaviour and decision making as realistic and insightful as possible, participants need to adequately incentivised and compensated. Smith's (1976) two essential elements, (1) avoidance of saturation and (2) explicit incentives were applied accordingly. Additionally, we also ensure that a third property, namely (3) dominance (Cassar & Friedman, 2004), is represented in the incentive system. SUB-SECTION 4.1.5 briefly describes the respective properties (1)-(3) and appropriate measures in experimental designs.

In addition to the success-unrelated *show-up fee*, participants could earn success-related pay-outs based on their decision in the different market entry games. The following formulae recalls the overall compensation composure for the experiment:

$$Compensation = 3 + \nu \sum_{g=1}^{4} (\Pi_i^g)^+ ,$$

where ν is the exchange rate and Π_i^g the profit for each game g played by role $i = \{Inc, Ent\}$[97]. Cross-influences between the market entry games were equivalently limited to a minimum.

[96] Informing participants of the opponent's unit costs could significantly impact speculations for the second (*tough)* game played.

[97] Note that $(x)^+ = max\{x, 0\}$.

In the context of the underlying taxonomy framework (Fudenberg & Tirole, 1984), this market entry game (*tough* investment) yields also four different period 2 combinations based on the pre-defined objective of the Incumbent and entry decision. In order to induce a specific objective for each participant[98], we defined respective rules concerning the Incumbents' compensations – in line with the model by Milgrom and Roberts (1982). For the four different combinations in period 2, FIGURE 4.4 summarises the defined rules.

		ENTRANT DECIDES TO	
		Enter	**Stay-Out**
INCUMBENT'S OBJECTIVE	**Allow Entry**	both play period 2	no period 2, fine for Incumbent
	Deter Entry	both in period 2, fine for Incumbent	only Incumbent in period 2

FIGURE 4.4: Period 2 game rules for possible objective-entry combinations in *tough* model

The minor difference between the *soft* and *tough* investment models – with respect to the rules for period 2 – is the fine in the *allow entry* and *Entrant stays out* combination[99]. Both fines are defined as significant proportions of the respective monopoly profits. Specifically, the Incumbent fine for facing entry (while the objective was to deter it) f_{Inc}^{dE} is defined as $f_{Inc}^{dE} = \frac{1}{3} \times \Pi_i(p^m, c_i)$. Equally, the fine for not having been able to induce entry (as Entrant stayed out) is set at $f_{Inc}^{aSO} = \frac{1}{3} \times \Pi_i(p^m, c_i)$. Hence, the respective profits per game g with a tough investment are

$$\Pi_i^g = B_i - A_i + \Pi_i^1(p_i^1, c_i) + \Pi_i^2(p_i^2, p_j^2, c_i) - f_i^\tau \,,$$

where p_i^1 and p_i^2 are the respective prices set in period 1 and period 2, and by definition $\Pi_{Ent}^1 = 0$, $f_{Ent}^\tau = 0$ and $f_i^\tau(\tau \neq \{dE, aSO\}) = 0$[100].

[98] Participants are likely to differ in their natural objectives, i.e. altruistic individuals might favour market entry where subjects familiar with microeconomics might naturally conclude that deterring entry yields more favourable outcomes for themselves.

[99] The reason is that we wanted to separate the strategies that simply maximise their profits in period 1 (without any concern for the imposed frame [*allow* vs. *deter*] from the ones that consciously adapt their behaviour.

[100] τ represents the possible period 2 combinations (of Incumbent objective and Entrant decision), where $\tau \in \{aE, aSO, dE, dSO\}$.

IV. 3 Selection of Suitable Personality Assessments

Personality research, which is a branch of psychology studying personality and its variation among individuals (sometimes also referred to individual differences), goes back to Carl Jung and his typification of personalities (Jung, 1923). Building on this, over the following decades several influential frameworks emerged, classifying personality along a number of categories or dimension (e.g., Catell, 1957; Myers, 1962). While many of the frameworks were subject to critique due to their non-robustness or non-replicability, empirical approaches (i.e., factor analyses) led to models composed of 5-6 main dimensions (e.g., Goldberg's (1990) Big Five). This thesis selectively (i.e., for the personality dimensions that this research focusses on) compares the advantages or disadvantages of different frameworks and inventories against the objective and background of this study. For a more thorough review, please refer to appropriate literature (e.g., Furnham, 1996; Saville & Blinkhorn, 1981).

In personality research, several different methods exist to test individuals (or groups) for the respective dimensions or traits. Simple observation, direct questioning, peer-reporting, projective tests as well as the laboratory approach are among commonly used methods. Another, much more efficient, method is the self-report inventory, where the subjects respond to sets of questions or statements (generally referred to as items) by indicating to what degree a certain item reflects their behaviour on a Likert scale[101] (Likert, 1932).

The method applied in this experimental study is the latter mentioned self-report inventory, which is also the most popular method in personality assessment (Paulhus & Vazire, 2007). The advantages of this method include easiness to collect large amount of data in short time as many subjects can take them at the same time, low cost of administration, independence of evaluation of the results, and can be anonymous, which may promote more honest answers. Disadvantages include problems around self-presentation (e.g., faking, exaggeration, or self-favouring), acquiescent responding (tendency to agree with statements regardless of the content), and extreme responding, the tendency to use the extreme choices on the rating scale (Paulhus & Vazire, 2007). Taking into consideration its wide popularity,

[101] The Likert Scale is named after psychologist Rensis Likert (1903-1981) and was developed to measure attitudes or opinions by asking participants directly – offering them a (typically 5-point) frequency scale as the answer option space .

its advantages, and the fact that most disadvantages are mitigated as much as possible[102], the self-report inventory represents the best option.

IV. 3.1 Testing for Aggression

Aggression is a widely researched personality state, trait, or both[103]. Suris et al. (2004) collected all clinical and research instruments to measure aggression – amounting to a total of 64 measure instruments. To identify the best suitable test for this project a preliminary filter logic has been applied to the conclusive list, excluding tests based on their i) assessment type (i.e., interviews, observational, projective, and laboratory), ii) measure type (i.e., state), iii) main target subject groups (i.e., clinical, children), and iv) focus area (i.e., violence, physical aggression). The resulting shortlist of 10 tests has subsequently been individually assessed – with regards to fit to the research focus and statistical reliability (see FIGURE 4.5 for the applied two-step filter logic).

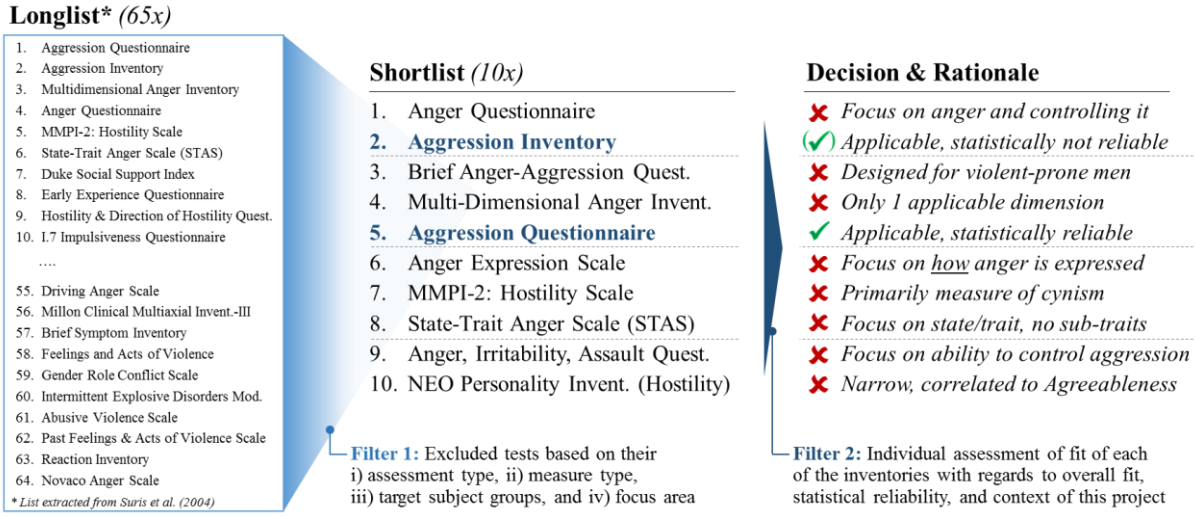

FIGURE 4.5: Methodology for the aggression inventory selection

The remaining two instruments are the Aggression Inventory (AI)[104] and the Aggression Questionnaire (AQ)[105], both being composed of four underlying dimensions. Whereas *physical*

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[102] Established personality tests (such as the ones applied in this thesis) generally account already for the mentioned disadvantages. Rational techniques (e.g., forced choice), demand reduction (e.g., anonymity and confidentiality) and covariate techniques addresses self-presentation. False-keying half of the items mitigates acquiescent responding, whereas extreme responding can be addressed by scale reduction or equal high and low answers (Paulhus & Vazire, 2007).

[103] A *state* represents a momentary emotional reaction to internal or external triggers, which dissolves after the emotional reaction passes and the 'normal' equilibrium resumes (Spielberger & Sydeman, 1994), A *trait*, on the other hand, refers to more stable and enduring dispositions of the individual (Allport & Odbert, 1936). Depending on the underlying inventory, *aggression* can be defined as either of the two, or not distinguish between the outlined differences.

[104] Developed by Brian A. Gladue (1991)

[105] Developed by Arnold H. Buss and Mark Perry (1992)

and *verbal aggression* are sub-dimensions in both tests, *impulsiveness* and *avoidance of aggression* further compose the AI, and *anger* and *hostility* the AQ. Their respective assessment of goodness of fit ratios (chi-square to degrees of freedom) of 2.23 and 2.43, respectively, suggest poor fit for both inventories (Archer, Kilpatrick, & Bramwell, 1995).

Bryant and Smith (2001) developed a shorter version of the AQ (initially consisting of 29 items) by excluding items with low or multiple loadings as well as items with reversed wording. The resulting 12-item measurement model, composed by the same four sub-dimensions, not only improved goodness of fit[106], but also demonstrated stronger discriminant validity for the refined *hostility* factor. Three statements now measure each of the four sub-dimensions with a randomised order throughout all 12 items.

Accordingly, the revised, 12-item, Aggression Questionnaire (subsequently referred to as the Aggression Questionnaire or AQ) has been selected for the experimental study.

IV. 3.2 Testing for Dominance

Dominance is represented in a few personality assessment instruments, namely Catell's 16 Personality Factor Questionnaire (16PF), California Psychological Inventory (CPI), the Interpersonal Circumplex (IPC), DISC, and Computerized Adaptive Assessment of Personality Disorder (CAT-PD). As the latter one focusses on personality disorders, it is not fully applicable to this experimental study. The CPI concentrates on predicting interpersonal behaviour – not one-dimensional personality traits. Hence, many of the CPI's dimensions are highly inter-correlated as they are based on the same underlying traits (Hattrup, 2003; Megargee, 2009) (Megargee, 2009). The IPC is a circular framework, which by design attempts to characterise how different dimensions or traits are related to each other, in contrast to their score itself. Furthermore, the underlying theoretic assumptions are, surprisingly, often not supported by empirical data analysis (Fabrigar, Visser, & Browne, 1997). Similarly, the DISC personality assessment also represents a circular framework with four dimensions, namely dominance, influence, steadiness, and conscientiousness. DISC also earned some criticism due to the forced-choice questions including two different dimensions, their circular structure, i.e.,

[106] The original Aggression Questionnaire yielded in three independent samples goodness-of-fit of 0.76-0.81, whereas as the new 12-item version yielded goodness-of-fit of 0.94 - confirmed by secondary analysis on independent data sets (Bryant & Smith, 2001).

not being able to score high on both opposing dimensions, and the high inter-correlations between the dimensions, especially the dominance dimension (Price, 2015).

The 16PF questionnaire, which is composed of sixteen personality dimensions (including Dominance)[107] and a result of years of factor-analytic research (Catell, 1957, 1973). Although there was also some criticism regarding the internal consistency and replicability of the results (Eysenck & & Eysenck, 1969; Howarth & Browne, 1971; Howarth, Browne, & Marceau, 1972; Levonian, 1961), Catell (1973) countered these claims by arguing that statistical heterogeneity of items is a result when constructing factor scales. Saville and Blinkhorn (1981) investigate both claims and come to the conclusion that Catell's claims are correct with regards to the relative adequacy of some individual scales, including the dominance scale – which confirms the use of the Dominance scale for this experimental study.

While favouring the 16PF inventory for this study (based on the acceptability of the Dominance scale itself and the test's overall popularity), an application of the inventory has not been feasible[108]. Fortunately, the International Personality Item Pool (IPIP)[109] offers the 16 Preliminary IPIP Scales (16-IPIP) inventory, designed to replicate the original 16PF inventory. The respective Dominance dimension in the 16-IPIP is labelled slightly different, namely as Assertiveness. Comparing the statistical reliabilities of both inventories, average reliability coefficients of the 16-IPIP are quite similar, with an overall [dominance/ assertiveness] mean item correlation of 0.29 [0.30] compared to 0.21 [0.18] for the 16PF and a coefficient alpha of 0.80 [0.81] versus 0.74 [0.68] for the original 16PF (Goldberg, 1999).

Given that the total number of items of the 16-IPIP is 163 and the focus of this research project lies solely on the Assertiveness dimension (with regards to this inventory), only the 10 items testing the Assertiveness dimension have been used in the experimental study.

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[107] The other dimensions are warmth, reasoning, emotional stability, liveliness, rule-consciousness, social boldness, sensitivity, vigilance, abstractedness, privateness, apprehension, openness to change, self-reliance, perfectionism, and tension.

[108] Upon contacting PAN (Performance Assessment Network) and IPAT (Institute for Personality and Ability Testing), the agency licensed to sell the test materials for the 16PF, a representative informed me that the pricing per tested individual is 16.50 USD, or 3,300,- USD in total for this study. Although a 35% discount was offered when signing a 'research agreement', the agreement implied that a publication of the results has to be agreed by PAN, as it 'allows them control over bad results being published without their knowledge/consent". Signing the agreement and/or paying the respective fees was not feasible within the defined project budget.

[109] The IPIP is a scientific collaboratory for the development of advanced measures of personality and other individual differences (http://ipip.ori.org). The site contains over 3000 items and 250 scales, replicating popular personality or individual differences testing inventories and making them accessible for researchers (without the related exorbitant costs in order to obtain the materials) in order to contribute to their further development and refinement Goldberg et al. (2006).

IV. 3.3 Testing for Big Five & HEXACO Personality Traits

One of most popular personality frameworks in the field of psychology research are the Big-Five Factor Structure (Big-Five)[110] developed by Goldberg (1983, 1990) and the closely related Five-Factor Model of personality structure (FFM)[111] by Costa and McCrae (1985, 1992; 1987). Both five-dimensional structures have dominated the field of personality research since the 1980s due to their statistical reliability and ability of its factor space to accommodate several other personality constructs measured by other instruments (Ashton & Lee, 2005). However, recently, evidence from cross-cultural and -lingual research emerged, favouring a six-dimensional framework, known as HEXACO[112] (Ashton, Lee, Perugini et al., 2004).

Accordingly, as also mentioned in Section III.2, it is worthwhile to distinguish between the *agreeableness* and *honesty-humility* scales due to their empirical and theoretical validity (Ashton & Lee, 2005, 2007; Ashton, Lee, & Goldberg, 2004). Furthermore, in the context of this research it will be advantageous to receive an indication of whether certain detected behavioural patterns are of re-active (*agreeableness*) or pro-active (*honesty-humility*) motivation (as indicated by Hilbig et al. (2013)).

HEXACO Personality Inventory				
Dimensions	Sub-Dimensions *(4 each)*			
Honesty-Humility	Sincerity	Fairness	Greed Avoidance	Modesty
Emotionality	Fearfulness	Anxiety	Dependence	Sentimentality
eXtraversion	Social Self-Esteem	Social Boldness	Sociability	Liveliness
Agreeableness (v Anger)	Forgiveness	Gentleness	Flexibility	Patience
Conscientiousness	Organization	Diligence	Perfectionism	Prudence
Openness to Experience	Aesthetic Appreciation	Inquisitiveness	Creativity	Unconventionality

Table 4.11: The HEXACO dimensions & respective sub-dimensions as developed by Ashton, et al. (2004)

As can be seen in Table 4.11, the each of the six dimensions is composed of four sub-dimensions. Each sub-dimension is assessed by two or three items and can potentially provide a better ground for analysis and interpretation of the results.

Due to the high popularity as well as empirical and theoretical evidence of the HEXACO inventory, it will serve as the main personality inventory and be included holistically in this experimental study. In order to keep assessment time limited, the 60-item long HEXACO-60 (Ashton & Lee, 2009) has been utilised in the experiment.

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[110] Namely *extraversion*, *agreeableness*, *conscientiousness*, *emotional stability*, and *culture*.

[111] Namely *extraversion*, *agreeableness*, *conscientiousness*, *neuroticism*, and *openness-to-experience*.

[112] Namely *honesty-humility* (H), *emotionality* (E), *extraversion* (X), *agreeableness* (A), *conscientiousness* (C), and *openness to experience* (O).

IV. 4 Implementation of Experiment

To ensure a replicability of the experimental study, the following will describe the process and structure of the experiment (Holt, 1995). The experiment took place in a laboratory-simulated[113] environment at the IBU institute at the *Karlsruhe Institute of Technology*. Each session consisted of three main parts and lasted between 60 and 80 minutes. Upon arrival, participants randomly drew cards with their respective seat/cubicle allocations and initial instructions (this would later also determine their role in the market entry game). The first part consisted of filling out the self-report personality assessments[114]. Once completed, the experimenter handed out instructions for the second part (the market entry games). After 10 minutes, the experimenter read aloud the instructions, while participants were given the chance to ask questions or clarify open points before starting the market entry games. Once all market entry games were completed, participants were asked to complete the third and last part of the experiment – a demographic and comprehension survey – before being called out one by one to receive the respective compensation. The following figure summarises the experiment stages for the participants including the respective durations, provided materials, and data that has been collected for this study.

	Part 1	Part 2	Part 3
Objective:	**Personality Assessment**	**Collection of Market Entry Behaviour**	**Demography Assessment & Compensation**
Duration:	*10-15min*	*40-60min*	*5-10min*
Materials:	▪ Short instructions (part 1) ▪ Personality questionnaire	▪ Instructions (part 2) ▪ On-screen instructions and data input *(z-Tree)* ▪ Payoff tables ▪ Profit-Calculator *(Excel)*	▪ On-screen demographic questionnaire *(z-Tree)*
Data collected via…	Physical questionnaire *(Paper & Pencil method)*	Laptop *(z-Tree)*	Laptop *(z-Tree)*

FIGURE 4.6: High-level overview of the experiment stages

[113] See FIGURE 4.7 below and APPENDIX A2.5 for further visual documentation of the experiment setup.

[114] The motivation to assess the personality dimensions before the market entry behaviour was based on the hypothesis that the personality assessment is more sensitive to prior (gaming) experience than the other way around. Prior research, however, does not show a consistent approach, as personality assessments were done i) in separate sessions (Hilbig et al. (2015); Gunnthorsdottir, McCabe, and Smith (2002), ii) just before the gaming experience (Hilbig and Zettler (2009); Hirsh and Peterson (2009), as well as iii) just after the gaming (Lönnqvist et al. (2011); Brandstätter and Königstein (2001).

IV. 4.1 Operational Implementation & Technical Setup of Experiment

The experiment sessions have been conducted in June 2016 at the Institute of Corporate Governance[115] at KIT. An experimental laboratory environment has been simulated[116], including the associated laboratory characteristics (e.g., separate entry and laboratory area, visually separated seats/cubicles). Accordingly, participant anonymity was ensured and undesired verbal or non-verbal communication prevented (see FIGURE 4.7). The seats were allocated randomly (participants drew cards upon arrival), so that the respective roles (Incumbent or Entrant) were allocated randomly. The second – interactive market entry gaming – part of the experiment was simulated using *z-Tree*, the *"Zurich Toolbox for Readymade Economic Experiments"* (Fischbacher, 2007).

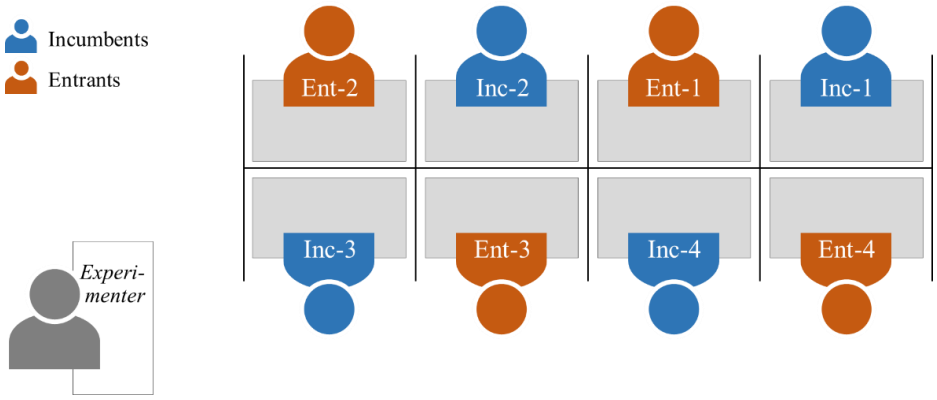

FIGURE 4.7: Laboratory-simulating experiment setup

All 25 experiment sessions (with 8 participants per sessions) took place in June 2016. Overall, 194 participants took part in the experimental study – in five sessions 1 or 2 roles were left unassigned, as the number of no-shows was surprisingly high[117].

IV. 4.2 Recruitment of Participants

Recruitment of participants hast been conducted via the Online Recruitment System for Economic Experiments (ORSEE) of the faculty for Economic Sciences at the Karlsruhe Institute of Technology. The web-based platform offers an efficient way to organize experiments and recruit participants. While it minimizes experimenter-participant interactions and,

[115] In German: *Institut für Unternehmensführung (IBU)*

[116] The laboratory environment embodied the typical characteristics of laboratories, including a layout that controls the subjects' views, convenience of imparting group and individual instructions, and monitoring of subject behaviour (Friedman & Sunder, 1994). For a visual documentation please refer to APPENDIX A2.5.

[117] Fortunately, the non-drawn role allocations belonged to *Entrant* roles, which enabled the fully use of the Incumbent data. That is, as the subject, when making the investment decision, had no prior interaction with the Entrant.

therefore, limits undesired biases to a minimum, research-relevant selection criteria can be specifically applied (Greiner, 2015). The database includes approximately 1,500 users – one third being female and 80 percent having a graduate degree (or higher)[118].

In order to ensure the participants' understanding of the experiment (i.e., minimise any potential biases or distortions of the results), invitations have been sent to users that i) are fluent in German (as the experiment language was phrased in German), and ii) already started their higher education (start of academic studies between June 2006 and June 2016). This resulted in 860 invitations being sent out[119]. As experience from other experimental studies showed, there is a no-show rate of 15-20% per session. Equivalently, each session capacity included a buffer (in this case a more conservative approach of three additional invitees to the required eight participants).

IV. 4.3 Part 1: Personality Traits Assessment

The personality assessment questionnaire was composed of i) the aforementioned 60-item HEXACO test, ii) the 10 Assertiveness items of the 16-IPIP, and iii) the 12-item Aggression Questionnaire. To limit self-report biases due to 10 consecutive Assertiveness-related questions, the 10 IPIP items have been included within the HEXACO test[120]. The AQ has a pre-defined order of items, which should not be altered (Bryant & Smith, 2001), and is based on a 6-point Likert scale for the answers (in contrast to the 5-point Likert scale of the HEXACO and 16-IPIP). Thus, no further blending was necessary nor sensible.

The final personality questionnaire consisted of 82 items – 70 items for the HEXACO and *assertiveness* traits and 12 consecutive items for *aggression* (see full version in APPENDIX A2.2.2). Participants completed the personality assessment within 8-15 minutes.

IV. 4.4 Part 2: Market Entry Games

Participants were handed out instructions providing all basic and necessary information for the subsequent market entry games (e.g., how to read and interpret payoff tables) – see full

[118] For a discussion of potential impacts of characteristics of the subject pool, please refer to SUB-SECTION V.2.1 in the following chapter.

[119] Information within the invitation email have been kept to a minimum, only stating that participants for a game-theoretic study, lasting ~75 minutes, are wanted, along with the session dates and timings. Please refer to APPENDIX A2.1 for the exact email text that has been sent out.

[120] The HEXACO-60 structure has one item for each dimension listed, before the second item of each dimension is listed, etc. In line with this logic, the 10 Assertiveness items have been included after each of these 'cycles', so that no dimension is inquired by consecutive items.

instructions in Appendix 2.3. The experimenter read the instructions aloud after 10 minutes, while potential comprehension questions were answered as well. Before the four market entry settings started, a test round was played to get participants acquainted with the experiment materials (i.e., profit tables, experiment software, profit calculator) and general price setting dynamics. Figure 4.8 provides an overview of an exemplary sequence of games that participants competed in. The sequence of market entry settings, i.e., *soft* or *tough* investment setting and *allow* or *deter* Incumbent objective, alternated between sessions (the underlying rationale and discussion follows in the next section, Section IV.5). Since each of the four games or setups that the participants competed in differed, no strong learning effects were expected. A verification analysis for learning effects confirmed the expectation as no significant effects over the time of the experiment were detected.

	Trial round	Game 1	Game 2	Game 3	Game 4
Investment type makes Incumbent…	-	Soft	Tough	Soft	Tough
Incumbent goal:	-	Deter Entry	Allow Entry	Allow Entry	Deter Entry
Duration:	*5-10min*	*8-12min*	*8-12min*	*8-12min*	*8-12min*

Figure 4.8: Illustration of exemplary sequence of games played during each session

Since Sections IV.1 and IV.2 discussed the market settings in detail, this sub-section does not replicate the market model specific description. The respective materials and information that were provided to participants are documented in detail in Appendix A2.3, including on-screen information for both settings. The average duration for the market entry games (i.e., the second part of the experiment) corresponded to 50 minutes.

IV. 4.5 Part 3: Demographic Questionnaire & Compensation

The third part of the experiment consisted of a *demographic questionnaire*, used to collect demographic and comprehension information about the participants for the subsequent statistical analysis. The information collected by the questionnaire included the participants' gender, age, academic degree, functional specialisation, hitherto experiment experience, as well as comprehension of the games and one's actions (see the full version of the questionnaire in Appendix A2.4). The corresponding results and discussion follows in Sub-Section V.2.1.

Once everyone completed the questionnaire, the experimenter called out the participants individually and paid out their respective cash compensation in private – in order to avoid

dissatisfaction or controversies (Croson, 2005). The completion of the questionnaires as well as compensation procedure took 5-10 minutes.

IV. 5 Summary of Statistical Considerations in Experiment Setup

This section summarises the experimental design considerations from the statistical point of view, which sets the fundament for a sound empirical analysis and reliable results. The *focus* variable[121] is represented in this research project by the personality scores for each personality dimensions – unlike in typical experimental studies, this variable is not controllable and, thus, cannot be varied among different *treatments*. Therefore, all participants played in all defined market entry settings, while their previously collected personality scores were later analysed against the background of their market entry behaviour. Notwithstanding, designing an experiment involves several pitfalls and considerations that the design accounted for and are outlined in the following paragraphs.

Four typical statistical methods, namely, *blocks*, *randomisation*, *keeping factors constant*, and *controlling*, have been applied to account for undesirable side effects from nuisance factors (Friedman & Sunder, 1994; Kirk, 1982). Potential nuisances included, for example, gender, previous experiment experience, or influence during the experiment. FIGURE 4.9 below illustrates the main statistical considerations that have been included in the design of the experiment setup.

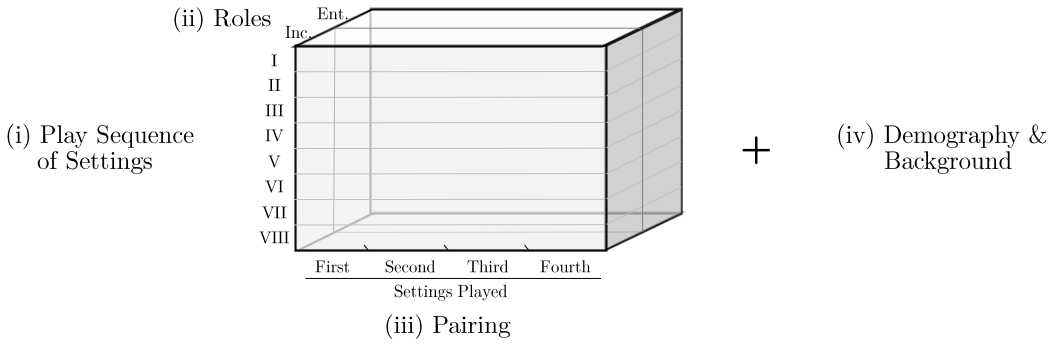

FIGURE 4.9: Experimental design concerning the statistical considerations

(i) Play Sequence of Settings: As all participants competed in all four setting combinations (of the type of investment, *tough* or *soft*, and the induced Incumbent objective, *allow* or *deter*),

[121] A *focus* variable is a variable whose effects are of primary interest to the experimenter (Friedman & Sunder, 1994).

the aim was to limit potential effects of having played, for example, the '*tough-deter'* setting before the '*soft-allow'* setting to a minimum through a thoroughly designed setup. Specifically, all possible the sequence orders of the four combinations (except *allow* and *deter* for the same invest following each other directly[122]) – yielding eight distinct order combinations – have been implemented through a *block design* and distributed *randomly* across the 25 sessions[123].

(ii) The allocation of the respective role, Incumbent or Entrant firm, has been assigned *randomly* through the drawing of upside down cards. The role itself has been defined to remain *constant* throughout the whole experiment to rule out potential revenge intentions. Furthermore, the Entrant role has not been aware of different Incumbent objectives throughout the experiment, which would have been jeopardised though alternating roles.

(iii) The respective pairing of different Incumbents and Entrants *alternated* for each of the four settings that were played. Participants have been aware that they play against a different opponent in each of the settings. The rationale was to reduce potential revenge intentions or strategic play that would go beyond each of the settings (since each setting was analysed on its own and setting-overarching strategies are not in the focus of this study and should accordingly be avoided). Due to the fact that the roles were assigned randomly and anonymously, no participant has been aware of whom he played against in a given setting.

(iv) Potential nuisance factors that go beyond the experiment experience, e.g., demographic or personal background related factors, have been accounted for through *control variables* applied in the subsequent statistical analysis. The full list of control variables that were utilised in the empirical analysis is described in Sub-Section V.1.1.

Furthermore, communication with participants before and during the experiment has been kept to a minimum do avoid potential *participant-predisposition* or *experimenter-expectancy* effects (Kirk, 1982). Other 'chronic nuisance' as *experience and learning*, *fatigue and boredom*, or *subject or group idiosyncrasies* as described by Friedman and Sunder (1994) were accordingly also covered by the experimental setup and considerations.

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[122] The rationale behind this exclusion included the potential risk of subconsciously inducing the urge to '*do something different this time'* if the very same situation followed with only the objective changing. Concretely, participants never played the same investment type (soft or tough) directly after each other.

[123] While each sequence block has been conducted 3 times, one sequence combination has been conducted 4 times.

V EMPIRICAL ANALYSIS & DISCUSSION OF RESULTS

The aim of this chapter is to test the hypotheses developed in CHAPTER III. After describing the definition of variables in SECTION V.1, descriptive statistics of these variables are outlined in SECTION V.2, as well as univariate analyses of expected and observed behaviours. Then, SECTION V.3 applies multivariate analyses (specifying multiple and logistic regression models) to thoroughly test the formulated propositions, discussing the results, and drawing respective conclusions. Closing, SECTION V.4 discusses the findings and places these in the context of existing literature.

V. 1 Definition of Variables

This section defines the variables used in the following descriptive and multivariate analyses. The following sub-sections respectively describe *control*, *personality*, and *behavioural market entry* variables.

V. 1.1 Definition of Control Variables

The demographic questionnaire handed out at the end of the experiment collected a more extensive list of variables including, for example, `Gender`, `EducationLevel`, or `SpecialisationField`[124]. In addition to the collected questionnaire variables, the individual game histories of the participants as well as the time to make a decision were also used to control for in the results (i.e., `PreviousPlayExperience` and `Time2Decide`, respectively). While all recorded control variables have been applied in the analyses (to rule out potential nuisance effects), results indicated only three control variables to be statistically significant:

`Gender (female)`	A dichotomous variable categorised as either *female* (=1) or *male* (=0).
`Consequences`	A dichotomous variable categorised as either *'I have not understood the consequences of my decisions'* (=1) or *'I have understood the consequences of my decisions'* (=0).
`Experiment-Experience`	A dichotomous variable categorised as having participated in *'more than five laboratory experiments'* (=1) or *'up to five'*[125] (=0).

[124] The questionnaire collected all of the following variables: `Gender`, `Age`, `EducationLevel`, `SpecialistationField`, `ExperimentExperience`, `ExperimentExperienceGame`, `KnowledgeEconomics`, `KnowledgeGameTheory`, `ExperimentObjective`, `PlatformHandling`, `UsedMaterials` and `UnderstoodConsequences`.

[125] Initially, the variable was collected as a categorical variable with multiple categories, i.e., *'none'*, *'1-2*, *'3-5'*, *'6-9'*, and *'above 9'*. However, analysis results indicated no additional value from distinguishing between these values.

V. 1.2 Definition of Personality Variables

The assessment of personality dimensions included eight main dimensions (`aggression`, `dominance`, and the six HEXACO factors) as well as 28 sub-dimensions (four variables for each, *aggression* and the HEXACO dimensions). While the respective characterisations can be found in Section III.2 (or in Appendix A1 for an extensive glossary list, which includes the sub-dimensions), this sub-section focusses on how the respective variables are defined.

Participants indicated to what extent specific statements represented their personality or attitude on a five- or six-point Likert-scale. While the sub-dimensions are comprised of 3 or 4 items or data points (per subject), the main dimensions' scores summarise 10 or 12 data points (i.e., statements). All statements were equally weighted, resulting in a score $\bar{S}^P$ for a personality (sub-)dimension P, calculated as follows:

$$\bar{S}^P = \frac{\sum_{i=1}^{n} s_i^P}{n},$$

where n represents the number of statements (or data points) for the respective personality (sub-)dimension P.

In line with the results by Ben-Ner and Kramer (2011), which suggest a non-linear relationship between personality and economic behaviour, we suggest to investigate the effect of strongly pronounced personality effects on market entry behaviour (as opposed to a linear relationship between behaviour and personality scores). That is, the continuous personality variables (representing the average scores for a given personality trait) were transformed into dichotomous variables, distinguishing the strongly pronounced traits (=1), defined as the upper-quartile scores among all participant scores, and the non-strongly pronounced traits (=0), defined as the bottom three quartiles.

V. 1.3 Definition of Market Entry Behaviour Variables

In line with the described market models in Section IV.1 and Section IV.2, the respective market entry models for a *tough* or *soft* investment represent fundamentally different investment types. Accordingly, the following paragraphs describe the recorded behavioural variables (representing the dependent variables) separately.

As the descriptive analysis in the next section reveals (Section V.2), the recorded investment behaviours in both settings (soft and tough) yielded highly right-skewed

distributions including a non-trivial share of zero values. While this potentially suggests the utilisation of a two-part model (Belotti, Deb, Manning, & Norton, 2015) on the one hand, the underlying Incumbent framework by Fudenberg and Tirole (1984) and its applications often distinguish dichotomously between *investing* or *not investing* (or *under-* and *overinvestments*). The high density around zero as well as the underlying quadratic relationships between the investment decisions (in points) and their associated effects (capacity shift and price) suggest incorporating very low investments into the *no-investing* or *underinvesting* category. Accordingly, the market entry variables (i.e., pre-entry investments), which were collected on a continuous scale, have been transformed into a dichotomous variable – with low or zero values transformed to zero and values above the threshold taking the value of 1[126].

For the market entry setting with a ***soft* investment**, two variables were defined, one for the Incumbent and one for the Entrant behaviour. In the pre-entry period the Incumbent can decide how much to invest in a *soft* investment opportunity. The setting either induces the objective to *deter* or *allow* market entry. Accordingly, the variable is defined as:

`2pmSoftDeterInvest` A dichotomous variable with a non-trivial share of values being zero (these include low non-zero values up to the threshold[127] of 10 [points]) and the ones taking the value of one for the remaining share (above the threshold value[127] of 10 [points]). This variable is also directly linked to the (percentage of) capacity shifted from the current market to the new market. Here, the setting induces the Incumbent to prefer to deter market entry.

`2pmSoftAllowInvest` As above, a dichotomous variable representing the pre-entry investment in the allow market entry setting.

After the pre-entry period and respective Incumbent investment, the Entrant firm makes its entry decision. As the Entrant role is unaware of the exogenously induced Incumbent objective (whether to deter or encourage entry), the defined Entrant variable does not distinguish between both settings[128]:

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[126] Please note: For proposition ***P3***, the variables have been transformed into semi-dichotomous (or semi-continuous) variables, since it is the 'magnitude' of the investment that is of central interest. Therefore, values below the threshold have been transformed to zero, while values above the threshold have been kept in their continuous form.

[127] The threshold has been defined based on the expected profit in period 2 when assuming Nash Equilibrium play. Accordingly, investments above this value encouraged entry (from a rational, Nash Equilibrium perspective), while values below it deterred entry (again, from a rational, Nash Equilibrium play perspective).

[128] Note: In the descriptive statistics analysis in the next section both variable scenarios are applied, the merged `SoftEnt Decision` as well as the distinguishing scenario with `SoftEntDecisionDet` and `SoftEntDecisionAll`.

`SoftEntDecision` A dichotomous variable representing to *'enter the* market' or *'not enter the market'*, i.e., staying out of the market in the second period.

Additionally, based on the preceding Incumbent invest and linked capacity shift, assuming rational play (i.e., Nash Equilibrium) in the post-entry period, the entry decision in each dyad can be classified as profitable or unprofitable (again, dependent on the preceding investment and the assumption of rational play). Accordingly, entries and non-entries (i.e., stay-outs) were classified as '*NE-rational*' or '*NE-irrational*'.

`SoftRatEntry` A dichotomous variable representing a *'NE-rational entry'* or an *'NE-irrational entry'*. Note, while all underlying data points represent an *'enter the market'* decision, this variable classifies those into *rational* or *irrational* from a Nash Equilibrium play perspective in period 2.

`SoftRatStayOut` A dichotomous variable representing a *'rational non-entry'* or an *'irrational non-entry'* decision. Here, while all underlying data points represent a *'stay out of the market'* decision, this variable classifies these non-entries into *'rational'* or *'irrational'* from a Nash Equilibrium play perspective in period 2.

The aforementioned classification of 'NE-rational' or 'NE-irrational' depends on the respective pre-entry investment by the Incumbent. Section IV.1 developed the market model in detail, which can be used to calculate the respective capacity threshold $C^T = 20\%$, beyond which entry becomes profitable for the Entrant (assuming Nash Equilibrium play).

For the market entry setting with a ***tough* investment**, equally two dichotomous variables have been defined[126]. Here, the Incumbent investment is represented by foregoing the monopoly profit by pricing below the profit-maximising price (and signal lower unit costs). Accordingly, the recorded variable is defined as:

`2pmToughDeterInvest` A dichotomous variable with a non-trivial share of values being zero (these include low non-zero values up to the threshold[129] of 20 [points]) and the value of one for the remaining share (above the threshold value[127] of 20 [points]). The values of foregone profit are based on the price set in period 1. Here, the setting induces the Incumbent to deter market entry.

[129] The threshold has been defined to match the distribution from the soft investment settings (as values tended to be slightly higher, potentially due to the steeper investment-effect relationship).

`2pmToughAllowInvest` As above, a dichotomous variable representing the pre-entry investment in the allow market entry setting.

Having observed the pre-entry price set by the Incumbent firm, the Entrant firm makes its entry decision, which is recorded by the following variable:

`ToughEntDecision` A dichotomous variable representing to *'enter the* market' or *'not enter the market'*, i.e., staying out of the market in the second period.

Since the unit costs are private information, it is not possible to classify the respective entry or stay out decisions as rational or irrational. The original paper of the underlying limit pricing model stated that limit pricing is applied by the Incumbent in all cases, independent of the level of unit costs (Milgrom & Roberts, 1982). Thus, comparing entry decisions throughout different pre-entry price levels equally sets the premises to shed light on the excess-entry phenomenon.

V. 2 Descriptive Statistics, Univariate Analysis, & Outlier Clearing

This section provides an overview of selected variables collected during the experimental study. After showing descriptive statistics of the **participant sample** of the experiment in SUB-SECTION V.2.1, SUB-SECTION V.2.2 provides an overview the collected **personality data**. Towards the end of this section, the univariate statistics of **market entry behaviour** are discussed (SUB-SECTION V.2.3). The next section, accordingly, brings all these variables together in the form of multivariate regression analyses (SECTION V.3).

V. 2.1 Analysis of Participant Sample Statistics

TABLE 5.1 provides an overview of the participant structure of the sample in the experimental study, including demographic, personal and prior knowledge related information about both the Incumbent and Entrant roles. The collection of the depicted information was motivated by i) gaining an overview over the participant sample in the experiment and ii) potentially identify factors that the multivariate analysis should control for. Since this research' purpose focuses on the relationship between personality and market entry behaviour, only significant exogenous variables are included in the following multivariate analysis.

The descriptive statistics indicate a significantly lower share of female participants (22.2 percent) in the experiment. As opposed to interactive economic situations as negotiations or multi-period games, the economic game settings in this research are relatively detached (e.g.,

due to anonymity or the fact that Incumbent action has no preceding interaction with the Entrant). This significantly limits potential interactive effects as for example illustrated by higher cooperation in bargaining games in mixed pairs (Sutter, R. Bosman, M. G. Kocher, & Winden, 2009). This is confirmed by Kray and Thompson (2004), who note that the distribution of *gender* of the counterpart is negligible if interactions are anonymous (as in this study).

Area	**Value**	**Incumbent**	**Entrant**	**Total**
Participation [n]	Count	100	94	194
Gender	Female	25	18	43
	Male	75	76	151
Age	Average	23.0	22.4	22.7
Education Level	PostDoc/PhD	0	0	0
(completed)	Master*	9	8	17
	Bachelor*	35	45	80
	High-School Diploma	55	39	94
	Other	1	2	3
Specialisation	Economic Sciences†	59	53	112
Field	Engineering	19	27	46
	Natural Sciences	7	7	14
	Human Sciences/Arts	3	1	4
	Other	12	6	18
Previous Experiment	None	8	8	16
Participations	1-2	14	12	26
	3-5	24	26	50
	6-9	24	31	55
	Above 9	30	17	47
Experiments with	Yes	88	80	168
Economic Games	No	12	14	26
Previous Knowledge	None	5	8	13
in Economics	Little-Basic	60	54	114
	Good-Very Good	35	32	67

** Bachelor and Master include 'Vordiplom' and 'Diplom', respectively*

† Here representing 'Engineering Economics' (i.e., 'Wirtschaftsingenieurwesen') and 'Technical Economics' (i.e., 'Technische Volkswirtschaftslehre')

TABLE 5.1: Participant structure and demographic information

However, gender may play a role for the individual's own attitude and overall behaviour. Croson and Gneezy (2009), for example, show that behaviour differs significantly between female and male participants, especially regarding their risk, social, and competition preferences. They find that women represent a more competition averse attitude. Similarly, behaviour in the prisoner's dilemma game indicated a more cooperative behaviour by women

than men (Ortmann & Tichy, 1999). As for risk preference, an analysis of 15 experiments confirmed a significantly different attitude towards risk by women when compared to men (Charness & Gneezy, 2012). As risk preference is a relevant factor in the context of market entry – and preliminary analyses indicated a significant impact of gender on market entry behaviour in this study – it was decided to randomly assign gender to the sessions and roles, but *control* for it in the following multivariate analyses. Notwithstanding, when analysing the external validity of the sample, the sample statistics' overrepresentation of men in fact is a relatively good proxy for current real-world settings. For example, a Forbes article recently stated that 24 percent of global senior roles are occupied by women (Medland, 2016), while 36 percent of all business are owned by women in the US (Stengel, 2016).

Age, current *education level*, and *specialisation field* provide a preliminary informative insight, as the pool of participants seems to be relatively homogeneous – the average age being 22.7 years and the majority pursuing their Bachelor or Master studies (89 percent) in either engineering or economic sciences (82 percent)[130]. While this relatively homogenous sample does not indicate the necessity to control for any of those factors, a more general point of external validity could be raised. Specifically, whether this student sample is representative for real-world decision makers in Incumbent or Entrant firms.

Early literature often criticised experimental studies that utilised student (potentially inexperienced) subject pools due to the relatively narrow and special segment of the population (Enis, Cox, & Stafford, 1972; Friedman & Sunder, 1994). While this may be true, the question should rather be whether the decisions and decision processes of student pools are significantly different from market representatives (i.e., managers or entrepreneurs). Several studies indicated an insensitivity to the choice of subject pools in economic situations (Cassar & Friedman, 2004; Croson, 2005; Davis & Holt, 1993; Exadaktylos, Espín, & Branas-Garza, 2013; Fehr & List, 2004; Phillips & Mason, 1992). Accordingly, numerous, widely accepted, experimental studies utilise student subject pools in their economic experiments (e.g., Brandts et al., 2007; Cain et al., 2015). More specifically, Moore et al. (2007) compare founders and non-founders and find no significant difference between their market entry behaviour. In fact, both groups exhibit excess entry. While this study is the first of its kind with respect to holistically analysing market entry behaviour against the background of personality, student

[130] Initial results from multivariate regression analyses did not indicate any significant effects of these characteristics. Accordingly, these characteristics included as control variables in the following analyses.

subjects represent a good sample to verify the developed propositions (especially, against the background of being good proxies for real-world managers or entrepreneurs as discussed above). If significant effects are found for this subject pool, the findings would strongly suggest a similar effect for real-world decision makers (which could be verified by an alternative sample in future research efforts).

Beyond gender and educational level (and specialisation), the respective *experience in economic experiments* may have a significant impact on behaviour detected, especially if subjects participated in similar experiments (Benson & Faminow, 1988). While relatively moderate fractions indicated to have *none* or *little* (21 percent) or *mediocre* (26 percent) previous experiment experience, more than half of the sample has indicated to have extensive prior experience (52 percent). Although investigations indicated that inexperienced students did not act significantly different in economic experiments than experts (Davis & Holt, 1993), initial analyses of this study's results' suggested some explanatory power. Thus, extensive prior experiment experience (i.e., participation in more than five experimental studies) is included in the later analyses as a control variable.

Although market information and required participant decisions were simplified as much as possible (through the utilisation of pre-red material, payoff tables, and profit calculators), the fact that more than 90 percent of participants are *familiar with economic concepts* is reassuring as towards predicted comprehension of the experiment and individual decisions.

V. 2.2 Analysis of Collected Personality Data

This sub-section is dedicated to the univariate analysis of the personality data of participants that has been collected via the self-report questionnaire at the beginning of the experiment. First, the descriptive statistics of the respective variables, which can be classified into main dimensions (*8x*) and sub-dimensions (*28x*), are presented in Table 5.2. The table summarises the respective number of observations (*N*), mean (*M*), standard deviation (*SD*), minimum (*min*), maximum (*max*), as well as their mean, 10^{th} (*10p*), and 90^{th} (*90p*) percentile. Then, Table 5.3 presents an overview of the pairwise correlations between the variables.

Notably, the means presented in Table 5.2 for *aggression* (as well as its sub-dimensions), are significantly lower than those for all other (sub-)dimensions, which is especially interesting, as the underlying Aggression Questionnaire (AQ) uses a 6-point Likert-scale (instead of five points). This supports the potential effect of *self-deception*, a form of unconscious self-

presentation. Self-deception includes variants as self-favouring bias, self-enhancement, and denial (Paulhus & Vazire, 2007), often linked to social norms or expectations. Self-reported 'positive' dimensions as *greed-avoidance* tend to have higher scores, while 'negative' dimensions as *aggression* have lower. Since this study compares the participant scores to each other, and this is a relatively common effect (Paulhus & Vazire, 2007), this is not of concern for the upcoming analyses.

Framework	**Dimension** (Subdimension)	N	M	SD	Min	10p	Median	90p	Max
Aggression†	**Aggression**	194	2.48	0.66	1.17	1.67	2.50	3.33	4.42
	Physical Aggression	194	2.20	1.05	1.00	1.00	2.00	3.67	5.33
	Verbal Aggression	194	2.76	0.78	1.00	1.67	2.67	4.00	5.00
	Anger	194	2.28	0.96	1.00	1.00	2.00	3.67	6.00
	Hostility	194	2.67	0.79	1.00	1.67	2.67	3.67	5.33
16-IPIP	**Assertiveness**	194	3.84	0.50	2.20	3.20	3.90	4.50	4.90
HEXACO	**Honesty-Humility**	194	3.24	0.63	1.70	2.40	3.20	4.00	5.00
	Sincerity	194	3.18	0.84	1.33	2.00	3.00	4.33	5.00
	Fairness	194	3.23	1.05	1.00	2.00	3.33	4.67	5.00
	Greed-Avoidance	194	2.95	0.98	1.00	2.00	3.00	4.00	5.00
	Modesty	194	3.61	0.94	1.00	2.15	3.50	5.00	5.00
	Emotionality	194	2.81	0.64	1.50	2.03	2.75	3.60	4.50
	Fearfulness	194	2.40	0.72	1.00	1.67	2.33	3.33	4.33
	Anxiety	194	3.36	1.02	1.00	2.00	3.50	4.50	5.00
	Dependence	194	2.63	0.97	1.00	1.50	2.50	4.00	5.00
	Sentimentality	194	2.98	0.90	1.00	1.67	3.00	4.33	5.00
	Extraversion	194	3.60	0.55	2.00	2.83	3.70	4.27	4.80
	Social Self-Esteem	194	3.90	0.73	1.33	2.67	4.00	4.67	5.00
	Social Boldness	194	3.41	0.72	1.33	2.43	3.33	4.33	5.00
	Sociability	194	3.45	0.84	1.50	2.50	3.50	4.50	5.00
	Liveliness	194	3.59	0.78	1.50	2.50	3.50	4.50	5.00
	Agreeableness	194	3.34	0.60	1.90	2.50	3.40	4.10	4.70
	Forgiveness	194	2.92	0.98	1.00	1.50	3.00	4.00	5.00
	Gentleness	194	3.23	0.75	1.33	2.33	3.33	4.33	5.00
	Flexibility	194	3.30	0.77	1.33	2.33	3.33	4.33	5.00
	Patience	194	3.99	0.82	1.50	3.00	4.00	5.00	5.00
	Conscientiousness	194	3.54	0.62	1.60	2.70	3.60	4.37	4.70
	Organisation	194	3.47	0.96	1.00	2.00	3.50	4.50	5.00
	Diligence	194	3.60	0.86	1.00	2.50	3.50	4.50	5.00
	Perfectionism	194	3.59	0.83	1.00	2.33	3.67	4.67	5.00
	Prudence	194	3.49	0.74	1.33	2.67	3.67	4.33	5.00
	Openness to Experience	194	3.43	0.58	1.90	2.70	3.40	4.17	4.90
	Aesthetic Appreciation	194	3.08	1.02	1.00	2.00	3.00	4.50	5.00
	Inquisitiveness	194	3.66	0.90	1.00	2.50	3.75	5.00	5.00
	Creativity	194	3.31	0.84	1.33	2.00	3.33	4.67	5.00
	Unconventionality	194	3.64	0.76	1.67	2.67	3.67	4.67	5.00

† 6-point Likert-scale (versus 5-point for all other frameworks)

TABLE 5.2: Descriptive statistics of all personality variables

Along those lines, a similar effect can be observed when comparing the means of the HEXACO and *assertiveness* dimensions, where more desirable dimensions as *assertiveness* (*3.84*; e.g., 'I do not get pushed around'), *extraversion* (*3.60*) and *conscientiousness* (*3.54*) show significantly higher scores than *emotionality* (*2.81*)[131]. While *agreeableness* and *honesty-humility* do not indicate such a strong connotation, their means rank as 4th (*3.34*) and 5th (*3.24*) among the six dimensions, respectively. Potentially, this could indicate that participants interpret these more 'soft' dimensions as weak, especially in a competitive context as economic games typically represent.

A first glance at the respective distributions (i.e., mean, median, 10th and 90th percentiles), confirms the shifted means and distributions of the less or more desired traits, and indicates that the personality dimensions further differ in their respective distributions (i.e., differently skewed distributions). FIGURE 5.1 depicts a visual illustration of these distributions in the form of box-plots[132]. When examining the respective box-plots for each personality dimensions, one can visually infer that all dimensions are relatively homogenous in the sense of their size, i.e., the level of agreement does not differ significantly between personality dimensions. If at all, the box-plots of *assertiveness* and *extraversion* are slightly shorter, supporting the aforementioned self-deception bias as subjects tend to 'agree' more on the selected scores.

[131] Note: While both the 16-IPIP (*assertiveness*) and HEXACO frameworks use 5-point Likert-scales, the respective framing and/or phrasing of the statements might differ (as the inventories have different origins) and account for the recorded effect.

[132] First developed by Tukey (1977), each boxplot consists of a box depicting the values of the 25th and 75th percentiles (or 1st and 3rd quartiles), while the horizontal line within the box corresponds to the median. The height of the box is defined as the 'inter quartile distance' (Kohler & Kreuter, 2012). The outer lines illustrate the respective maximum values (excluding outliers, which are data points 1.5 times [of the inter quartile distance or box size] beyond the 25th or 75th percentiles).

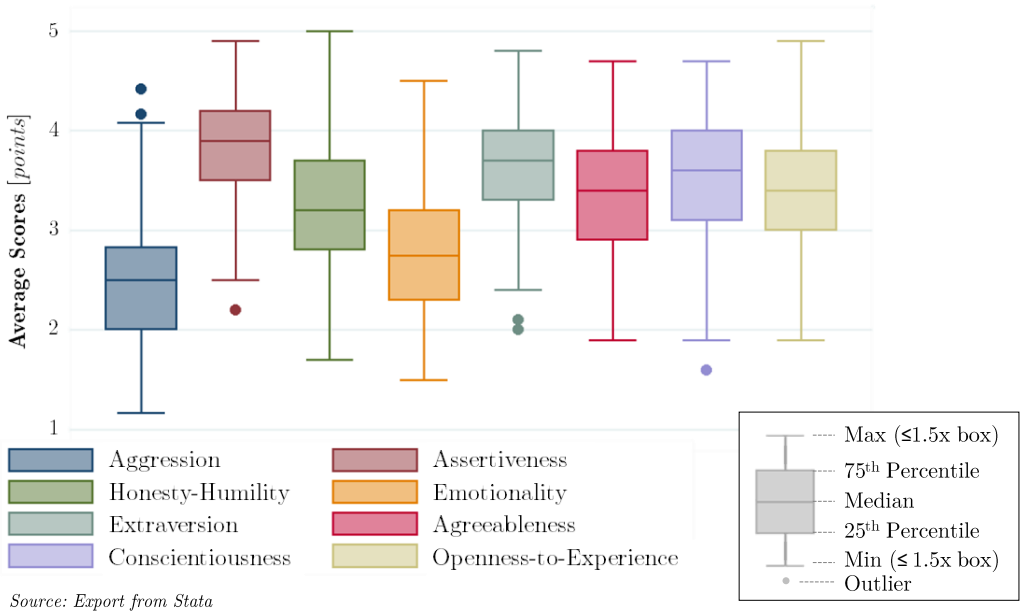

FIGURE 5.1: Box-plot distribution of main personality dimension scores[131]

In addition, the visual inspection of the symmetries of the box-plots further supports the initial conjecture that some dimensions embody skewed distributions. While not very significant, it is possible to detect that the upper whisker is shorter for *assertiveness* and *conscientiousness* than the lower whisker. A reversed observation can be made for *aggression* and *emotionality*.

Before confirming this conjecture, it is worthwhile to point out that there are very few outliers (data points lying outside 1.5 times of the upper or lower quartile (Kohler & Kreuter, 2012)]), with 6 outliers throughout 1,552 data points for four of the eight dimensions. As these outliers do not seem to be extreme, an outlier correction is not necessary at this point.

In order to shed further light on the distributions, especially potential skewness, I generated histograms for each of the personality dimensions and calculated the respective skewness factors, as shown in the following figure.

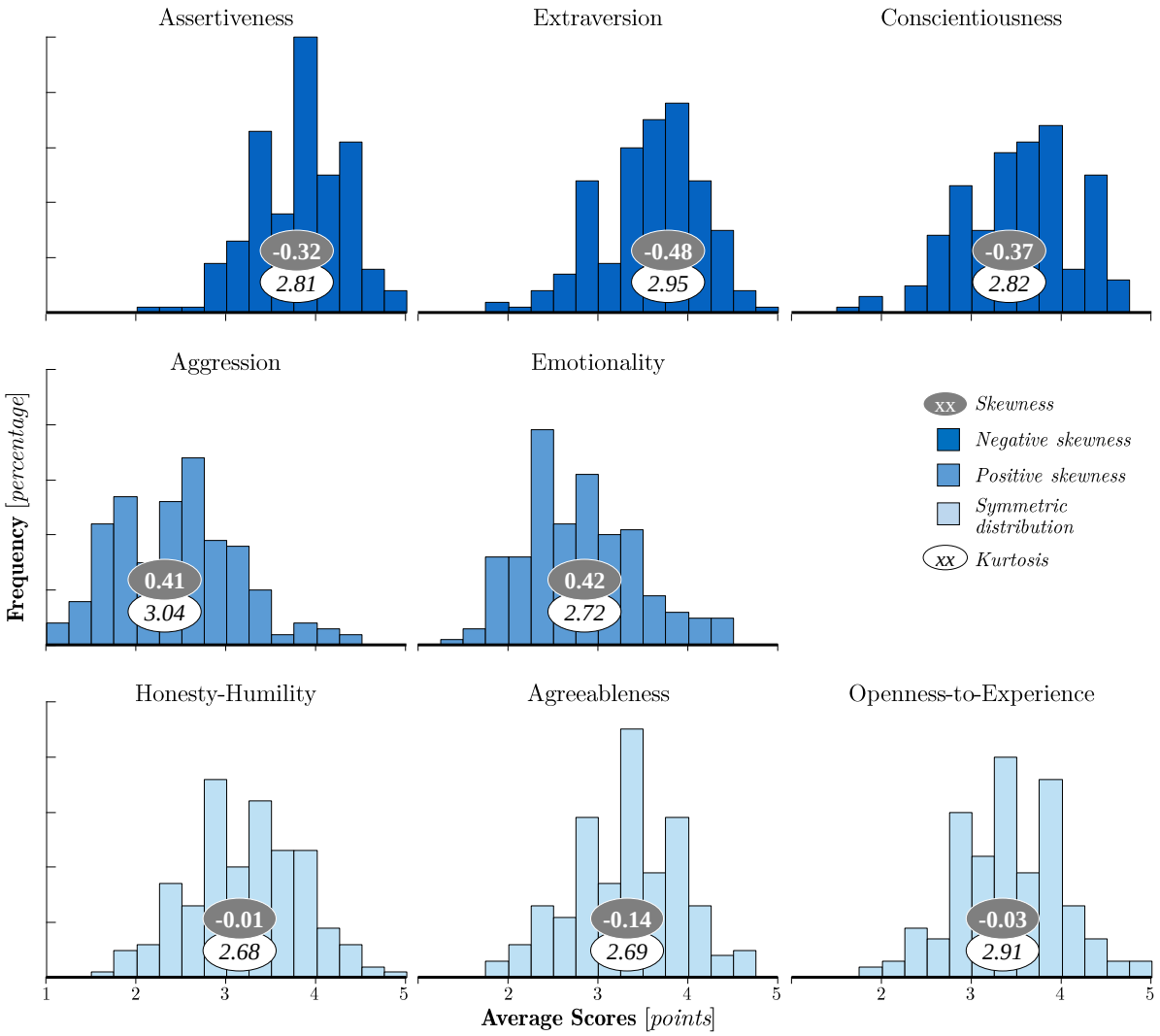

FIGURE 5.2: Histograms, skewness, & kurtosis of the main personality dimension distributions

As initially suspected, the dimensions differ in their distributions. While the skewness of the distributions are not substantial (i.e., below -1 or above 1), a few dimensions do exhibit minor skewnesses differing from 0. The negatively skewed distributions of *assertiveness* (*-0.32*), *extraversion* (*-0.48*), and *conscientiousness* (*-0.37*) imply that the majority of data is located in the upper side of the scores. Contrarily, *aggression* (*0.41*) and *emotionality* (*0.42*) are positively skewed, suggesting that the majority of data is located in the lower part of the scores. As mentioned before, these observations confirm the self-deception bias that is linked to desirable or undesirable personality dimensions. While *assertiveness*, *extraversion*, and *conscientiousness* seem to be reflected as desirable dimensions also in this sample, *aggression* and *emotionality* represent the less desired dimensions.

While this can become a potential problem for very extreme cases (e.g., nearly all of the subjects selected the maximum or minimum scores), an analysis of the respective kurtoses

rejects this risk (see scores in FIGURE 5.2). High scores would indicate steep distributions around the distribution mean. While a kurtosis of 3.0 equates to the value of the normal distribution, the distributions for the main dimensions seem to represent relatively normal distributions[133].

TABLE 5.3 below depicts the pairwise correlations between the main personality dimensions, namely, the Spearman correlation coefficients[134]. A more extensive heat-map analysis, including all 34 personality (sub-)dimensions, is displayed in APPENDIX A4.1.

				Correlation coefficients						
Framework	**Personality Dimension**	**M**	**SD**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AQ	(1) Aggression	2.48	0.66	-						
16-IPIP	(2) Assertiveness	3.84	0.50	-0.09	-					
HEXACO	(3) Honesty-Humility	3.24	0.63	-0.35*	-0.06	-				
	(4) Emotionality	2.81	0.64	0.15	-0.31*	0.06	-			
	(5) Extraversion	3.60	0.55	-0.23*	0.47*	0.04	-0.17	-		
	(6) Agreeableness	3.34	0.60	-0.52*	-0.28*	0.38*	-0.03	0.06	-	
	(7) Conscientiousness	3.54	0.62	-0.15	0.34*	0.13	0.19*	0.17	-0.11	-
	(8) Openness-to-Experience	3.43	0.58	-0.11	0.16	0.2*	-0.08	0.12	0.05	-0.01

*Note: Correlation coefficients denoted with * correspond to a significance level of 0.01*

TABLE 5.3: Mean, standard deviation, and Spearman's correlation coefficients of main personality dimensions

The evaluation of the pairwise correlations involves two aspects, the within-framework correlations of the HEXACO inventory, which should not yield many inter-correlations, and a cross-framework examination. The latter might give initial valuable insights into underlying relationships between the dimensions. As expected (due to the underlying factor analyses), the within-framework correlations are very limited, showing weak mediocre correlations for *honesty-humility – openness-to-experience* (*0.20*) and *emotionality – conscientiousness* (*0.19*). The remaining and more significant correlation between *agreeableness* and *honesty-humility* (*0.38*) is not surprising, as both represent a form of cooperative and pro-social behaviour (and have historically been consolidated).

Aggression seems to be negatively correlated to *agreeableness* (*0.52*), *honesty-humility* (*0.35*), and *extraversion* (*0.23*). While the personality dimensions are not necessarily mutually exclusive (i.e., a person can score high on all dimensions), these results suggest that the conflict-seeking dimension *aggression* and the harmony-seeking dimensions *honesty-humility* and *extraversion* are correlated in opposite directions, i.e., simultaneous high or low scores are

[133] Most likely this is driven by a substantial sample size as well as the utilisation of established personality inventories.

[134] Since the underlying variables are measured on an ordinal scale (i.e., Likert-scale), Spearman's correlation has been applied.

unlikely to be observed. However, latter analyses should verify this indication and check for potential mutual cancellation. The correlation with *extraversion* – while of mediocre magnitude – could be driven by the self-deception bias discussed before.

Interestingly, there seems to be no correlation between *aggression* and *assertiveness*, which – based on the hypotheses development methodology – could have been expected. The non-correlation could simply imply that both factors do neither necessarily reinforce nor exclude each other. Alternatively, both dimensions are measured by different inventories (with different origins), which might attach different notions to the dimension(s)[135]. The remaining (positive and negative) correlations of *assertiveness* with other dimensions seem to follow the earlier observed tendency to unconsciously score higher (lower) on more (less) desirable traits.

As for the extensive correlation matrix (see APPENDIX A4.1), including all 34 personality trait variables (i.e., main and sub-dimensions), the sub-dimensions of all main dimensions are, unsurprisingly, positively and significantly correlated to their respective 'super'-dimension. In addition, all sub-dimensions are positively and significantly (except for a two cases[136]) correlated with the other corresponding sub-dimensions, further confirming the validity of the personality data for the sample. In line with the aforementioned main-trait intercorrelations, the sub-dimensions depict a persistent significant (negative) correlation between *aggressiveness* indicates with the harmony-seeking dimensions *honesty-humility* and *agreeableness*.

In summary, the recorded personality data does not exhibit any critical anomalies that subsequent analyses have to account for or outliers that need to be cleared. All dimensions embody nearly normal distributions (see kurtoses) with slight skewness for the more desired or less desired dimensions (in line with the mean comparison between dimensions). The intercorrelations support the rationale of *conflict-* and *harmony-seeking* traits applied in CHAPTER III while developing the propositions.

V. 2.3 Analysis of Market Entry Behaviour

This sub-section reviews the univariate analysis of observed market entry behaviour during the experiment (as defined by the variables in the previous section). First, the paragraphs discuss the descriptive statistics of the Incumbent actions, before following with the Entrant decisions.

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[135] Specifically, the statements in the Aggression Questionnaire are relatively strong in their message (e.g., '*I have hit someone*'), while the statements in the 16-IPIP are more desirable (e.g., '*I do not like to be pushed around*').

[136] *Fairness* and *creativity* do not depict significant correlations (at 0.01 level) with one or two of their respective co-sub-traits.

The aim is to identify potential regularities (or irregularities) with regards to expected behaviour based on the developed propositions and hitherto literature, as well as potentially obtaining preliminary indications concerning the recorded behaviours.

TABLE 5.4 summarises recorded **Incumbent decisions**, including the number of observations (*N*), mean (*M*), standard deviations (*SD*), and pairwise Pearson correlation coefficients. The equivalent distributions are further analysed based on the subsequent box-plot analysis (see FIGURE 5.3). The following analyses distinguish between the four market and investment settings as defined based on the underlying theoretical FT-framework.

Type of Investment	Variable Name	N	M	SD	Min	10p	Median	90p	Max	Pearson coefficients (1)	(2)	(3)
Soft	(1) `SoftDeterInvest`	100	28.25	32.57	0.0	2.0	12.5	72.0	200.0			
	(2) `SoftAllowInvest`	100	34.59	34.35	0.0	3.9	20.0	80.4	200.0	0.15		
Tough	(3) `ToughDeterInvest`	100	34.26	52.72	0.0	0.0	6.3	100.0	306.3	0.04	-0.02	
	(4) `ToughAllowInvest`	100	35.58	40.90	18.1	18.2	21.3	86.3	351.3	-0.07	-0.15	0.03

*Note: Correlation coefficients denoted with * correspond to a significance level of 0.01*

TABLE 5.4: Descriptive statistics and Pearson correlation coefficients for Incumbent variables

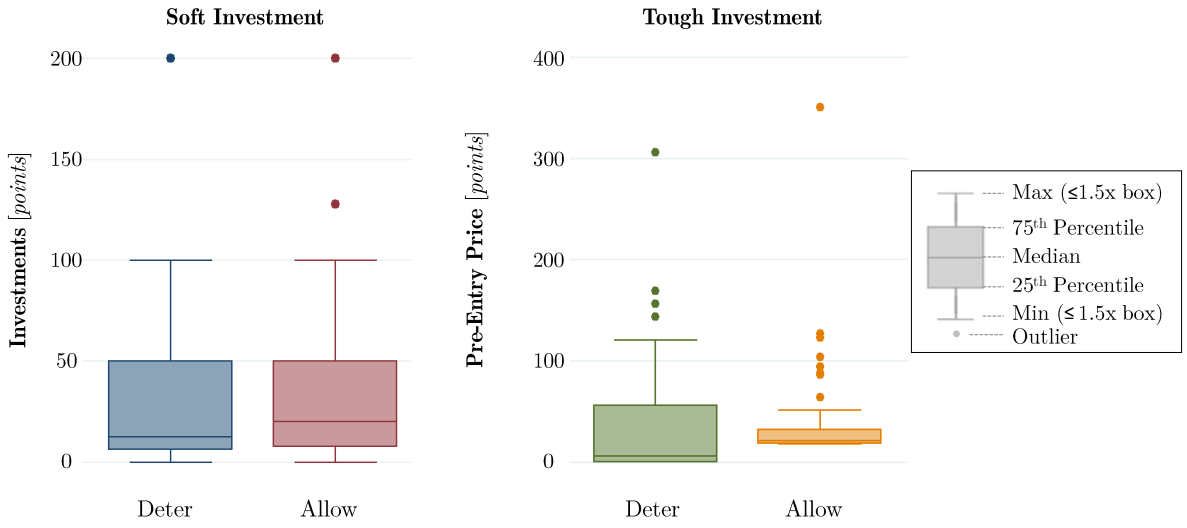
While the observed mean for the soft investment type is higher for the allow settings (compared to deter), the Wilcoxon rank-sum test (*diff.=6.34*; *z=1.73*; *p=0.083*) only confirms this observation at the 0.1 significance level. Although the confirmed difference is in line with the exogenously induced objective and underlying FT-framework, the moderate significance suggests that additional factors drive Incumbent behaviour. In addition, the distribution statistics of the soft settings strongly suggest skewed distributions, most likely driven by the underlying quadratic cost function. The fact that, for both cases, upper and lower end extremes have been recorded is surprising and will be verified through a box-plot analysis.

Interestingly, the difference between both tough investment settings is visibly smaller than the difference in the soft investment setting. The Wilcoxon rank-sum test, however, confirms the visual analysis with a higher significance, rejecting the null hypothesis (*diff.=1.32*; *z=3.80*; *p=0.000*). Similar to the soft investment setting, extreme cases have been recorded for the respective investments (implying the selection of the minimum price point of 2.00), which suggests potential outliers that should be cleared for the multivariate regression analysis.

The pairwise correlation coefficients do not detect any significant correlations. While significant correlations would have suggested consistent Incumbent behaviour throughout the different settings, these results indicate that behaviour is somewhat setting-specific (even if not

confirmed visible on a sample level as indicated above). This is in line with previously discussed literature (CHAPTER II), which found that the task context impacts the effectiveness of a personality trait (Pothos et al., 2011).

Subsequently, FIGURE 5.3 depicts the Incumbent investment distributions in the form of box plots, which sheds some light on the aforementioned conjecture of potential outliers and skewness. For the soft investment setting, the box plot graph identifies three outliers (two taking the maximum possible value of a pre-entry investment). While the third higher investment (i.e., value of 128) is not necessarily irrational, the two data points taking the maximum value of 200 remain conspicuous. As closer examination reveals that two different subjects are responsible for the outliers and, potentially, were not fully aware of the consequences of their actions[137], these outliers should be accounted for in later analyses.



Source: Export from Stata

FIGURE 5.3: Box-plot distribution of Incumbent behaviour

Similarly (and even more significantly), the distributions in the tough investment setting depict highly right-skewed distributions with two clear outliers. While there seem to be more outliers, the two extreme ones both taking the minimum price levels of 2.00 (recorded by two different subjects), strongly suggesting some sort of scale experimentation and therefore to exclude them from the following analysis. While a very low pre-entry price might be justifiable in the deter setting (in order to achieve the objective of entry deterrence), the fact that unit

[137] While one subject reported to '*not have fully understood the consequences of all his/her actions*' (allow), the other reported to have '*little*' prior knowledge in economics and '*not have used the profit calculator in any of the settings*'.

costs are higher in both cases (2.5 and 2.65 respectively), yielding negative results in the pre-entry period, further confirms their outlier characteristic. Furthermore, the post-experiment questionnaire provides some indication that both subjects were, potentially, not fully aware of the consequences of their actions[138], which confirms the exclusion of both data points.

As suspected, the box plots and calculated skewnesses (*2.04* [deter] and *1.68* [allow] in the soft setting; 2.*25* [deter] and 5.*10* [allow] in the tough setting) confirm the asymmetric distributions of the variables. The substantial skewness factors in both settings (i.e., values above 1.0) are likely to be partly explained by the associated quadratic functions (for shifted capacity and price level). While the descriptive analysis suggested relatively similar distributions, the box plots suggest a visually observable difference between the deter and allow setting. That is, the Incumbent behaviour in the allow setting is significantly more concentrated around the non-investment zero, suggesting some effect of the induced Incumbent objective.

TABLE 5.5 summarises the descriptive statistics for the recorded **Entrant behaviours**. It comprises the number of observations (*N*), absolute (*F*) and relative (*F%*) frequencies, as well as the mode. In line with prior procedure, it also includes the pairwise correlation coefficients[139].

Type of Investment	Variable Name	N	F	F(%)	Mode	Relevant Phi coefficients					
						(1)	(2)	(1&2)	(3)	(4)	(5)
Soft	(1) SoftEntDecisionDet	94	70	74.47	1	-					
	(2) SoftEntDecisionAll	94	80	85.11	1	0.23*	-				
	(1&2) SoftEntDecision	188	150	79.79	1			-			
	(3) SoftRatEntry	150	108	72.00	1				-		
	(4) SoftRatStayOut	38	16	42.11	0					-	
Tough	(5) ToughEntDecisionDet	94	54	57.45	1	0.14	0.00				-
	(6) ToughEntDecisionAll	94	53	56.38	1	0.08	-0.13				0.15
	(5&6) ToughEntDecision	188	107	56.91	1			0.02			

*Note: Correlation coefficients denoted with * correspond to a significance level of 0.05; shaded area exludes non-inclusive data set comparisons*

TABLE 5.5: Descriptive statistics and Phi correlation coefficients for Entrant variables

The table above displays the entry frequency for all recorded dyads. It is important to point out that each of these entry decisions is not necessarily comparable to each other, as in each case a preceding Incumbent investment (which might be different for each case) potentially influenced the respective entry decision. Therefore, the interpretation of the descriptive statistics has to be conducted with caution, as these preceding investments are very

[138] While one subject has '*not understood one or two of the market settings*', the other subject reported to have used the profit calculator '*only in one setting*'.

[139] The Pearson correlation coefficient between two binary variables is defined as the Phi coefficient.

likely to have affected Entrant decisions and are not included in the analysis at this point. The above table summarises the entry decision in three different ways (whereas iii) is not applicable to the tough setting):

i) each Incumbent objective setting is displayed separately (deter and allow),

ii) both settings are merged (since – from the Entrant's point of view – both scenarios do not differ from each other[140], which is the reason that latter analyses do not include the former [i.e., separated] variables), and

iii) *NE-rational* entries or non-entries, respectively – assuming Nash Equilibrium play in period 2 and taking into consideration the entry cost.

In the complete information setting (i.e., soft investment), the significant correlation at the 0.05-level between both entries, (1) and (2), can have several causes. One is the previously mentioned Incumbent investment, which did not seem to differ significantly between both objective settings. Furthermore, this correlation can be driven by the overarchingly high share of entries (around 80 percent). Lastly, one of the previously developed propositions (that personality traits might drive excess entry) also remains as a potential driver. While a similar effect is recorded for the signalling setting (i.e., tough investment), it is not significant.

In order to shed further light on the mentioned preceding Incumbent investments, Table 5.6 summarises the point-biserial correlation coefficients for the Entrant decisions and their associated Incumbent investments. Strikingly, only one significant correlation is recorded for the entry decisions, namely, for the tough investment behaviour and the deter market entry objective. This suggests a few potential implications – briefly discussed in the following.

Type of Investment	Variable Name		Preceding Incumbent Invesments for (1)-(4)
Soft	(1)	`SoftEntDecisionDet`	0.11
	(2)	`SoftEntDecisionAll`	0.01
Tough	(3)	`ToughEntDecisionDet`	-0.35*
	(4)	`ToughEntDecisionAll`	-0.17

*Note: Correlation coefficients denoted with * correspond to a significance level of 0.01*

Table 5.6: Point-biserial correlation coefficients for entry decisions and Incumbent investments

While the univariate results should be analysed with caution, it is puzzling that only one of the four settings yields significant correlation results. While the coefficients denote the

[140] Except for the indirect effect of preceding Incumbent investments, which are likely to be affected by the defined setting.

expected effect direction (positive for the soft and negative for the tough investment), these results seem to suggest that entry decisions are not exclusively affected by Incumbent investments. In addition, the observed excess entry behaviour potentially also explains the missing correlation. Especially, the following analysis of *NE-rational* and *–irrational* entries should yield promising insights, potentially explain whether personality accounts for the NE-irrational entries (or stayouts).

In summary, the descriptive statistics analysis of market entry data yielded some valuable insights. Besides raising some attention to a few outliers that will be accounted for in the following analyses, it supported the initial research motivation that market entry behaviour (by Incumbent and Entrant) is driven by more than just the underlying factual parameters (as the conflicting findings in theoretical and empirical research in CHAPTER II suggested). While personality and market entry behaviour have not been linked yet, the heterogeneous results between the respective investment types suggest promising insights. In addition, the inconsistent investment and entry behaviour – in combination with the findings on different effects of personality traits in different contexts (Pothos et al., 2011) – potentially support the developed propositions.

V. 3 Multivariate Regression Analysis of Research Hypotheses

While the descriptive and univariate analysis results can be interpreted in the direction of the developed propositions and hypotheses, statistically sound findings and conclusions need to be developed based on the multivariate regression analysis in this section. After the description of appropriate empirical models and potential statistical challenges and problem areas associated with the analysis (SUB-SECTION V.3.1), the Incumbent (SUB-SECTION V.3.2) and Entrant behaviour (SUB-SECTION V.3.3) are analysed successively. A summary of the detected experimental findings closes this section (SUB-SECTION V.3.4).

V. 3.1 Applied Empirical Models & Potential Problem Areas

This sub-section's aim is to describe the appropriate empirical models that were applied to test the developed hypotheses. The dependent variable (DV) data that has been collected is continuous (pre-entry investment) and binary (entry decision) taken at a given point in time,

which implies that mostly multivariate cross-section models should be utilised (Wooldridge, 2015), namely, linear and logistic regression models (V.3.1.1). Subsequently, potential challenges associated with the collected data sets or applied models as well as the interpretation of their results are discussed. I also discuss potential methods and approaches on how to deal with and – ideally – solve these issues.

V. 3.1.1 Selection of Appropriate Multivariate Regression Models

The collected data represents cross-sectional data, which comprises data points collected across different individuals (or households, firms, etc.) at a given point in time (Wooldridge, 2015). Accordingly, multivariate linear (continuous DV) and logistic (binary DV) regression models are typically applied for the corresponding analyses. However, the descriptive statistics, and especially the *box-plot analysis*, of the collected Incumbent behaviours in Sub-Section V.2.3 depicted a highly right-skewed distribution for the presumably continuously distributed DV, which puts the utilisation of a purely linear regression into question (Belotti et al., 2015). A popular approach, which has also been applied in this analysis, is to transform the (skewed) continuous dependent variable into a dichotomous variable and run a logistic regression (propositions ***P1*** and ***P2***). For the analysis of the 'investment magnitude' (proposition ***P3***), applying the logistic would not be sufficient, as information concerning the investment amount would be lost. The type of underlying data commonly arises in biological or ecological contexts (Fletcher, MacKenzie, & Villouta, 2005), where different approaches have been developed to appropriately analyse the underlying data without loss of valuable information. The two established approaches represent (i) the transformation of the dependent variable on the one hand, and (ii) applying a combination of two regression models on the data set.

(i) While log-transforming the skewed DV is often an effective solution (Wooldridge, 2015), the problem with a log-transformation in this particular case is the non-trivial share of zero values (since $\log(0)$ is undefined). Hyndman (2010) summarises two common approaches that avoid this problem by right-shifting the distribution by a defined parameter before log-transforming it (i.e., the *Box-Cox transformation*[141]) or defining a log-like transformation with values for zero (i.e., the *inverse hyperbolic sine (IHS) transformation*[142]). Against the

[141] Originally developed by Box and Cox (1964), the common application of the two-parameter transformation is a right-shift of the distribution by the value of 1 to enable a log-transformation (Hyndman, 2010).

[142] Initially developed by Johnson (1949), this transformation has the two advantageous characteristics of behaving like a log-transformation for larger values and mapping zero values to zero (Hyndman, 2010).

background of the underlying FT-framework and the research question whether Incumbents invest in the pre-entry period or not, a log-transformation does not necessarily represent the best applicable method to analyse the underlying investment data.

(ii) The second approach involves combining more than one regression model on the unchanged underlying data set (Belotti et al., 2015; Fletcher et al., 2005). Typically, the first part of the model analyses the probability of observing a positive-versus-zero outcome, while the second part then analyses the continuous, positive values, excluding the zero values (Belotti et al., 2015). While different regression models can be combined together, a common approach involves a logistic regression for the binary variable analysed in the first part and a linear regression for the continuous variable in the second part. Against the aforementioned background of the underlying framework as well as the fact that the data is not transformed, we propose to apply a two-part model for the underlying semi-continuous investment variable (i.e., continuous variable with a non-trivial share of zero values). The following paragraphs discuss the applied models as well as the regression model for analysing the Entrant behaviour.

The most popular statistical multiple regression method for continuous cross-section data is the **ordinary least square (OLS) regression** (Cameron & Trivedi, 2005; Wooldridge, 2015). The OLS-regression identifies OLS estimators (estimates of the intercept β_0 and slope parameters β_i, for $i = \{1, \dots, n\}$) so that the sum of squared errors is minimised for all observations (Cameron & Trivedi, 2005; Wooldridge, 2015). While the OLS regression assumes a linear relationship of the parameters, alternative non-linear models have been calculated as well, in order to verify the suitability of the OLS for this data set. Instead of deriving, defining, and discussing OLS regression fundamentals, this thesis focusses (in the next sub-sub-section) on the associated pitfalls and challenges that might arise and how to deal with those.

The DV recorded for the Entrant behaviour is dichotomous (i.e., taking values of 0 or 1, also known as binary). Similarly, the first part analysis of the Incumbent behaviour utilises a dichotomous variable (zero versus non-zero values). Both cases suggest the utilisation of a **logistic regression model** (or simply logit regression). In line with Wooldridge's (2015) definition, the logit regression models the probability of 'success' for the dependent variable (i.e., $y = 1$), using a logistic function $G(z)$, which takes values strictly between 0 and 1 for real numbers z:

$$P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k)\,,$$

where y represents the dependent variable, x the vector of regressors, and $G(z)$ the function

$$G(z) = \frac{e^z}{1 + e^z}.$$

While $G(z)$ is a cumulative distribution function (cdf) of the *standard logistic* distribution in the logit model, $G(z)$ represents the *standard normal* cdf in the **probit model** (Cameron & Trivedi, 2005), defined as

$$G(z) = \int_{-\infty}^{z} \Phi(v)dv\,,$$

where $\Phi(v)$ is the standard normal density[143]. Specifically, the logit and probit models differ in their assumption regarding the distribution of the errors, the former assuming a standard logistic distribution, the latter a normal distribution. While the distribution of errors is unknown for this data set, this thesis' analysis methodology primarily utilises the logit model, which also bears the advantage of transforming the coefficients into equivalent – more interpretable – odds ratios. The probit model, yielding very similar (though not identical) results (Rodríguez, 2007; Stock & Watson, 2012), is leveraged as a secondary verification model for the results (i.e., a robustness test).

Although cross-sectional data is often referred to as the 'least complex' type of data sets (Wooldridge, 2015), it may include several idiosyncrasies, which could distort results or mislead appropriate interpretations of the findings. In addition to data outliers (discussed in the previous section), the most relevant idiosyncrasies – especially for the underlying data set and experimental setting – are discussed in the following sub-sub-sections.

V. 3.1.2 Potential Non-Linearity of the Parameters

One of the most important conditions for using the OLS regression model is the linear relationship between the DV and the IV (Kohler & Kreuter, 2012; Wooldridge, 2015). Using the OLS regression model in presence of non-linearity would yield less accurate and potentially misleading results. Since the study results by Ben-Ner and Kramer (2011) suggest a non-linear relationship between behaviour and personality, it is necessary to verify the non-linearity assumption for this data set to ensure unbiased regression results. The most common method

[143] Which is defined as $\Phi(v) = (\sqrt{2\pi})^{-1}\, e^{-\frac{v^2}{2}}$.

for detecting non-linearity is the *component-plus-residual-plot*[144](Kohler & Kreuter, 2012; UCLA: Statistical Consulting Group), henceforth *cpr-plot*. FIGURE 5.4 exhibits the cpr-plots for all eight main personality dimensions for the *soft* investment and *allow entry* case[145].

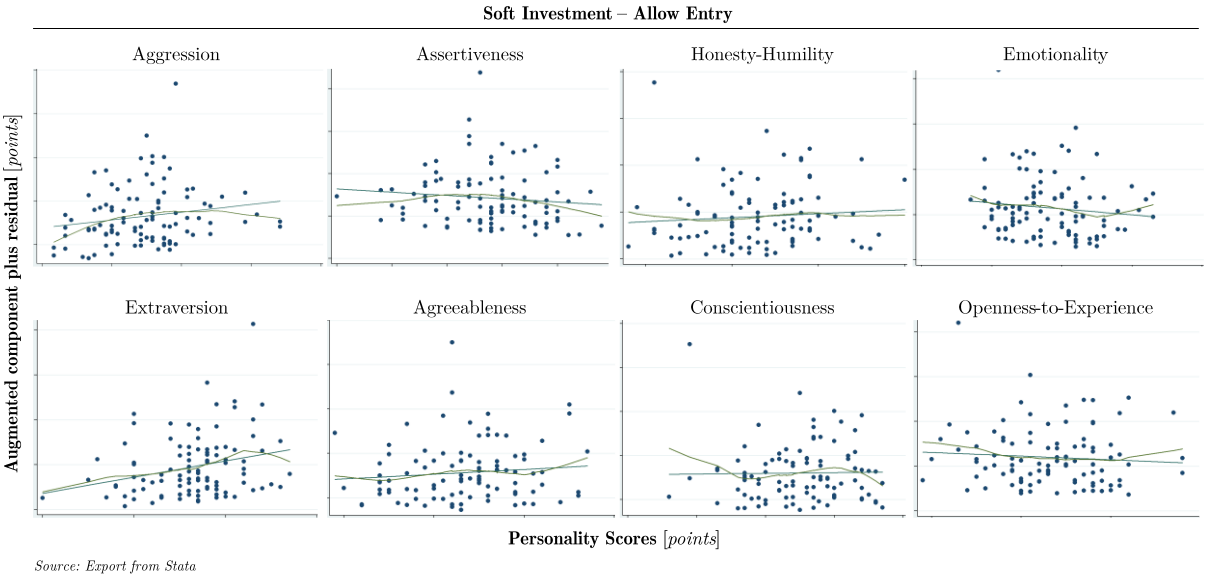


FIGURE 5.4: *Cpr-plots* for the main personality trait variables (soft invest & allow entry setting) – full data

In case of linearity, the (straight) regression line and the median spline[146] should yield similar gradients throughout the data set. In case of alternating gradients (especially changing gradients) the underlying data suggests to bear non-linear relationships. In line with the sensitivity level outlined by Kohler and Kreuter (2012), the above *cpr-plots* for the full data set (see FIGURE 5.4 and APPENDIX A4.2.1), although somewhat inconsistent, do indicate non-linearity to a certain extent.

More importantly, the *cpr-plot analysis* for the reduced data set[147], which is relevant for the OLS regression, more strongly suggests non-linearity for most of the personality dimensions. FIGURE 5.5 illustrates the equivalent results for the *soft* invest and *allow entry* setting. The three remaining *cpr-plot* results are documented in APPENDIX A4.2.2 – overall, confirming the non-linearity findings by Ben-Ner and Kramer (2011) towards the extremes of the personality scores. Accordingly, we decided to transform the continuous personality variables into

[144] The *component-plus-residual-plot* draws the product of residuals and their linear component of the independent variable against the independent variable (Kohler & Kreuter, 2012).

[145] The *cpr-plots* for the *soft-deter* and both *tough* investment settings are displayed in APPENDIX A4.2.1. The cpr-plots for the OLS-relevant, reduced data set (i.e., excluding outliers and non-investment values) are documented in APPENDIX A4.2.2.

[146] The *median spline* is identical to a median-trace line, with the exception that it is composed of curves instead of lines (Kohler & Kreuter, 2012).

[147] Excluding outliers and zero-values for the dependent variables.

dichotomous variables indicating strongly pronounced personality scores for the given dimension[148] (i.e., value of 1) and the non-strongly pronounced scores (i.e., value of 0).

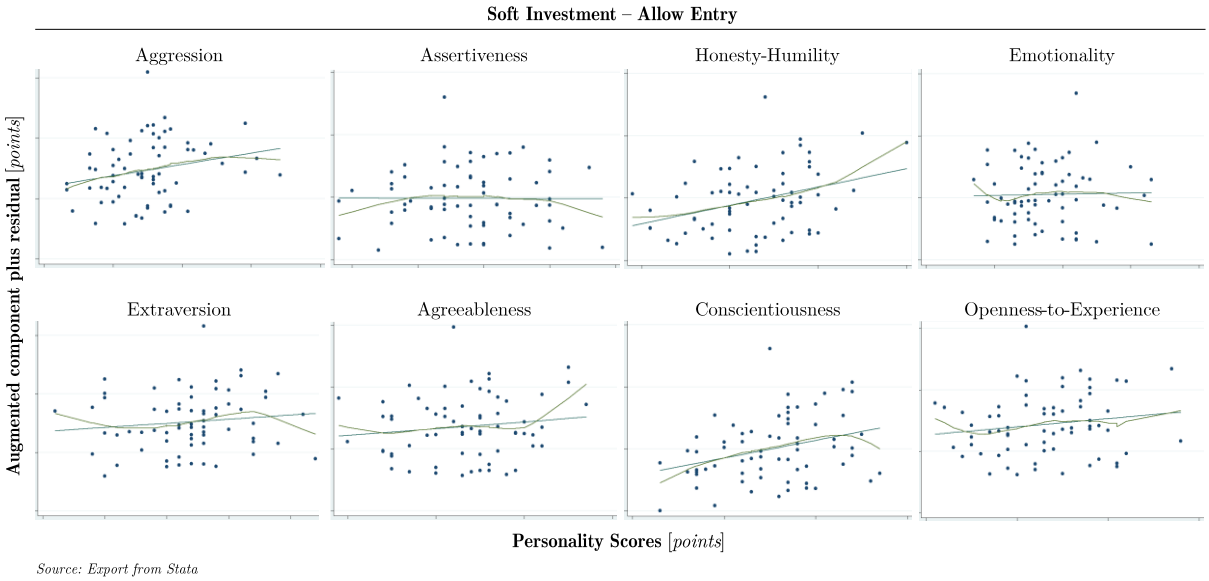


FIGURE 5.5: *Cpr-plots* for the main personality trait variables (soft invest & allow entry setting) – OLS-relevant

V. 3.1.3 Many Variables & the Problem of Overfitting

Overfitting is defined as the use of models and procedures that violate the principle of *parsimony*, i.e., using all that is necessary for the modelling, but nothing more (Hawkins, 2004). Potential causes comprise including irrelevant variables, inter-correlated variables, too small samples, or simply too many independent variables in the model (Baum, 2006; Cameron & Trivedi, 2005; Wooldridge, 2015). This may yield a statistical model that describes random error or noise as opposed to the underlying relationship. Accordingly, overfitting may lead to a loss of efficiency and misleading results, as coefficients or p-values (Kohler & Kreuter, 2012).

Most of the above causes can easily be controlled for in the empirical analysis. However, the number of variables (in relation to the sample size) might be particularly relevant for this analysis. Although overfitting depends on more than just the relation between number of independent variables and the sample size, rules of thumb indicated a minimum of 10-15 observations per IV (Draper & Smith, 1998; Frost, 2015). A similar magnitude was found for logistic regression models, identifying a minimum of 10 events per predictor variable, henceforth

[148] Strongly pronounced personality dimensions were defined as being within the upper quartile of the participant sample.

EPV (Peduzzi, Concato, Feinstein, & Holford, 1995; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). However, a more recent simulation study by Vittinghoff and McCulloch (2007) indicated that this rule might be too conservative, suggesting 5-9 EPV for logistic regressions.

The independent variables in the following regression analysis are mainly comprised of the personality trait variables as well as potential control variables (CV). For the main personality dimensions, this implies *eight* independent variables (plus potential CVs) and *24* variables for the sub-dimensions (plus potential CVs). For the sample size of 100 (or 94) observations for the logistic (or two-part) regression, the aforementioned rules of thumb indicate magnitudes of around 8-10 variables for the conservative and 11-20 variables for the less conservative approach. In any case, the sub-dimensions scenario lies above these thresholds, which is why the following regression analysis addresses this potential issue.

Among the potential techniques to avoid overfitting such as *regularisation*, *early stopping*, or *pruning*, cross-validation is the most popular method to detect and avoid overfitting. There are several versions of cross-validation (i.e., *test-set*, *leave-one-out* (LOOCV), and *k-fold cross-validation*), all applying the same methodology of removing one or more data points, estimating a regression, and testing it on the removed data point(s). Each of these methods represents a compromise between reliability, required effort, and data 'wastage'. Two other measures commonly used to compare regression models are AIC[149] and the BIC[150], both accounting for goodness of fit of the model and its parsimony by penalising using additional degrees of freedom while rewarding improvements in goodness of fit (Baum, 2006).

A common approach to select a subset of variables from a complex model is known as *stepwise regression*, an iterative process of adding and excluding regressor variables to determine which variables explain some of the variance opposed to those that do not (e.g., Hirsh & Peterson, 2009). This procedure is often leveraging the AIC to infer whether the prior step (of adding or deducting an IV) improved the model or worsened it, i.e., a smaller AIC suggesting a 'better' model. As this procedure is relatively model-specific, stepwise regression is employed and reported during the latter analyses, especially for the regression models with

[149] *Akaike Information Criterion* as developed by Akaike (1974).

[150] *Bayesian Information Criterion*, often referred to as the *Schwarz Criterion* after Schwarz (1978).

a high independent variables to sample size ratio (i.e., sub-dimension personality traits scenario and analysis of stay-out decisions [with $N = 38$]).

V. 3.1.4 Heteroskedasticity of Standard Errors

Another crucial assumption of the OLS regression is that the variance of error terms is constant,

$$VAR(\epsilon_j) = \sigma^2 ,$$

for all j, also known as homoskedasticity (Kohler & Kreuter, 2012). The violation of this assumption is equivalently known as *heteroskedasticity*. Heteroskedasticity typically occurs when errors increase with the IV or increase as the values become more extreme (Williams, 2010), i.e., a (tilted) sandglass-like distribution. Model misspecifications can produce heteroskedasticity, for example when not having corrected for non-linearity (as described in the paragraphs above).

In general, heteroskedasticity can become a problem for regression results (e.g., coefficients, standard errors, or significance tests) as the model gives equal weight to all observations when, in fact, observations with larger disturbance variance contain less information, which can especially problematic with methods as the logistic regression (Williams, 2010). Accordingly, the following paragraphs (i) present methods of detecting heteroskedasticity, (ii) conduct these tests on the underlying data set, and (iii) discuss the analysis implications going forward.

Heteroskedasticity can be detected through two common approaches: visual inspection and calculation of several heteroskedasticity test factors (typically, if visual inspection indicates potential heteroskedasticity, the more formal tests are conducted subsequently [Williams, 2010]). As an initial and rapid assessment the 'symmetry plot' serves as a good proxy (Schnell, 1994), plotting the kth observations above the median versus the kth observation below the median (where $1 \leq k \leq \lfloor \frac{n-1}{2} \rfloor$[151]). The graphs in FIGURE 5.6 depict the respective symmetry plots for the four Incumbent variables (excluding outliers and low investments below the threshold value). A asymmetric or skewed distribution of the symmetry plot indicates heteroskedasticity and suggests further examination (Kohler & Kreuter, 2012).

[151] Where ⌊x⌋ is the floor function of *x*, i.e., rounding down to the next natural number.

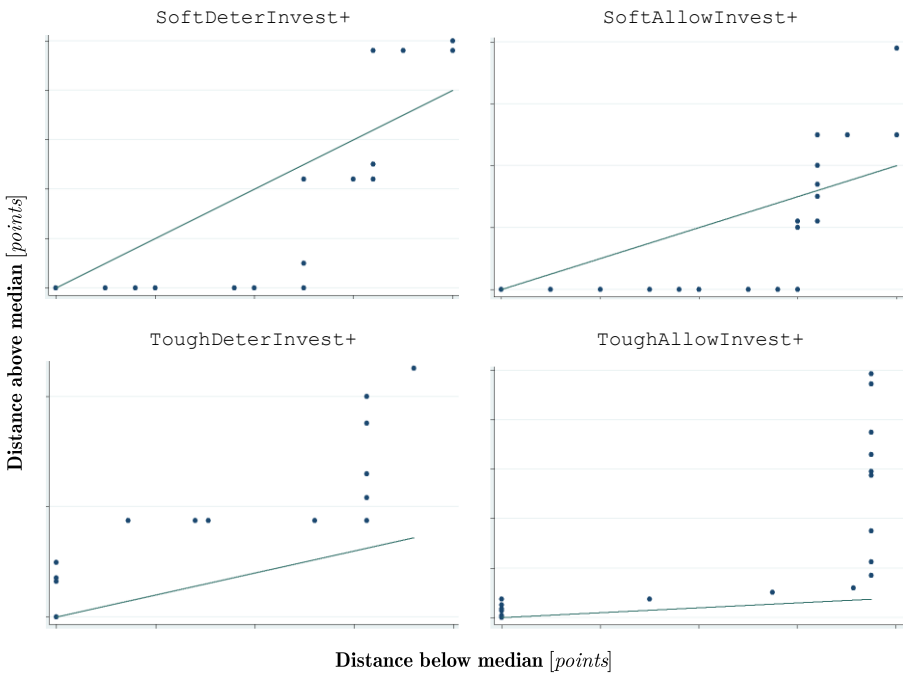


FIGURE 5.6: Symmetry plots for each of the dependent variables

All symmetry plots in FIGURE 5.6 indicate asymmetric distributions, potentially indicating heteroskedasticity and suggesting further inspection. Subsequent analysis implies utilising the popular *residuals-vs.-fitted-values* (*rvf*) plot method (Kohler & Kreuter, 2012). FIGURE 5.7 depicts the respective *rvf-plots* including indicative threshold lines, emphasising the residual dispersion along the fitted values. Visual inspection shows an increasing dispersion (in contrast to an 'envelope' distribution) for all four settings, strongly indicating an underlying heteroskedasticity and suggesting further inspection (Williams, 2010).

The two most popular tests for heteroskedasticity are the *Breusch-Pagan / Cook-Weisberg* test and *White's General* test. While the former tests for linear forms of heteroskedasticity, as the increasing residual dispersion suggests, the latter is a more general test detecting heteroskedasticity also for non-linear cases (Williams, 2010). TABLE 5.7 below summarises the respective results for both tests, namely the χ^2-values and associated significance levels.

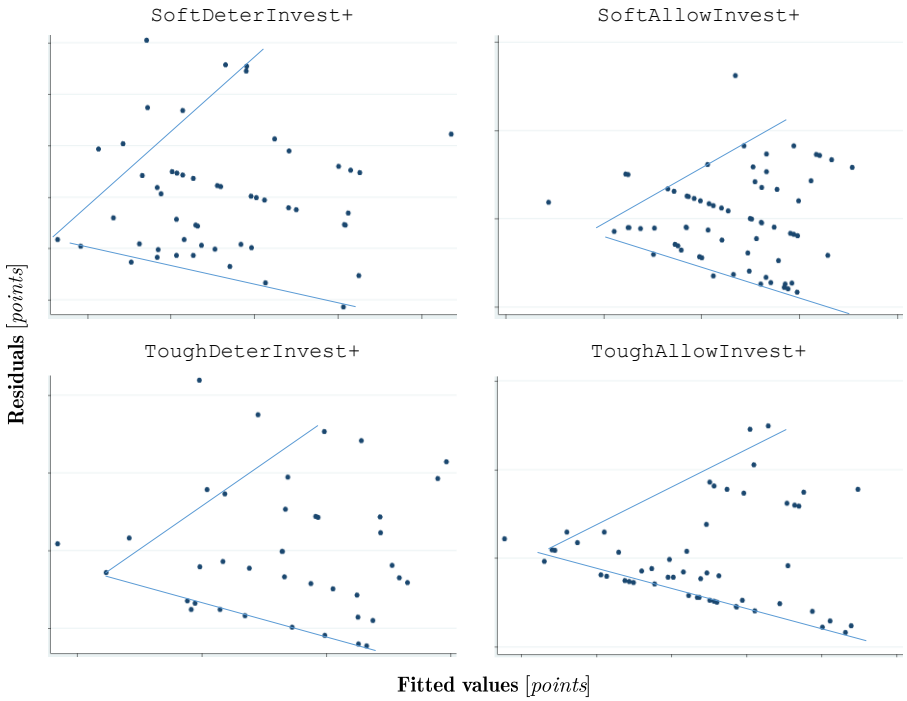


FIGURE 5.7: Rvf-plots for each of the dependent variables

Despite the strong visual indication for consistent heteroskedasticity, only the two *allow*-settings exhibit significant results suggesting linear heteroskedasticity. Out of the methods to deal with heteroskedasticity, including (i) transformation if the variables, (ii) using robust standard errors, or (iii) weighted least squares (Williams, 2010), I apply *robust standard errors* (also known as Huber/White estimators). That is, the statistical program relaxes the OLS assumptions that errors are both independent and identically distributed. While resulting coefficient estimates do not change, associated p-values are more trustworthy (Williams, 2010; Wooldridge, 2015).

Investment	**Incumbent**	**Tests**[a]		
Type	**Objective**	**Breusch-Pagan**[b]	**White's General**	**Heteroskedasticity**
Soft	Deter entry	0.01	39.36	-
	Allow entry	5.65**	21.46	*linear*
Tough	Deter entry	0.13	40.00	-
	Allow entry	12.88***	46.95	*linear*

Note: χ^2 *values denoted with *, **, or *** correspond to significance levels of 0.1, 0.05, or 0.01 respectively*

a) Reported values correspond to respective χ^2 values

b) Also known as *Cook-Weisberg* test

TABLE 5.7: Heteroskedasticity test results for IVs of all four settings

V. 3.1.5 Verification of Low Multicollinearity

Perfect multicollinearity violates the assumptions of the OLS and logit regression models. While perfect multicollinearity is detected automatically by the statistic software[152], high multicollinearity is not and can potentially distort coefficient results (Wooldridge, 2015). I have undertaken several measures to ensure that the possibility of high multicollinearity is limited as much as possible and, subsequently, verified through specific procedures that high multicollinearity is suspendable. The initial measure for minimising the risk of multicollinearity is a precise definition of variables (i.e., include only unique variables, no correlated variables due to indirect effects).

The first verification check was conducted by the univariate analysis examining the pairwise correlation coefficients for the main personality traits (SECTION 5.2) as well as all personality variables[153] (APPENDIX A4.1). Besides the correlations of sub-dimensions belonging to the same main dimensions, no strong correlations were observed for all other combinations. For multivariate regression analysis, the *variance inflation factor* (VIF) analysis is a popular method to quantify the severity of multicollinearity, providing an index that measures how much the variance of estimated coefficients are inflated due to multicollinearity (Baum, 2006). After running i regressions for each of the regressors x_i, the VIF_i index is calculated as

$$VIF_i = \frac{1}{1 - R_i^2},$$

where R_i^2 is the coefficient determination of the respective regressions. As described above, the following analyses primarily examine the set of main personality dimensions. In a subsequent step, the respective sub-dimensions are analysed in order to gain further understanding of underlying behavioural drivers and influences. Accordingly, the VIF-analysis (i.e., calculating $\max(VIF_i)$ for a set of i independent variables) summarised in TABLE 5.8 was conducted for both sets, the main dimensions (*8x*) and the sub-dimensions[154] (*29x*) – as well as the control variable included in both sets[155]. The respective VIF indices as well as their maximum VIFs

[152] In this case: *Stata* (StatCorp LP*; www.stata.com*).

[153] As can be seen in the correlation coefficient table in the appendix,

[154] Since *assertiveness* does not comprise sub-dimensions, it was also included in the set of sub-dimensions.

[155] TABLE 5.8 reports the respective VIF-analysis results conducted with the initial personality scores (opposed to the transformed dichotomous variables). The VIF-analysis has also been run with the dichotomous personality variables. Since the respective VIF values were in general significantly lower, only the continuous personality variables are reported.
Alternatively, the VIF-analysis results could have been reported for each of the following regressions. Since the independent variables do not vary vastly between regressions (or use sub-sets of the extensive sub-dimension analysis on the right-hand side of Table 5.8), confirming high multicollinearity at this stage reduces reporting magnitudes on the following pages.

(per variable set) disarm any multicollinearity presumptions, as their values are significantly lower than the commonly applied threshold value of 10.0 (Schendera, 2014; Wooldridge, 2015).

'Main Set' Variable as DV	R^2	VIF	'Sub Set' Variable as DV	R^2	VIF
Aggression	0.421	1.727	PhysicalAggression	0.499	1.996
Assertiveness	0.445	1.801	VerbalAggression	0.592	2.451
Honesty-Humility	0.386	1.629	Anger	0.656	2.907
Emotionality	0.326	1.483	Hostility	0.663	2.968
Extraversion	0.298	1.425	Assertiveness	0.636	2.745
Agreeableness	0.435	1.770	Sincerity	0.611	2.571
Conscientiousness	0.415	1.709	Fairness	0.535	2.150
Openness-to-Experience	0.370	1.587	GreedAvoidance	0.420	1.725
Gender (female)	0.396	1.655	Modesty	0.440	1.785
Consequences not understoo	0.221	1.283	Fearfulness	0.502	2.007
Experiment Experience	0.118	1.134	Anxiety	0.489	1.956
			Dependence	0.500	1.999
			Sentimentality	0.464	1.866
			SocialSelfEsteem	0.582	2.392
			SocialBoldness	0.522	2.093
			Sociability	0.441	1.788
			Liveliness	0.522	2.092
			Forgiveness	0.492	1.967
			Gentleness	0.645	2.817
			Flexibility	0.542	2.185
			Patience	0.588	2.427
			Organization	0.582	2.392
			Diligence	0.621	2.638
			Perfectionism	0.573	2.344
			Prudence	0.606	2.535
			AestheticAppreciation	0.509	2.038
			Inquisitiveness	0.420	1.725
			Creativity	0.455	1.834
			Unconventionality	0.513	2.053
			Gender (female)	0.608	2.550
			Consequences not understoo	0.406	1.684
			Experiment Experience	0.354	1.548
Max VIF		**1.801**			**2.968**

TABLE 5.8: VIF-analysis for main dimension and sub-dimension variable sets

V. 3.2 Effects of Personality Traits on Incumbent Behaviour

The aim of this sub-section is to shed light on the developed propositions ***P1***, ***P2***, and ***P3*** from CHAPTER III, hypothesising Incumbent investment behaviour in the context of potential market entry (see TABLE 3.1). Ultimately, the following empirical findings should provide an indication concerning the Incumbent-side of this thesis' research question:

Can personality get in the way of Incumbent behaviour?

V. 3.2.1 Empirical Findings on the Effects of Personality on Incumbent Behaviour

In line with the methodology and research design developed and described above, the following paragraphs focus on the multivariate regression analysis concerned with personality dimensions and their effect on Incumbent behaviour. Firstly, the Incumbent behaviour in the *soft* investment setting will be analysed – for both Incumbent objectives, to allow and deter market entry. Following this, the *tough* investment setting behaviour for allowing and deterring entry, respectively, is examined. The next sub-sub-section then investigates the model fit and robustness of the empirical results (following the same aforementioned structure).

Soft Investment

The following regression analyses investigate the effect significantly pronounced personality dimensions[156] on Incumbent investment behaviour. As described above, the highly skewed distribution of Incumbent investments as well as high number of no investments (i.e., values of 0), suggests the use of a logistic regression model(Belottietal.,É. The model fits the binary variable for its probability of observing a positive-versus-zero outcome (in this case invest or no invest[157]).

TABLE 5.9 summarises the respective logistic regression results for Incumbent behaviour in the soft investment setting, displaying both, the induced objectives to allow and deter market entry. Results for each scenario include two models, a base model including only control variables as predictors and the main personality model including all main personality dimension scores as predictors. While these reported results may appear unapproachable due to its depth of reported information, TABLE 5.14 towards the end of this sub-section summarises the relevant coefficient and statistical significance results for each of the developed hypotheses.

In general, results for both models, *MODEL SA2* and *SD2*, support the initial motivational proposition of personality affecting pre-entry investment behaviour (invest vs. not invest). For both settings, results suggest a significant effect of at least one strongly pronounced personality dimensions (at the 0.05-level). Furthermore, the likelihood-ratio test[158] further supports this, by suggesting that including the personality variables significantly improves the empirical model (at p=0.004 and p=0.03 levels for *allow* and *deter* entry, respectively).

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[156] Recorded scores in the top quartile, i.e., above 75th percentile.

[157] As described in SECTION V.1, values close to 0 have are interpreted as underinvesting and included as 'no-investment' values.

[158] In line with definitions outlined by Cameron and Trivedi (2005) and UCLA: Statistical Consulting Group.

Dependent Variable:			2pmSoftAllowInvest				2pmSoftDeterInvest			
			Allow Entry				Deter Entry			
			Control		Personality		Control		Personality	
			Model SA1		*Model SA2*		*Model SD1*		*Model SD2*	
Model	**Field**	**Variables**	β	p	β	p	β	p	β	p
Logit	**Personality**	Aggression			-1.31**	.03			-1.14**	.05
	Variables	Assertiveness			-0.40	.49			-0.13	.82
		Honesty-Humility			-0.19	.77			0.37	.50
		Emotionality			-0.83	.19			0.25	.68
		Extraversion			-0.26	.64			-0.11	.83
		Agreeableness			-1.06	.16			-1.24**	.04
		Conscientiousness			-0.49	.47			-0.49	.43
		Openness-to-Experience			-0.05	.92			-0.47	.34
	Control	Gender (female)	-0.83	.10	-0.78	.27	-0.14	.76	-0.52	.41
	Variables	Consequences	-0.55	.46	-0.48	.59	-0.33	.60	-0.34	.66
		Experiment experience	0.78*	.08	0.87*	.09	1.22***	.00	1.39***	.00
	Intercept	constant	0.63*	.07	1.94***	.00	-0.47	.16	0.29	.59
	Model	N	99		99		99		99	
		Pseudo R2	0.06		0.14		0.06		0.11	
	Test	LR χ^2 (Model 2 vs. 1)[a]	-		10.92***	.00	-		6.93**	.03

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

2pmSoftAllowInvest = 0 *when* SoftAllowInvest ≤ 10 & 2pmSoftAllowInvest = SoftAllowInvest *when* SoftAllowInvest > 10

2pmSoftDeterInvest = 0 *when* SoftDeterInvest ≤ 10 & 2pmSoftDeterInvest = SoftDeterInvest *when* SoftDeterInvest > 10

a) The Likelihood-Ratio test results indicate the probability of the additional variables (Model 2 vs. 1) not improving the model fit

Table 5.9: Logistic regression model results for Incumbent behaviour in the soft invest setting

Support for Conflict-Seeking Personality Traits – ***P1***

Proposition ***P1*** is concerned with conflict-seeking personality traits and their potential effect on pre-entry investment behaviour, specifically, possibly hindering subjects to behave in an *theory-consistent*[159] way. The respective underlying hypotheses state that high scores on the *aggression* and *assertiveness* dimensions endorse a framework-deviating behaviour in the allow-entry setting (H1.2) and a framework-consistent behaviour in the deter-entry setting (H1.4).

In more detail, *Model SA2* finds support for H1.2, which hypothesises that conflict-seeking personality dimensions endorse framework-deviating behaviour. While the framework suggests an (over-)investment in a soft investment, the coefficient for `aggression` is negative ($\beta = -1.314$) and statistically significant at the 0.05 level (at p=0.034). Thus, the model results suggest that higher *aggression* scores indeed limit investment into soft measures, contrary to the appropriate overinvestment in order to encourage entry. No significant support is found for the *assertiveness* dimensions. From the control variables, previous `experiment experience` seems to have a positive effect on framework-conform pre-entry investing behaviour in the allow setting (p=0.088). For the entry deterring setting, *Model SD2* confirms

[159] As discussed in Chapter III, *theory-consistent* refers to *'not deviating from the hypothesised behaviour from the underlying pre-entry investment framework by Fudenberg and Tirole (1984)'*.

the findings from the allow setting regarding the `aggression` variable (here representing framework-consistent behaviour) and the hypothesis (H1.4) with a negative coefficient ($\beta = -1.141$) and a significance level of p=0.049.

In summary, the regression results find support for proposition ***P1***. Both results, for the allow and deter entry settings, find support for *aggression* (conflict-seeking) to affect Incumbent behaviour in a theory-deviating (allow; H1.2) and theory-consistent (deter; H1.4) way.

Support for Harmony-Seeking Personality Traits – ***P2***

Proposition ***P2*** is concerned with harmony-seeking personality dimensions and their potential to affect pre-entry investment behaviour. While no support for the underlying hypotheses for *agreeableness* and *honesty-humility* in the allow-entry setting is found (H2.4), and a framework-consistent behaviour in the allow-entry setting (H2.4), findings on behaviour in the deter-entry setting depict intriguing results. *Agreeableness* seems to have a negative effect on whether the Incumbent invests in the pre-entry period or not ($\beta = -1.241$; p=0.049) – contrary to the hypothesised behaviour (H2.2). While statistically not significant, the positive coefficient for the `honesty-humility` variable ($\beta = 0.366$; p=0.514) confirms the decision to choose the HEXACO over the Big-Five personality framework and, thereby, differentiate between pro-active and re-active cooperative behaviour.

Support for Emotionality Sub-Traits – ***P3***

Proposition ***P3*** is concerned with the sub-dimensions of *emotionality*, potentially affecting pre-entry investment behaviour. Specifically, *dependence* and *fearfulness* were hypothesised to amplify investment behaviour in conformity with the framework. In order to analyse the magnitude of the respective investments, the logistic regression model is limited due to the binary nature of the dependent variable. Accordingly, a two-part model has been applied in order to analyse the results with respect to proposition ***P3***. The two-part model approach finds appropriate use for "significantly skewed data distributions with a significant share of zero values" (Belotti et al., 2015). The first part of the model applies a logistic regression model for the zero vs. non-zero values of the dependent variable. The second part, then, analyses only the continuous, non-zero values of the dependent variable by applying a OLS regression model.

Before outlining the regression results, it is worthwhile to point out the risk of *overfitting* in the context of numerous independent variables (for the sub-dimensions up to 29 variables)

and/or a logistic regression (limited to 5-9 events[160] per predictor [Vittinghoff & McCulloch, 2007]). To limit the risk of overfitting, a *step-wise regression* approach has been applied. Furthermore, validity tests have been conducted for each regression model to rule out the risk of overfitting, namely, the AUC for the ROC curve[161] and the mean RMSE via *5-fold cross-validation*[162]. TABLE 5.10 below summarises the main – statistically sound – results (a more thorough discussion follows in the next sub-sub-section). The detailed documentation of the sub-dimension analyses is available in the appendix (A4.3.1).

While most sub-dimensions did not indicate any significant effect on Incumbent behaviour, the *emotionality* sub-traits *sentimentality* and *dependence* both appear to affect investment behaviour. High sentimentality scores seem to decrease the likelihood to invest in the allow entry setting ($\beta = 0.891$; p=0.092). Although *dependence* does not confirm the hypothesis in the first part of the model, the hypothesised effect (H3.1) is confirmed in the OLS part, regressing the non-zero investments, indicating a highly significant effect on investment magnitude ($\beta = 21.810$; p=0.015). Equivalently, no such effect was recorded for the deter entry setting (p=0.520). While fearfulness does indicate some support for the second hypothesis (H3.2) with a higher investment behaviour (among all investing subjects) in the emotionality model (p=0.087), equivalently significant results cannot be confirmed in the 'relevant' model (p=0.115). Beyond emotionality sub-dimensions, results indicate *physical aggression* (p=0.099), *greed avoidance* (p=0.022), and *diligence* (p=0.024) to impact pre-entry investment behaviour.

In summary, the sub-dimension analysis found partial support for ***P3,*** by confirming the hypothesised behaviour for *dependence* (H3.1). However, the regression results could not confirm the hypothesis for *fearfulness* (H3.2). The interpretation as well as interpretability of other sub-traits needs to be further investigated in the following sub-sections.

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[160] Please note that the number of events does not refer to the number of observations, but the total number of recorded events, i.e., values of 0 or 1 (accordingly, the lower of both counts is considered).

[161] The area under curve (AUC) calculates the area under the Receiver Operating Characteristic (ROC) curve as an indicator for the goodness of fit (as well as potential *overfit*). The plotted ROC curve is a straight line if the model has no predictive ability and more bowed for high predictive power of the model (Cameron & Trivedi, 2005).

[162] The average root mean-squared error (RMSE) for each of the 5-fold cross-validations is reported. The 5-fold cross-validation has been conducted 5 times for each of the models. Accordingly, the mean RMSE represents the average of 25 RMSE values.

Table 5.10: Two-part regression (logistic & OLS) results for selected sub-dimensions in the soft invest setting

Dependent Variable:		2pmSoftAllowInvest												2pmSoftDeterInvest											
		Allow Entry												Deter Entry											
		Control				Emotionality				Relevant				Control				Emotionality				Relevant			
		Model SA3				*Model SA4*				*Model SA5*				*Model SD3*				*Model SD4*				*Model SD5*			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Personality Variables	Aggression																								
	Physical Aggression									-0.80*	.10	-5.70	.42									0.10	.83	17.31**	.03
	Verbal Aggression																								
	Anger																								
	Hostility																								
	Assertiveness																								
	Honesty-Humility																								
	Sincerity																								
	Fairness																								
	Greed Avoidence									-0.76	.12	19.06**	.02												
	Modesty																								
	Emotionality																								
	Fearfulness					-0.22	.63	-5.10	.55									-0.17	.73	-13.77*	.09	-0.44	.35	-11.52	.12
	Anxiety					0.25	.62	0.13	.99									0.43	.37	-4.47	.59				
	Dependence					-0.13	.80	21.81**	.02	-0.03	.95	15.52*	.09					-0.87	.11	7.72	.52				
	Sentimentality					-0.89*	.09	-9.31	.34	-0.91*	.09	-4.34	.63					0.01	.99	2.36	.75				
	Extraversion																								
	Social Self-Esteem																								
	Social Boldness																								
	Sociability																								
	Liveliness																								
	Agreeableness																								
	Forgiveness																								
	Gentleness																								
	Flexibility																								
	Patience																								
	Conscientiousness																								
	Organisation																								
	Diligence																					1.10**	.02	3.78	.57
	Perfectionism																								
	Prudence																								
	Openness-to-Experience																								
	Aesthetic Appreciation																								
	Inquisitiveness																								
	Creativity																								
	Unconventionality																								
Control Variables	Gender (female)	-0.83	.10	9.16	.27	-0.54	.31	9.97	.31	-0.71	.19	5.07	.58	-0.14	.78	-12.64	.20	0.08	.89	-10.15	.30	-0.48	.42	-6.02	.57
	Consequences	-0.55	.46	-2.14	.83	-0.35	.66	-0.11	.99	-0.36	.66	-0.28	.98	-0.33	.60	33.65***	.00	-0.38	.56	26.27**	.02	-0.24	.71	25.50**	.04
	Experiment experience	0.78*	.08	-9.05	.25	0.86*	.07	-4.96	.54	0.88*	.07	-8.21	.25	1.22***	.00	-2.65	.75	1.30***	.00	-2.88	.75	1.33***	.00	-1.42	.85
Intercept	constant	0.63*	.07	50.11***	.00	0.80*	.07	45.69***	.00	1.35***	.01	42.23***	.00	-0.47	.16	47.66**	.00	-0.44	.27	52.21***	.00	-0.87*	.05	43.50***	.00
Model	N	99		67		99		67		99		67		99		52		99		52		99	0	52.00	
	F-statistic (p-value)	-		0.33		-		0.13		-		0.00		-		0.01		-		0.01		-	0	0.00	
	R^2	-		0.05		-		0.15		-		0.25		-		0.17		-		0.24		-	0	0.30	
	Pseudo/Adjusted R^2	0.06		0.00		0.08		0.05		0.12		0.16		0.06		0.12		0.09		0.12		0.11	0	0.21	
	Root MSE	-		27.94		-		27.32		-		25.64		-		23.64		-		23.71		-	0	22.42	
Tests	LR χ^2 (versus *Model 3*)[a]	-		-		-		3.37	.19	7.32**	.03	-		-		-		3.53	.17	-		5.87*	.05	0	-
	AUC for ROC curve[b]	0.67		-		0.67		-		0.71		-		0.66		-		0.71		-		0.71	0	-	
	Mean RMSE (5-fold CV)[c]	-		28.09		-		29.23		-		27.98		-		24.23		-		26.84		-	0	25.11	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively* `2pmSoftAllowInvest` = 0 *when* `SoftAllowInvest` ≤ 10 & `2pmSoftAllowInvest` = `SoftAllowInvest` *when* `SoftAllowInvest` > 10; `2pmSoftDeterInvest` = 0 *when* `SoftDeterInvest` ≤ 10 & `2pmSoftDeterInvest` = `SoftDeterInvest` when `SoftDeterInvest` > 10

a) The LR test results indicate the probability of the additional variables (versus Model 3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating Characteristic (ROC) curve*

c) Avereage recorded RMSE for 5-fold cross-validation run 5 times

Tough Investment

The following logistic regression analyses investigate the effect of strongly pronounced personality dimensions on the pre-entry investment behaviour. TABLE 5.11 summarises the logistic regression model results. In line with the above approach (for the soft investment setting), the results are briefly described along the underlying propositions ***P1***, ***P2***, and ***P3***.

Dependent Variable:			2pmToughAllowInvest				2pmToughDeterInvest			
			ALLOW ENTRY				DETER ENTRY			
			Control		**Personality**		**Control**		**Personality**	
			MODEL TA1		*MODEL TA2*		*MODEL TD1*		*MODEL TD2*	
Model	**Field**	**Variables**	β	p	β	p	β	p	β	p
Logit	**Personality**	Aggression			-0.41	.47			0.33	.62
	Variables	Assertiveness			-0.28	.58			-0.71	.18
		Honesty-Humility			-0.33	.55			-0.33	.57
		Emotionality			0.60	.28			-0.53	.39
		Extraversion			0.35	.46			0.18	.73
		Agreeableness			0.80	.18			0.79	.19
		Conscientiousness			-0.21	.71			0.72	.24
		Openness-to-Experience			0.30	.54			0.05	.92
	Control	Gender (female)	0.12	.80	-0.08	.90	-1.41**	.01	-1.25*	.06
	Variables	Consequences	1.28	.12	1.17	.18	0.79	.32	0.86	.31
		Experiment experience	0.12	.78	0.05	.91	-0.47	.29	-0.56	.23
	Intercept	constant	-0.02	.95	-0.15	.77	0.09	.79	-0.01	.99
	Model	N	99		99		99		99	
		Pseudo R2	0.02		0.07		0.06		0.10	
	Test	LR χ^2 (Model 2 vs. 1)[a]	-		5.63*	.06	-		4.93*	.08

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

2pmToughAllowInvest = 0 *when* ToughAllowInvest ≤ 20 & 2pmToughAllowInvest = ToughAllowInvest *when* ToughAllowInvest > 20

2pmToughDeterInvest = 0 *when* ToughDeterInvest ≤ 20 & 2pmToughDeterInvest = ToughDeterInvest *when* ToughDeterInvest > 20

a) The Likelihood-Ratio test results indicate the probability of the additional variables (Model 2 vs. 1) not improving the model fit

TABLE 5.11: Logistic regression model results for Incumbent behaviour in the tough invest setting

In contrary to the results for the soft investment setting, results for both models *TA2* and *TD2* do not provide evidence for the overarching proposition of personality affecting pre-entry investment behaviour. Although the likelihood-ratio test gives some indication – at the 0.1 level – for an improved predictive power (p=0.060 for *TA2* and p=0.085 for *TD2*), this is likely to be driven by the increased number of predictor variables. None of the predictor variables yield statistically significant results for the tough investment setting and, thereby, not finding any support for propositions ***P1*** or ***P2***.

Proposition ***P3*** is concerned with the sub-dimensions of *emotionality*, potentially affecting pre-entry investment behaviour. Specifically, *dependence* and *fearfulness* were hypothesised to amplify investment behaviour in conformity with the framework. In line with the structure for the soft investment setting, TABLE 5.12 below summarises the relevant two-part regression

results[163]. Detailed documentation of the results (including interim results of the stepwise or hierarchical regression approach) are available in the appendix (A4.3.2).

The hypothesised effects of high-scoring subjects on the *dependence* (H3.1) and *fearfulness* (H3.2) sub-dimensions are neither supported by the results for the allow setting ($p_{dep;Logit}$=0.552, $p_{dep;OLS}$=0.503, $p_{fear;Logit}$=0.195, and $p_{fear;OLS}$=0.579) nor for the deter setting ($p_{fear;Logit}$=0.195, and $p_{fear;OLS}$=0.579). The stepwise regression analysis for all remaining sub-dimensions yielded inconclusive results, as most sub-dimensions' results were not robust in alternative variable combinations (as the tables in APPENDIX A4.3.2).

Beyond emotionality sub-dimensions, results for the allow entry setting indicated `forgiveness` to positively impact the likelihood to invest in a tough-making investment (p=0.045). While *physical aggression*, *sociability*, and *gentleness* indicated potential effects on pre-entry investment behaviour during the stepwise regression analysis, none of the significance threshold levels was confirmed in a model with altered predictor variables (*MODEL TA5*). The deter setting yielded similarly inconclusive results during the stepwise regression analysis (see A4.3.2), with `social self-esteem` ($\beta = 23.412$; p=0.071), `liveliness` ($\beta = 24.982$; p=0.060), and `forgiveness` ($\beta = -27.155$; p=0.031) indicating significant effects on the investment magnitude of all investing subjects.

Furthermore, `consequences` seems to positively affect the magnitude of investing in all models (p<0.005) in the allow entry setting – being framework-deviating, which intuitively is comprehensible. Interestingly, results for the deter entry setting yielded significant results for `gender` in all models (p<0.05), suggesting that female subjects were less likely to invest.

In summary, the sub-dimension analysis found no support for ***P3,*** by not finding any significant results for the behaviours for *dependence* (H3.1) and *fearfulness* (H3.2). The interpretation as well as interpretability (i.e., robustness) of other sub-traits is discussed in the following sub-sections.

[163] As before, the results include overfitting tests for the logistic regression (AUC for the ROC curve) and the OLS regression (mean RMSE via multiple 5-fold cross-validation),

TABLE 5.12: Two-part regression (logistic & OLS) results for selected sub-dimensions in the tough invest setting

Dependent Variable:		2pmToughAllowInvest												2pmToughDeterInvest											
		ALLOW ENTRY												DETER ENTRY											
		Control				**Emotionality**				**Relevant**				**Control**				**Emotionality**				**Relevant**			
		MODEL TA3				*MODEL TA4*				*MODEL TA5*				*MODEL TD3*				*MODEL TD4*				*MODEL TD5*			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Personality Variables	Aggression																								
	Physical Aggression									-0.16	.75	-9.43	.25												
	Verbal Aggression																								
	Anger																								
	Hostility																								
	Assertiveness																								
	Honesty-Humility																								
	Sincerity																								
	Fairness																								
	Greed Avoidence																								
	Modesty																								
	Emotionality																								
	Fearfulness					0.62	.20	-4.92	.58									0.27	.57	2.25	.90				
	Anxiety					0.25	.58	11.79	.19									0.10	.83	-1.20	.94				
	Dependence					-0.31	.55	-5.97	.50									0.11	.84	2.03	.90				
	Sentimentality					-0.11	.82	-4.19	.69									-0.59	.30	28.55*	.08				
	Extraversion																								
	Social Self-Esteem																					0.45	.88	23.41*	.07
	Social Boldness																								
	Sociability									0.71	.12	12.08	.14												
	Liveliness																					-1.10**	.02	24.98*	.06
	Agreeableness																								
	Forgiveness									0.98**	.05	-10.85	.17									0.59	.22	-27.16**	.03
	Gentleness									-0.80	.11	11.11	.20												
	Flexibility																								
	Patience																								
	Conscientiousness																								
	Organisation																								
	Diligence																								
	Perfectionism																								
	Prudence																								
	Openness-to-Experience																								
	Aesthetic Appreciation																								
	Inquisitiveness																								
	Creativity																								
	Unconventionality																								
Control Variables	Gender (female)	0.12	.80	4.21	.65	-0.03	.95	8.51	.40	0.41	.44	-1.02	.90	-1.41**	.01	-19.31	.27	-1.40**	.01	-17.05	.40	-1.22**	.03	-30.08**	.05
	Consequences	1.28	.12	32.50***	.00	1.44	.10	33.87***	.00	1.19	.14	33.89***	.00	0.79	.32	-7.94	.64	0.99	.25	-22.48	.15				
	Experiment experience	0.12	.78	-2.47	.76	0.11	.81	0.22	.98	0.22	.61	1.62	.83	-0.47	.29	13.62	.34	-0.44	.33	14.25	.33				
Intercept	constant	-0.02	.95	39.54***	.00	0.22	.60	37.01***	.00	-0.39	.43	36.45***	.00	0.09	.79	70.59***	.00	0.04	.93	65.20***	.00	0.14	.73	70.01***	.00
Model	N	99		54		99		54		99		54		99		40		99		1.4		99		40.00	
	F-statistic (p-value)	-		0.03		-		0.01		-		0.00		0.06		0.30		-		0.24		-		0.01	
	R^2	-		0.16		-		0.20		-		0.28		-		0.06		-		0.11		-		0.25	
	Pseudo/Adjusted R^2	0.02		0.11		0.04		0.07		0.08		0.17		0.06		-0.02		0.00		-0.08		0.09		0.16	
	Root MSE	-		28.65		-		29.18		-		27.57		-		45.41		-		46.67		-		41.13	
Tests	LR χ^2 (versus *MODEL 3*)[a]	-		-		2.07	.36	-	.19	7.64**	.02	-		-		-		1.48	.48	-		4.23	.12	-	
	AUC for ROC curve[b]	0.54		-		0.63		-		0.68		-		0.64		-		0.65		-		0.69		-	
	Mean RMSE (5-fold CV)[c]	-		28.09		-		29.44		-		28.72		-		46.93		-		51.24		-		42.99	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively* `2pmSoftAllowInvest` = 0 *when* `SoftAllowInvest` ≤ 10 & `2pmSoftAllowInvest` = `SoftAllowInvest` *when* `SoftAllowInvest` > 10; `2pmSoftDeterInvest` = 0 *when* `SoftDeterInvest` ≤ 10 & `2pmSoftDeterInvest` = `SoftDeterInvest` when `SoftDeterInvest` > 10

a) The LR test results indicate the probability of the additional variables (versus Model 3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating Characteristic (ROC) curve*

c) Avereage recorded RMSE for 5-fold cross-validation run 5 times

V. 3.2.2 Model Fit & Robustness of Findings on Incumbent Behaviour

The following paragraphs aim to investigate the statistical robustness of the models and significant findings reported above. Of the different practices that can be applied I pursue two common approaches, namely, (A) modifying the regression model specification in some way, typically by adding or removing regressors[164] (Leamer, 1983; Lu & White, 2014) as well as (B) applying alternative (yet applicable) regression models to the same set of variables.

TABLE 5.13 summarises the results of the respective robustness checks for the soft investment setting. Since the tough investment setting did not yield any significant results, the respective robustness checks were omitted. The first robustness test (A) reports the results of the three logistic regression models with varying regressor combinations[164]. For the second test (B), alternative regression models are calculated namely, the probit[165] (as the main test) and the tobit[166] (as the secondary test) regression models.

The results for the *allow entry* setting are confirmed by all robustness tests. For the deter entry setting, on the other hand, the results are not as consistent. Specifically, in each of the tests, (A) and (B), one of the regression models does not confirm the results. Nevertheless, the robustness of the results can be confirmed (even if not as significantly as for the allow setting), as for both tests, (A) and (B), the more relevant regression models ((A)-2, (A)-3 and the probit model) do confirm the results. As mentioned above, the *tobit* model, (B)-2, represents the secondary test, as the associated assumption of a censored distribution of the DV, i.e., a continuous distribution of the DV with a non-trivial share of values on a known threshold value, e.g., zero (Hayashi, 2000). In this case, 52 percent of the DV represent this value, which suggests the utilisation of logit or probit models rather than the tobit model. Accordingly, the non-confirmation can be disregarded, especially in the context of positive confirmations for the two other robustness tests.

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[164] Three distinct variable combinations were applied and calculated. The reported *coefficient* (β) represents the average coefficient value, whereas the reported significance level represents the median value. The three predictor combinations include:
i) the robustness-tested variable (RTV) + the control variables (CVs),
ii) the conflict- and harmony-seeking variables + RTV + CVs, and
iii) the overall-affecting variables (*aggression*, *agreeableness*, *honesty-humility*, *extraversion*) + RTV + CVs.

[165] Unlike the logistic regression, the *probit regression model* uses a standard normal cumulative distribution function (cdf). The logistic model assumes a cdf of the standard logistic distribution (Cameron & Trivedi, 2005).

[166] The *tobit model* is used to analyse the relationship between predictor variables and a non-negative positive DV, which' distribution is roughly continuous over strictly positive values but zero a non-trivial fraction of the population (Wooldridge, 2015). Thus, as mentioned in the descriptive statistics analysis in SECTION V.2, this model is applicable for the collected data. Computations included robust standard errors, as typically required in tobit models (Gujarati, 2011).

Setting	Relevant Variables	ALLOW ENTRY						DETER ENTRY					
		'Original'	(A) - 1[a]	(A) - 2[a]	(A) - 3[a]	(B) - 1	(B) - 2	'Original'	(A) - 1[a]	(A) - 2[a]	(A) - 3[a]	(B) - 1	(B) - 2
		β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)	β (sign.)
SOFT	*Model*	*Logit (SA2)*	*Logit*	*Logit*	*Logit*	*Probit*	*Tobit*	*Logit (SD2)*	*Logit*	*Logit*	*Logit*	*Probit*	*Tobit*
INVEST	Aggression	-1.31**	-0.86*	-1.30**	-1.29**	-0.75**	-23.82**	-1.14**	-0.57	-0.94*	-0.94*	-0.71**	-12.90
	Assertiveness	-0.40		-0.58		-0.24	-12.75	-0.13		-0.33		-0.07	-1.45
	Honesty-Humility	-0.19		0.07	0.05	-0.10	5.64	0.37		0.25	0.23	0.24	0.62
	Emotionality	-0.83				-0.47	-13.60	0.25				0.17	-4.51
	Extraversion	-0.26			-0.24	-0.14	7.33	-0.11			-0.24	-0.06	-4.49
	Agreeableness	-1.06		-1.17*	-1.09	-0.61	-17.65	-1.24**	-0.63	-1.15*	-1.07*	-0.77**	-20.48
	Conscientiousness	-0.49				-0.30	-0.25	-0.49				-0.30	-13.97
	Openness-to-Experience	-0.05				-0.02	-2.23	-0.47				-0.29	-5.49
	Gender (female)	-0.78	-1.05**	-1.34**	-1.29**	-0.47	-10.14	-0.52	-0.23	-0.50	-0.50	-0.35	-8.77
	Consequences	-0.48	-0.47	-0.39	-0.31	-0.28	-8.21	-0.34	-0.28	-0.20	-0.14	-0.20	8.59
	Experiment experience	0.87*	0.80*	0.86*	0.86*	0.49*	8.39	1.39***	1.26***	1.36***	1.36***	0.86***	29.57***
	constant	1.94***	0.92**	1.56***	1.42**	1.13***	36.21***	0.29	-0.32	0.08		0.18	9.18
	Support (A) & (B)		✓	✓	✓	✓	✓		✗	✓	✓	✓	✗

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

a) Average coefficient & median p-value reported for 3 distinct model (predictor) variations:

1) Robust-test variable (RTV) + control variables (CVs); 2) conflict-seeking & harmony-seeking variables + RTV + CVs

3) Overall-affecting variables (Aggr., Agree., H-H., Extra.) + RTV + CVs

✓ Robustness confirmed

✗ No support

TABLE 5.13: Summary of robustness tests for results for Incumbent behaviour analysis

In summary, the findings for the main personality dimensions are robust for the soft investment setting. Accordingly, the findings are discussed – in the context of the hypothesised behaviours – in the following paragraphs.

V. 3.2.3 Discussion of Findings on Incumbent Behaviour

One of the main findings of the above analyses is the fact that the hypothesised results are not consistent throughout different settings, here soft and tough investment opportunities. This supports the conclusions discussed in the literature review in CHAPTER II that the influence of personality traits on behaviour is – at least partly – dependent on the situational setting (Lönnqvist et al., 2011; Pothos et al., 2011). On a further note, this is confirmed in my results not only by the soft-tough inconsistency, but also the fact that conflict-seeking traits are not necessarily *always* related to non-cooperative behaviour as well as harmony-seeking traits are not necessarily *always* related to cooperative behaviour as documented by Boone et al. (1999b). Specifically, the striking results indicating that *agreeableness* seems to decrease the likelihood of investing in a mutually beneficial investment that would make herself soft for the post-entry period (in the deter entry setting with $\beta = -1.241$ and p=0.037). Equivalently, in the soft investment and deter entry setting individuals with higher *aggression* scores seem to be less likely to invest. TABLE 5.14 summarises all relevant empirical results, their respective robustness tests, and links them to the respective hypotheses. Due to the inconsistency between the soft and tough investment settings, the subsequent discussion covers each setting separately.

		ALLOW ENTRY				DETER ENTRY			
Setting	**Relevant Variables**	**Hypothesis**	**Results**	**(A)**	**(B)**	**Hypothesis**	**Results**	**(A)**	**(B)**
SOFT INVEST	Assertiveness	**H1.2:** ⊖	–	–	–	**H1.4:** ⊖	–	–	–
	Aggression		–**	✓**	✓**		–**	✓**	✓**
	Agreeableness	**H2.4:** ⊕	–	–	–	**H2.2:** ⊕	–**	✓*	✓**
	Honesty-Humility		–	+	–/+		+	–	–
	Hypothesis support	**H1.2**	✓			**H1.4**	✓		
		H2.4	✗			**H2.2**	↯		
TOUGH INVEST	Assertiveness	**H1.1:** ⊕	–	n.a.	n.a.	**H1.3:** ⊕	–	n.a.	n.a.
	Aggression		–	n.a.	n.a.		+	n.a.	n.a.
	Agreeableness	**H2.3:** ⊖	+	n.a.	n.a.	**H2.1:** ⊖	+	n.a.	n.a.
	Honesty-Humility		–	n.a.	n.a.		–	n.a.	n.a.
	Hypothesis support	**H1.1**	✗			**H1.3**	✗		
		H2.3	✗			**H2.1**	✗		

*Note: *, **, & *** correspond to significance levels of 10%, 5%, and 1%, respectively* ✓ *Hypothesis confirmed* ✗ *Hypothesis not confirmed*
⊖ *Hypothesised negative effect on pre-entry investment behaviour* ↯ *Hypothesis reversed*
⊕ *Hypothesised positive effect on pre-entry investment behaviour*

TABLE 5.14: Summary of results, robustness tests, & hypotheses for Incumbent behaviour

In the soft investment setting, the hypothesised behaviours are confirmed (and robust) for the higher scoring *aggression* individuals – as in both objective settings their likelihood to invest is significantly lower than of the remaining subjects. In the deter market entry setting

this behaviour represents FT-framework-consistent behaviour. In the allow market entry setting, however, this behaviour deviates from the FT-framework (suggesting an (over-) investment in the soft-making investment to signal cooperativeness). Thus, in this scenario results confirm that personality can hinder individuals (with higher *aggression* scores) to behave 'optimally' (i.e., in line with the investment behaviour outlined by the FT-framework) in a market entry situation. Interestingly, the `assertiveness` variables did not yield any significant results throughout all Incumbent settings and analyses. Although *assertiveness* (as a proxy for *dominance*) was hypothesised to similarly behave less cooperatively (based on the dual-concern model discussed in CHAPTER III), no significant results were recorded. Potential explanations may lie within the nature of the dimension and its inventory[167]. Overall, the findings for Incumbent behaviour in the soft setting do support the stated proposition ***P1***.

Hypothesised behaviours for harmony-seeking personality dimensions do not find any empirical support in both settings. Strikingly, in the deter market entry setting high scores of *agreeableness* were even found to decrease the likelihood of pre-entry investment ($p=0.037$) against the initial hypothesis. In this case, not investing is consistent with pre-entry behaviour suggested by the FT-framework. Pothos et al. (2011) pointed out that the altruistic effect often depends on self-interest, which is not the case in the deter setting and could accordingly be an explanation for this hypothesis-opposing finding. Although *honesty-humility* was defined as the more pro-active cooperation driver (Hilbig et al., 2015), no significant effects are found for high scores of *honesty-humility* dimension (especially in the allow entry setting this should have driven pre-entry investment). Overall, the harmony-seeking findings in the soft investment setting do not find any support for the developed proposition ***P2***. In fact, previous findings linking altruistic behaviour by high *agreeableness* individuals to self-interest were confirmed in the deter setting (with a lower likelihood to invest, i.e., signal cooperation, in the post-entry period).

In the tough investment setting, all hypotheses related to propositions ***P1*** and ***P2*** were not confirmed by the analyses. Interestingly, the tough investment setting does not yield any significant results for the main personality dimensions. The significantly different result for

[167] On the one hand, the 16-IPIP inventory represents a proxy scale recreating the 16PF by Catell (1957), and thus might not capture the traits facets as precisely as the comparatively more sound 16PF inventory. On the other hand, the associated questions to derive a respective score are comparatively positively phrased, which potentially results in distorted scores due to self-favouring biases during the evaluation (Paulhus & Vazire, 2007).

both settings seems to support the previously mentioned finding that the influence of personality dimensions depends to some extent on the situational setting (Lönnqvist et al., 2011; Pothos et al., 2011).

Proposition ***P3*** was concerned with the sub-dimensions of *emotionality* – and their potential effect on the magnitude of the pre-entry investments. H3.1 hypothesised *dependence* to increase investments in the context of allowing market entry, as these subjects are more aware of the dependence on the competitor's actions and, thus, are willing to invest more. Similar to the results of the first two propositions, this hypothesis is confirmed for the soft setting, but not for the tough setting (p_{soft}=0.015 and p_{tough}=0.503). The second hypothesis (H3.2) predicted *fearfulness* to amplify framework-consistent investment behaviours as 'appropriate' investments would potentially not be sufficient from the individual's perspective, which was not confirmed in any of the settings. It is worthwhile to point out that the results for the sub-dimensions have to be analysed with caution due to a few statistical pitfalls that may distort results[168]. Accordingly, the post-analysis interpretation is kept limited to the analysis of hypotheses (developed before the empirical analysis) or to generate complimentary insights for findings on main personality dimensions.

Beyond the developed propositions and the associated findings, *extraversion* indicated a significant, yet inconclusive, effect on the magnitude of pre-entry investment behaviour in both allow entry cases (soft and tough setting). Although the literature review indicated that extroverts behave more rational than non-extroverts (based on findings by Ben-Ner et al., 2008; Lönnqvist et al., 2011; Schmitt et al., 2008), the amplified investment behaviour is 'rational' in one scenario (soft investment) and 'irrational' in the second (tough investment). Accordingly, a second potential explanation – that extroverts experience greater reward from cooperative behaviour (Hirsh & Peterson, 2009) – is not applicable. The action-seeking nature of extraversion (as discussed in CHAPTER III) might, however, explain this effect for all participants that did invest. The associated sub-dimension analysis (see APPENDIX A4.3) did not provide additional insights to the potential driving factors behind this behaviour.

[168] I see two major pitfalls that may arise and distort any interpretability of the results. Firstly, each of the sub-dimensions is based on three or four items only. This implies a higher risk of limited robustness of the scores – especially when compared to the 10-12 items for each of the main dimensions. Secondly, the high number of potential variables that may play a role in the sample (in combination with the first pitfall) potentially yield – although statistically significant – results that emerged by chance.

In summary, the analysis results find support for the hypothesised proposition ***P1*** *(conflict-seeking),* but not ***P2*** *(harmony-seeking).* However, even for ***P1***, the results are not as consistent as the propositions predicted, most notably, the difference between the soft and tough investment setting. For conflict-seeking dimensions (***P1***) the analysis found consistent empirical support for the soft investment setting, even confirming that personality might get in the way of choosing an theory-consistent strategy. These findings were not confirmed in the tough investment setting. The harmony-seeking dimensions, on the other hand, did not find any support for the hypotheses of proposition ***P2***. While the results not confirmed the hypothesised behaviour in the tough investment, a striking reversed effect was identified in the soft investment setting (and deter entry objective). Proposition ***P3*** found partially supporting results, confirming the hypothesised effect of higher *dependence* scores in the soft investment setting, but not in the tough setting.

		Investment Setting	
Proposition	**Objective**	Soft	Tough
P1: **Conflict-Seeking Traits**	Allow	✓ **	✗
	Deter	✓ **	✗
	Overall	✓	✘
P2: **Harmony-Seeking Traits**	Allow	✗	✗
	Deter	↯ **	✗
	Overall	✘	✘
P3: **Emotionality Sub-Traits**	Allow	✓ **	✗
	Deter	✗	✗
	Overall	(✓)	✘

✓ *Proposition confirmed* (✓) *Proposition partly confirmed*
✗ *Proposition not confirmed* ↯ *Proposition reversed*
*Note: *, **, & *** correspond to significance levels of 10%, 5%, and 1%, respectively*

Table 5.15: Summary of Incumbent propositions & findings

Accordingly, the findings discussed above – summarised for each proposition in Table 5.15 – do support the overarching hypothesis of personality affecting decision making in market entry games and potentially even getting in the way of choosing the optimal pre-entry strategy for the Incumbent. The inconsistency of the results suggests, however, that personality explains Incumbent behaviour only to a certain extent, and is dependent on additional situational factors (as for example the type of potential investment), which supports the findings outlined by Pothos et al. (2011) and Lönnqvist et al. (2011).

V. 3.3 Effects of Personality Traits on Entrant Behaviour

The aim of this sub-section is to shed light on the developed propositions ***P4***, ***P5***, and ***P6*** from CHAPTER III, hypothesising market entry behaviour in the context of preceding Incumbent investing activities (see TABLE 3.1). Ultimately, the following empirical findings provide an indication concerning the Entrant-side of this thesis' research question and potentially explain the discrepancy between empirical and theoretical findings:

Can personality get in the way of Entrant behaviour?

V. 3.3.1 Empirical Findings on the Effects of Personality on Market Entry Decisions

The following paragraphs focus on the multivariate regression analysis in order to investigate the developed propositions and underlying hypotheses on entry behaviour. While the Incumbent analysis has been differentiating between the respective settings – the soft and tough making investments – I propose a slightly adjusted wording for both settings for the Entrant analysis. That is, emphasising the implications that the Incumbent investment has on the post-entry period. I will refer to the soft investment setting as the *complete information setting*, since the investment (magnitude) has concrete implications for the post-entry profits and participant compensation (without room for interpretation[169]). The pre-entry investment behaviour in the tough investment setting does not necessarily have concrete implications on the post-entry profits (as the Incumbent might choose his price independently from the underlying costs or the post-entry price). Accordingly, I will henceforth refer to the tough investment setting as the *signalling setting* (with incomplete information[170]).

Signalling Setting (Tough Investment)

The following regression analyses investigate the effect significantly pronounced personality dimensions[171] have on entry behaviour after preceding Incumbent investments. The DV in this regression analysis is the entry decision, which suggests the use of a logistic regression.

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[169] That is, with respect to the respective profit functions for both players, not the potential strategies that might be applied by the opponent to signal a specific behaviour in the next period.

[170] Games with *incomplete information* are games where players do not have common knowledge about the game that is being played (Levin, 2002). Specifically, both competing firms (or participants) are not aware of the opponent's unit costs. In a game of *complete information*, each player's payoff function is common knowledge among all the players, as for example the prisoner's dilemma (Gibbons, 1992).

[171] Recorded scores in the top quartile, i.e., above 75th percentile.

TABLE 5.16 summarises the respective regression results for the entry decisions in the signalling setting (i.e., tough setting). In line with the procedure above, the initial model fits the control variables only. The second model further includes *nuisance* variables, that is, variables that have to be included as they may affect the results, but are of little or no direct interest (Friedman & Sunder, 1994). The third regression model, then, fits the control and nuisance variables as well as the focus variables of this research, i.e., the main personality dimensions. The number of (minimum) events in the signalling setting is 81 (i.e., *stayouts*), which suggests the inclusion of no more than 9-16 variables[172]. Although the 12 predictor variables in the third model are within this range, the following sub-sub-section, investigating the robustness of the empirical results, assesses the robustness of these results.

Overall, the results support the initial proposition of personality affecting entry behaviour by the Entrant, with the LR test confirming the improved predictive power of the model including the personality variables (*MODEL TE3*) at the 0.01-level ($\chi^2 = 12.162$; p=0.002) compared to the nuisance model (*MODEL TE2*).

Dependent Variable:		ToughEntDecision					
		Control		**Nuisance**		**Personality**	
		MODEL TE1		*MODEL TE2*		*MODEL TE3*	
Field	**Variables**	β	p	β	p	β	p
Nuisance	Foregone Profit			-0.02***	.00	-0.02***	.00
Variables	Unit Costs			-0.30	.89	-0.32	.88
Personality	Aggression					-0.18	.67
Variables	Assertiveness					0.41	.33
	Honesty-Humility					0.44	.28
	Emotionality					0.03	.95
	Extraversion					1.09***	.01
	Agreeableness					0.13	.75
	Conscientiousness					-0.44	.28
	Openness-to-Experience					-0.35	.36
Control	Gender (female)	-0.08	.84	-0.18	.66	-0.21	.68
Variables	Consequences[a]						
	Experiment experience	-0.49*	.10	-0.66**	.03	-0.72**	.04
Intercept	constant	0.55	.02	1.98	.71	1.82	.74
Model	N (minimum events)	188 (81)		188 (81)		188 (81)	
	Pseudo R2	0.08		0.08		0.13	
Test	LR χ^2 (Model 2 vs. 1 & 3 vs. 2)[b]	-		17.59***	.00	12.16***	.00

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

Foregone Profit is the foregone Incumbent profit in the previous period (i.e., Incumbent investment)

a) Consequences has been excluded from the regression models as only one recorded non-zero value

b) The Likelihood-Ratio test results for $\chi 2$ indicate the probability of the additional variables (Model 2 vs. 1 & Model 3 vs. 2) improving the model fit

TABLE 5.16: Logistic regression results for Entrant decisions in signalling setting (tough)

[172] Applying the rule of thumb by Vittinghoff & McCulloch (2007) of „5-9 events per predictor" yields 9-16 variables for 81 events.

Support for Conflict-Seeking Personality Traits – ***P4***

Proposition ***P4*** hypothesises the conflict-seeking personality traits (*aggression* and *assertiveness*) to positively affect the likelihood to enter the market. That is, affecting market entry positively for higher *aggression* or *assertiveness* scores (H4.2) beyond the effect that the opponent's pre-entry signalling is predicted to have (H4.1), as these traits are characterised as not trusting (Buss & Perry, 1992) and sceptical and challenging or questioning others (Catell, 1957), respectively. Although it is not necessarily a hypothesis by definition, [H4.3] formulates the expectation that the harmony-seeking personality traits do not affect entry beyond the signalling (as these traits are characterised as honest, unassuming, and trusting (Ashton & Lee, 2007) and the signal is interpreted as genuine).

MODEL TE2 and *TE3* both find support for H4.1, indicating the foregone profit (or, investment) to have a negative effect on the entry likelihood (p_{TE2}=0.000; p_{TE3}=0.001). Interestingly, *MODEL TE3* does not find any support for the hypothesised effect of *aggression* (p=0.670) or *assertiveness* (p=0.332). The expected results for harmony-seeking personality traits are confirmed, with *agreeableness* (p=0.748) and *honesty-humility* (p=0.276) not having a significant effect on the entry likelihood. Throughout all three models, the control variable for previous `experiment experience` indicates to negatively affect entry likelihood (p_{TE1}=0.098; p_{TE2}=0.034; p_{TE3}=0.036).

In summary, the core of proposition ***P4*** (H4.2) is neither confirmed for *aggression* nor for *assertiveness* at any of the significance thresholds. The accompanying, nuisance hypothesis (H4.1), on the other hand, is confirmed at the 0.01-level.

Support for Action-Seeking Personality Traits – ***P5***

Proposition ***P5*** hypothesises the action-seeking personality traits (*extraversion* and *openness-to-experience*) to positively affect the likelihood to enter the market beyond the opponent's signalling in the previous period. Hypothesis H5.1, concerned with the preceding signalling (i.e., Incumbent investment), is the same as H4.1 discussed above. Accordingly, the expected outcome of harmony-seeking traits not affecting entry likelihoods ([H5.3]) mirrors the aforementioned statement [H4.3]. To limit unnecessary receptiveness, these results are not discussed in this paragraph anew. *MODEL TE3* finds statistically significant support for the core hypothesis of proposition ***P5***, indicating *extraversion* to positively affect the likelihood to enter the market (beyond the opponent's signalling), at the 0.01-level. Results confirm H5.2

for extraversion, with β=1.091 and p=**0.010**. Combining these findings with the aforementioned results for H5.1 and [H5.3], the regression analysis confirms for proposition ***P5*** for the action-seeking personality dimension *extraversion* at the 0.01-level.

Complete Information Setting (Soft Investment)

The soft investment setting represents a complete information game, with both players being aware of the respective profit functions for both firms (affected by the preceding Incumbent investment). The following regression analysis first investigates the effect significantly pronounced personality dimensions[173] have on the likelihood to enter the market beyond the preceding investment. Expecting Nash-Equilibrium play by both firms, the *rationality* of entering the market or not depends on the respective investment[174]. Thus, each entry (or stayout) decision can be classified as '*NE-rational'* or *'NE-irrational'*[175]. The DVs for the second NE-based analyses are dichotomous variables '`NE-rational entries`' and '`NE-rational stayouts`'[176]. All of the described models utilise a logistic regression.

TABLE 5.17 summarises the according results for the logistic regression models for the complete information setting. These include i) the initial two models as described in the signalling setting (*SE1* & *SE2*), ii) 8 regression models for each of the main personality dimensions (*SE3.1-SE3.8*), as well as iii) a *relevant* model with the two personality variables that indicated a significant effect on entry likelihood (*SE3.9*). The number of (minimum) events in this setting is 33 (i.e., *stayouts*), which suggests the inclusion of no more than 3-6 variables[177]. Given the two control variables (`Gender` and `Experiment experience`) and the nuisance variable (`Incumbent Invest`), it is negligent to include all personality variables into the model without jeopardising the interpretability and soundness of the statistical results. Accordingly, instead of including all personality variables simultaneously, a stepwise or hierarchical approach, in line with Hirsh and Peterson (2009), has been applied. That is, adding and removing each of the personality variables separately and, thus, limiting the number of predictor variables to no more than four.

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[173] Recorded scores in the top quartile, i.e., above 75th percentile.

[174] Note, the described function further depends on the associated entry costs. Given the entry costs of *100 points*, entry is economically worthwhile for a capacity shift of $C > 19.2\%$.

[175] Please note that strong emphasis lies on the assumption that both firms play according to Nash-Equilibrium play.

[176] That is, a value of 1 indicating '*NE-rationality'* and 0 indicating '*NE-irrationality'*.

[177] Applying the rule of thumb by Vittinghoff & McCulloch (2007) of „5-9 events per predictor" yields 3-6 variables for 33 events.

Table 5.17: Logistic regression results for Entrant decisions in complete information setting (soft)

Dependent Variable:		SoftEntDecision																			
		Control		**Nuisance**		**Aggression**		**Assertiveness**		**Hon.-Humility**		**Emotionality**		**Extraversion**		**Agreeableness**		**Conscient.**		**Openn-to-Exp**		**Relevant**	
		Model SE1		*Model SE2*		*SE3.1*		*SE3.2*		*SE3.3*		*SE3.4*		*SE3.5*		*SE3.6*		*SE3.7*		*SE3.8*		*SE3.9*	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Nuisance	Incumbent Invest			0.00	.41	0.00	.44	0.00	.46	0.00	.39	0.01	.36	0.00	.43	0.00	.40	0.00	.45	0.01	.33	0.00	.25
Personality	Aggression					0.23	.60																
Variables	Assertiveness							-0.61	.12														
	Honesty-Humility									0.63	.15												
	Emotionality											0.99*	.06									1.18*[1]	.04
	Extraversion													-0.28	.50								
	Agreeableness															-0.50	.20						
	Conscientiousness																	-0.51	.20				
	Openness-to-Experience																			0.77*	.09	0.93*[1]	.05
Control	Gender (female)	-0.71*	.09	-0.65	.14	-0.65	.14	-0.83*	.07	-0.78*	.08	-1.15*	.03	-0.64	.14	-0.63	.15	-0.64	.14	-0.69	.13	-1.30*	.02
Variables	Consequences[a]																						
	Experiment experience	0.18	.62	0.21	.58	0.17	.65	0.29	.44	0.24	.53	0.37	.34	0.24	.52	0.18	.63	0.25	.52	0.13	.75	0.33	.41
Intercept	constant	1.44*[1]	.00	1.28*[1]	.00	1.25*[1]	.00	1.49*[1]	.00	1.49*[1]	.00	1.07*[1]	.00	1.35*[1]	.00	1.44*[1]	.00	1.40*[1]	.00	1.12*[1]	.00	0.81*[1]	.04
Model	N (minimum events)	188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)		188 (33)	
	Pseudo R2	0.02		0.02		0.02		0.03		0.03		0.04		0.02		0.03		0.03		0.04		0.06	
Test	LR χ^2 (vs. *Model SE2*)[b]	-		0.63	.73	0.28	.87	2.23	.33	2.07	.36	3.66	.16	0.46	.80	1.62	.45	1.60	.45	3.04	.22	7.93*[1]	.02

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

`Foregone Profit` *is the foregone Incumbent profit in the previous period (i.e., Incumbent investment)*

a) `Consequences` *has been excluded from the regression models as only one recorded non-zero value*

b) The Likelihood-Ratio test results for $\chi 2$ indicate the probability of the additional variables (vs. Model SE2) improving the model fit. The $\chi 2$ for Model SE2 compares the fit to Model SE1 respectively.

Overall, the results yield inconsistent support for the overarching proposition of personality affecting entry behaviour by the Entrant. The LR test significantly confirms an improved predictive power only for the last model, including the two *relevant* personality variables (*Model SE3.9*) at the 0.05-level ($\chi^2 = 7.932$; p=0.019) – when compared to the nuisance model (*Model SE2*).

Support for Action-Seeking Personality Traits – ***P6***

Proposition ***P6*** hypothesises action-seeking personality traits (*openness-to-experience* and *extraversion*) to positively affect the likelihood to enter the market. That is, affecting market entry positively for higher *openness-to-experience* or *extraversion* scores (H6.2) beyond the effect that the opponent's pre-entry capacity shift is expected to have (H6.1). As described above, based on the Incumbent investment, the entry decision can be classified as *rational* or irrational – given the entry-related cost and the crucial assumption that both firms compete according to Nash Equilibrium play. Thus, all recorded entries can be classified as *NE-rational* or *NE-irrational* (as the expected net profit is negative). Amongst these entries, action-seeking personality traits are expected to negatively impact *NE-rational* entry decisions, i.e., *entry* decisions that should have been *stayout* decisions (H6.3).

Interestingly, all models (*SE2* to *SE3.9*) do not indicate any support for H6.1, i.e., the Incumbent investment to (positively) affect entry decisions (p>0.246 for all models)[178]. *Model SE3.8*, however, confirms the hypothesised (positive) effect of strongly pronounced action-seeking personality traits on entry behaviour (H6.2) for the `openness-to-experience` predictor (β=0.770; p=0.096). Beyond the hypothesised action-seeking personality traits, *Model SE3.4* further indicates a positive effect of `emotionality` on entry decisions (p=0.063). Both models (*SE3.4* and *SE3.8*) do not seem to statistically improve the predictive power of the base *Model SE2* at any of the threshold levels ($p_{SE3.4}(\chi^2)$=0.160; $p_{SE3.8}(\chi^2)$=0.219). *Model SE3.9* on the other hand, including both of the personality variables, does not only indicate a significantly improved predictive power ($p_{SE3.9}(\chi^2)$=0.019), but also higher significance levels for both predictor variables (p_{emot}=0.038; p_{o2ex}=0.047). Although the five predictor variables that *Model SE3.9* uses are within the aforementioned

[178] While the quadratic relationship the investment (in points) has with the capacity shift (percentage) could explain these somewhat puzzling results, the logistic regression model *SE3.9*, with `capacity shift` (instead of `incumbent investment`) as the nuisance variable, equally, did not yield any statistically significant results (β=0.748; p=0.384).

range, the following robustness verifications examine the model for potential overfitting. Throughout most of the models, `gender (female)` indicates female participants being less likely to enter the market.

Hypothesis H6.3 classifies all entries into *NE-rational* and *NE-irrational* – based on the associated entry costs and the assumption that both firms play Nash-Equilibrium strategies. H6.3, which hypothesises action-seeking traits to drive *NE-irrational* entry, is investigated in a separate regression model, analysing only the positive entry decisions and classifying them into *NE-rational* entries and *NE-irrational* entries. TABLE 5.18 summarises the logistic regression results for all entries (being *NE-rational* or not). TABLE 5.19 summarises the respective regression results for all stayouts (equally being *NE-rational* or not)[179].

Before discussing the regression results, it is worthwhile to emphasise the fact that the analyses (for all entries or all stayouts) include a selection bias. Thus, later discussions and interpretations shall be conducted with caution. The results from the logistic regression models[180] (*MODELS SE5.1 – SE5.9*) find support for hypothesis H6.3 for the action-seeking personality variable `openness-to-experience` (β=-0.769; p=0.060). The negative coefficient confirms the hypothesised effect that `openness-to-experience` might drive *NE-irrational* entries. The χ^2 results for the LR test for *MODELS SE5.1 –SE5.8* do not confirm a higher predictive power for the added variables. This can potentially be explained by the fact that only one personality variable is added at a time, which cannot explain all effects[181]. *MODEL SE5.9*, which includes `openness-to-experience` and `conscientiousness`, on the other hand, does indicate a higher predictive power at the 0.1-level (p=0.076)[182] and confirms the negative that `openness-to-experience` has on *NE-rational* entries (p=0.070).

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[179] Since the *NE-rationality* depends on the `incumbent investment` the nuisance variable is not included in the models.

[180] For detailed results of all models (*MODELS SE5.1 – SE5.8*) please refer to APPENDIX A4.3.3.

[181] The rationale behind this stepwise approach of independently adding the personality variables lies in the fact that the number of events is very limited (42 events for 150 observations), which suggests a predictor count range of 4-8 variables. To avoid overfitting, my modelling approach aimed at the conservative lower end of this range.

[182] All model combinations have been calculated for `openness-to-experience`. While all models confirmed the statistical significance of the negative effect of `openness-to-experience` at the 0.05-level, `conscientiousness` yielded the best overall model fit (χ^2=5.152; p=0.076). Accordingly, the displayed relevant model (*MODEL SE5.9*) represents the combination of `openness-to-experience` and `conscientiousness`.

Dependent Variable:		NE-rational entry																			
		Control		Aggression		Assertiveness		Hon.-Humility		Emotionality		Extraversion		Agreeableness		Conscient.		Openn-to-Exp		Relevant	
		Model SE4		*SE5.1*		*SE5.2*		*SE5.3*		*SE5.4*		*SE5.5*		*SE5.6*		*SE5.7*		*SE5.8*		*SE5.9*	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Nuisance	n/a																				
Personality Variables	Aggression			0.33	.45																
	Assertiveness					-0.26	.53														
	Honesty-Humility							0.04	.92												
	Emotionality									0.49	.37										
	Extraversion											-0.31	.48								
	Agreeableness													-0.49	.24						
	Conscientiousness															-0.61	.19			0.59	.19
	Openness-to-Experience																	-0.77*	.06	-0.76*	.07
Control Variables	Gender (female)	-0.68	.15	-0.65	.17	-0.73	.14	-0.69	.16	-0.95*	.09	-0.65	.19	-0.66	.17	-0.87*	.09	-0.62	.21	-0.80	.13
	Consequences[a]																				
	Experiment experience	-0.71*	.06	-0.76*	.05	-0.69*	.07	-0.71*	.06	-0.63	.11	-0.69*	.07	-0.76*	.05	-0.69*	.07	-0.62	.10	-0.60	.12
Intercept	constant	1.47*	.00	1.41*	.00	1.54*	.00	1.46*	.00	1.35*	.00	1.53*	.00	1.62*	.00	1.36*	.00	1.62*	.00	1.49*	.00
Model	N (minimum events)	150 (42)		150 (42)		150 (42)		150 (42)		150 (42)		150 (42)		150 (42)		150 (42)		150 (42)		150 (42)	
	Pseudo R2	0.03		0.04		0.03		0.03		0.04		0.03		0.04		0.04		0.05		0.06	
Test	LR χ^2 (vs. *SE4/SE6*)[b]	-		0.58	.75	0.38	.83	0.01	.99	0.90	.64	0.53	.77	1.31	.52	1.83	.40	3.48	.18	5.15’	.08

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

Foregone Profit *is the foregone Incumbent profit in the previous period (i.e., Incumbent investment)*

a) Consequences *has been excluded from the regression models as only one recorded non-zero value*

b) The Likelihood-Ratio test results for $\chi 2$ indicate the probability of the additional variables (vs. Model SE4/SE6) improving the model fit.

Table 5.18: Logistic regression results for *NE-rational* entry decisions in complete information setting (soft)

Dependent Variable:		NE-rational stayout																			
		Control		Aggression		Assertiveness		Hon.-Humility		Emotionality		Extraversion		Agreeableness		Conscient.		Openn-to-Exp		Relevant	
		MODEL SE4		*SE5.1*		*SE5.2*		*SE5.3*		*SE5.4*		*SE5.5*		*SE5.6*		*SE5.7*		*SE5.8*		*SE5.9*	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Nuisance	n/a																				
Personality	Aggression			0.47	.57																
Variables	Assertiveness					1.12	.14														
	Honesty-Humility							0.87	.23												
	Emotionality									-0.37	.73										
	Extraversion											0.75	.34								
	Agreeableness													0.02	.98						
	Conscientiousness															2.31*	.07			2.48*	.04
	Openness-to-Experience																	0.61	.44	0.99	.29
Control	Gender (female)	-0.68	.15	0.17	.83	0.50	.56	0.13	.87	0.39	.68	0.13	.87	0.18	.82	0.52	.61	0.16	.84	-0.61	.55
Variables	Consequences[a]																				
	Experiment experience	-0.71*	.06	-0.71	.29	-0.94	.19	-0.56	.43	-0.78	.31	-0.90	.22	-0.69	.31	-1.57	.11	-0.62	.37	-1.51	.11
Intercept	constant	1.47*	.00	-0.17	.76	-0.37	.51	-0.38	.50	0.01	.98	-0.19	.72	-0.06	.92	-0.04	.93	-0.23	.68	-0.34	.59
Model	N (minimum events)	150 (42)		38 (16)		38 (16)		38 (16)		38 (16)		38 (16)		38 (16)		38 (16)		38 (16)		38 (16)	
	Pseudo R2	0.03		0.03		0.06		0.05		0.02		0.04		0.02		0.13		0.03		0.03	
Test	LR χ^2 (vs. *SE4/SE6*)[b]	-		0.39	.82	1.94	.38	1.43	.49	0.13	.94	0.97	.62	0.00	.99	5.59'	.06	0.60	.74	6.94'	.03

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

Foregone Profit *is the foregone Incumbent profit in the previous period (i.e., Incumbent investment)*

a) Consequences *has been excluded from the regression models as only one recorded non-zero value*

b) The Likelihood-Ratio test results for $\chi2$ indicate the probability of the additional variables (vs. MODEL SE4/SE6) improving the model fit.

Table 5.19: Logistic regression results for *NE-rational* stayout decisions in complete information setting (soft)

Although the personality dimensions in focus of this thesis were not hypothesised to have any effects on the stayout decisions, the logistic regression results in TABLE 5.17 yielded interesting findings[183]. Results (*MODEL SE7.9*) indicate `conscientiousness` to have a positive effect on *NE-rational* stayouts (β=-2.484; p=0.038), i.e., higher scoring individuals on the conscientiousness dimension are more likely to not enter the market when the pre-entry capacity shift indicates a more competitive strategy by the Incumbent (again, assuming Nash Equilibrium play by both players).

In summary, the core hypotheses of proposition ***P6*** (H6.2 and H6.3) are confirmed for the action-seeking dimension *openness-to-experience*. High scores on the dimensions do not only drive the likelihood to enter the market in general, but also drive *NE-irrational* entries, when taking into account the known pre-entry investment and associated capacity shift.

V. 3.3.2 Model Fit & Robustness of Findings on Entry Behaviour

The following paragraphs investigate the statistical robustness of the findings presented above. The preceding analysis applied logistic regression models due to the dichotomous nature of the dependent variable. The chosen methods to validate the robustness of the empirical results include (A) modifying the regression model specification by adding or removing regressors[184] (Leamer, 1983; Lu & White, 2014) and (B) applying alternative (yet applicable) statistical analyses to the same set of variables (of interest). For the latter, the main and preliminary robustness model is the probit regression model. Additionally, a univariate analysis has been conducted to investigate a partially linear relationship between the DV and variable in question[185].

TABLE 5.20 summarises the results of the respective robustness analyses for the settings, i.e., signalling and complete information setting. TABLE 5.21 summarises the robustness analyses for the NE-rational entry or stayout decisions.

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[183] For a detailed documentation of the results (*MODELS SE7.1 – SE7.8*) please refer to APPENDIX A4.3.3.

[184] Three distinct variable combinations have been applied and modelled. The reported coefficient (β) and reported significance levels represent the median value of the three alternative models. The three predictor combinations include:
i) only the robustness-tested variable (RTV) + nuisance variables (NVs) + control variables (CVs),
ii) the RTV + conflict- and action-seeking variables + NVs + CVs,
iii) the RTV + overall-affecting variables (*emotionality*, *extraversion*, *conscientiousness*, *openness-to-experience*) + NVs + CVs.

[185] Due to the strictly dichotomous nature of the DV, a *tobit* model (as applied for the Incumbent behaviour) is not applicable.

		SIGNALLING SETTING (TOUGH)						COMPLETE INFORMATION SETTING (SOFT)					
		'Original'	(A) - 1	(A) - 2	(A) - 3	(B) - 1	(B) - 2	*'Original'*	(A) - 1	(A) - 2	(A) - 3	(B) - 1	(B) - 2
		Logit	*Logit*	*Logit*	*Logit*	*Probit*	*Univariate*	*Logit*	*Logit*	*Logit*	*Logit*	*Probit*	*Univariate*
DV Type	**Relevant Variables**	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*
Entry (=1)	`Foregone Profit`	-0.02***	-0.02***	-0.02***	-0.02***	-0.01***	-0.27***	0.01	0.01	0.01	0.01	0.00	0.07
	`Unit Costs`	-0.32	-0.32	-0.31	-0.33	-0.20	-0.01						
	`Aggression`	-0.18		-0.24		-0.13	-0.08			0.16			
	`Assertiveness`	0.41		0.23		0.25	0.10			-0.82**			
	`Honesty-Humility`	0.44				0.26	0.06						
	`Emotionality`	0.03			-0.08	0.02	0.02	1.18**	1.18**	1.13*	1.22**	0.68**	0.05
	`Extraversion`	1.09***	1.12***	1.03***	1.18***	0.64**	0.18**			0.01	-0.13		
	`Agreeableness`	0.13				0.06	0.08						
	`Conscientiousness`	-0.44			-0.25	-0.26	-0.04				-0.49		
	`Openness-to-Experience`	-0.35			-0.16	-0.21	-0.02	0.93**	0.93**	1.18**	0.92*	0.54**	0.11
	`Gender (female)`	-0.21	-0.30	-0.24	-0.20	-0.12	-0.01	-1.30**	-1.30**	-1.52**	-1.22**	-0.76**	-0.13*
	`Consequences`[a]												
	`Experiment experience`	-0.72**	-0.80**	-0.75**	-0.79**	-0.44**	-0.12*	0.33	0.33	0.40	0.41	0.19	0.04
	`constant`	1.82	1.89	1.91	1.99	1.12		0.81**	0.81**	1.02**	0.95**	0.49**	
	Support		✓	✓	✓	✓	✓		n.a.	✓	✓	✓	✗

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

a) Median coefficients & p-values reported for 3 distinct model (predictor) variations:

i) Robust-test variable (RTV) + nuisance variables (NVs) + control variables (CVs)

ii) RTV + conflict-seeking & action-seeking variables + NVs + CVs

iii) RTV + Overall-affecting variables (Emot., Extra., Consc., O2E.) + NVs + CVs

✓ *Robustness confirmed*

✗ *No support*

TABLE 5.20: Summary of robustness tests for results for Entrant behaviour analysis

		Complete Information - Entries						Complete Information - Stayouts					
		'Original'	(A) - 1	(A) - 2	(A) - 3	(B) - 1	(B) - 2	'Original'	(A) - 1	(A) - 2	(A) - 3	(B) - 1	(B) - 2
		Logit	Logit	Logit	Logit	Probit	Univariate	Logit	Logit	Logit	Logit	Probit	Univariate
DV Type	**Relevant Variables**	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*	β *(sign.)*
NE-rational	`Aggression`			0.12						-0.42			
decision (=1)	`Assertiveness`			-0.06						-0.04			
	`Honesty-Humility`												
	`Emotionality`				0.40						0.12		
	`Extraversion`			-0.12	-0.24					0.27	0.35		
	`Agreeableness`												
	`Conscientiousness`	0.59			0.64	0.36	0.08	2.48**	2.31*	2.68*	2.38**	1.49**	0.28**
	`Openness-to-Experience`	-0.76*	-0.77*	-0.70	-0.70	-0.46*	-0.18**	0.99		0.86	0.98	0.64	0.15
	`Gender (female)`	-0.80	-0.62	-0.62	-1.01*	-0.50	-0.12	-0.61	-0.52	-0.69	-0.65	-0.36	0.04
	`Consequences`[a]												
	`Experiment experience`	-0.60	-0.62	-0.64	-0.53	-0.35	-0.15*	-1.51	-1.57	-1.62	-1.54	-0.91*	-0.17
	`constant`	1.49***	1.63***	1.63***	1.43***	0.91***		-0.34	-0.04	-0.25	-0.43	-0.23	
	Support		✓	✗	✗	✓	✓		✓	✓	✓	✓	✓

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively*

a) Median coefficients & p-values reported for 3 distinct model (predictor) variations:

i) Robust-test variable (RTV) + nuisance variables (NVs) + control variables (CVs)

ii) RTV + conflict-seeking & action-seeking variables + NVs + CVs

iii) RTV + Overall-affecting variables (Emot., Extra., Consc., O2E.) + NVs + CVs

✓ *Robustness confirmed*

✗ *No support*

Table 5.21: Summary of robustness tests for results for *NE-rational* behaviour analysis

In general, the robustness tests confirm all findings throughout both settings. The only minor discrepancies were recorded in the complete information setting for `entry` as the DV

and `NE-rational entry` as the DV. As pointed out above, the preliminary robustness test model for (B) is the probit regression, extended by the (less applicable, yet indicative) univariate analysis. While the correlation coefficients for both personality variables are not significant at any of the threshold levels, the coefficient and associated p-value for `openness-to-experience` provide an indicative support for the logit results (β=0.114; p=0.117). Accordingly, this (statistically significant) non-confirmation is not critical for the findings.

Similarly, the results of the three logistic regression models (with alternating predictor combinations) provide partial, yet not statistically significant, support for the initial findings in the complete information setting and NE-rational entry analysis. The calculated p-values for the `openness-to-experience` variable yield relatively homogenous values in proximity of (or below) the significance threshold ($p_{i)}$=0.060; $p_{ii)}$=0.111; $p_{iii)}$=0.107)[186].

In summary, the findings for each of the settings and calculated models are supported by the different robustness tests that have been conducted. Accordingly, the following paragraphs discuss these findings in the context of the hypothesised behaviours.

V. 3.3.3 Discussion of Findings on Entry Behaviour

In general, the findings from the regression analyses documented above confirm the hypothesised effect of action-seeking personality dimensions on market entry decisions. No support is found for the conflict-seeking personality dimensions in the signalling setting. These results contrast the findings of the experimental study conducted by Bergstrom et al. (2016), which did not find any support for effects of any of the Big Five personality traits.

Similarly to the findings for the Incumbent behaviour, the empirical results documented above are not as consistent as expected. Namely, results indicate *extraversion* to have an effect on entry decision in the signalling setting (p=0.010) but not the complete information setting (p=0.497), while results for *openness-to-experience* indicate the respective opposite effect ($p_{sign.}$=0.363; $p_{c.i.}$=0.047). In line with the Incumbent findings, this supports the line of argument that the effect of personality traits depends (partly) on the situational setting (Lönnqvist et al., 2011; Pothos et al., 2011). In this case, the different nature of both settings (signalling versus complete information) makes the discussion and interpretation particularly

[186] Furthermore, as part of the, initial, stepwise regression approach in the previous sub-sub-section, `openness-to-experience` has been modelled independently with each of the other main personality variables. Results for all eight models confirmed `openness-to-experience` as negatively affecting *NE-rational* entry decisions at the 0.1 significance level.

interesting. TABLE 5.22 summarises all relevant empirical results, their respective robustness tests and links them to the respective hypotheses. The following discussion commences with the signalling setting, before proceeding to the complete information setting.

		SIGNALLING SETTING				COMPLETE INFORMATION SETTING			
DV Type	**Relevant Variables**	**Hypothesis**	**Results**	**(A)**	**(B)**	**Hypothesis**	**Results**	**(A)**	**(B)**
Entry (=1)	Incumbent Invest	**H4/5.1:** ⊖	– ***	✓***	✓***	**H6.1:** ⊕	+		
	Assertiveness	**H4.2:** ⊕	+				–		
	Aggression		–				+		
	Agreeableness	**[H4/5.3]**	+				–		
	Honesty-Humility		+				+		
	Extraversion	**H5.2:** ⊕	+ ***	✓***	✓**	**H6.2:** ⊕	–		
	Openness-to-Experience		–				+ **	✓**	✓**
	Emotionality		+				+ **	✓**	✓**
	Conscientiousness		–				–		
	Hypothesis support	**H4.1 & H5.1** ✓	**H4.2** ✗				**H6.1** ✗		
		[H4.3] & [H5.3] [✓]	**H5.2** ✓				**H6.2** ✓		

		COMPLETE INFORMATION - ENTRIES				COMPL. INFORMATION - STAYOUTS			
NE-rational decision (=1)	Assertiveness		–				+		
	Aggression		+				+		
	Agreeableness		–				+		
	Honesty-Humility		+				+		
	Extraversion	**H6.3:** ⊖	+				+		
	Openness-to-Experience		– *	✗	✓*		+		
	Emotionality		+				–		
	Conscientiousness		+				+ **	✓*	✓**
	Hypothesis support	**H6.3** ✓							

*Note: *, **, & *** correspond to significance levels of 10%, 5%, and 1%, respectively*

⊖ *Hypothesised negative effect on pre-entry investment behaviour*

⊕ *Hypothesised positive effect on pre-entry investment behaviour*

✓ *Hypothesis confirmed* ✗ *Hypotheis not confirmed*

(✓) *Hypothesis partly confirmed* [✓] *Expected results confirmed*

TABLE 5.22: Summary of results, robustness tests & hypotheses for Entrant behaviour

In the signalling setting, the hypothesised (negative) impact of the nuisance variable (H4.1 and H5.1), i.e., the preceding Incumbent investment, is confirmed at the 0.01-level (p=0.001). This is not surprising, as a higher investment signals lower unit costs, makes the Incumbent appear more competitive (i.e., 'tougher'), and, hence, deters market entry. Although the signalled unit costs of the Incumbent do not necessarily correspond to the actual costs, Tingley and Walter (2011) already indicated the effectiveness that non-binding communication can have to deter entry. The fact that the non-binding signal comes at a cost, makes the signal more credible and amplifies this effect. –

Furthermore, the hypothesised effect that `extraversion` potentially has on entry behaviour (H5.2) is confirmed at the 0.01-level (p=0.001), positively affecting the likelihood to enter the market beyond the preceding signal. Keeping in mind the deduction made in the

literature review, that extroverts are more rational than non-extroverts[187], this result suggests that high scoring extraversion participants are somewhat sceptical towards the Incumbent's signal. While their preference for social interaction (Moberg, 2001) might suggest the general urge to enter the market in order to interact with the Incumbent, the fact that `extraversion` does not yield any significant results for the complete information setting (p=0.483) supports the rationality claim derived in the literature review, as entry is not pursued at any cost. Interestingly, *openness-to-experience* did not indicate any significant effect on the entry decisions.

In the complete information setting, on the other hand, the regression analyses did yield significant results, suggesting `openness-to-experience` to positively affect market entry decisions (p=0.047) and thereby confirming hypothesis H6.2. While the dimension's '*willingness to experience novelty*' (Moberg, 2001) is likely to drive the entry likelihood for high scoring participants, it is interesting to see that effect in the context of a complete information game setting. This suggests that this willingness to experience novelty is higher than the more rational, monetary compensation attached to the decision (as the decision can be expressed as a function of the investment, when assuming Nash Equilibrium play in the post-entry period). Strikingly, in this complete information context, the preceding Incumbent investment does not affect the entry decision (p=0.247), as suggested by H6.1. This is somewhat puzzling as the investment in the signalling setting is non-binding and has indicated a significant effect, while the investment in the complete information setting has no such effect although it is binding for the post-entry period. A potential explanation for these results might include the underlying distribution of the Incumbent investments, which is heavily right-skewed. Accordingly, the statistical data basis for the 'investing' (or, *overinvesting*) type is relatively small, and, thereby, limits the statistical significance of the positive coefficient (as hypothesised).

Although *openness-to-experience* positively affects the likelihood to enter the market, a line of argumentation might include the claim that these entries were rationale, and thus, does not account for or provide partial explanation for the phenomenon of excess entry. Fortunately, the complete information setting provides the opportunity to classify the recorded entries – under the crucial assumption of Nash Equilibrium play by both firms in the post-entry period – into *rational* and *irrational* entries. In fact, as the initial results indicated, the regression

[187] Based on the studies by Ben-Ner et al. (2008), Lönnqvist et al. (2011), and Schmitt et al. (2008).

results confirm the hypothesis (H6.3) that `openness-to-experience` drives *NE-irrational* market entry (p=0.070). This confirms the overarching proposition of this thesis, stating that personality might get in the way of optimal market entry behaviour. Furthermore, this finding potentially accounts for some of the excess entry phenomenon observed in empirical studies, suggesting that personality partially drives excess entry (in addition to the economical rationales, e.g., *liability of newness* (Stinchcombe, 1965) or *lottery ticket effect* (e.g., Camerer & Lovallo, 1999), discussed in SECTION II.2).

Besides the discussed personality dimensions that were in focus of the hypotheses, the complete information setting results indicated `emotionality` to positively affect market entry decisions (p=0.038) in addition to `openness-to-experience` as discussed above. However, the follow-up analysis of the entries in the complete information setting does not indicate `emotionality` to *irrationally* drive entry rates (p=0.370) – assuming Nash Equilibrium play in the post-entry period. The recorded effect could be a consequence of the aforementioned setting and distribution preconditions combined with chance[188]. In fact, the univariate follow-up analysis finds indicative support (just above the significance threshold) for this explanation[189].

Interestingly, the analysis of the stayout decisions indicated `conscientiousness` to positively affect the *NE-rational* stayout decisions (p=0.038), i.e., invigorating the decision to not enter the market in cases where it was rational to do so based on the preceding investment (and assuming Nash Equilibrium play in the post-entry period). It seems that within the general tendency of excess entry (as evidenced in empirical studies (e.g., Siegfried & Evans, 1994) and this experiment[190]), high scoring individuals on the *conscientiousness* dimension take the time to 'deliberate their decision carefully' as described by Lee and Ashton (2008).

In summary, the analysis results find support for both propositions concerned with action-seeking personality traits ***P5*** and ***P6***. In particular, these findings contrast the results reported by Bergstrom et al. (2016) in their restaurant-opening experiment, not finding any indication

[188] Specifically, higher scoring *emotionality* individuals being paired by chance with Incumbents, who invest more and, accordingly, legitimise entry from a *NE-rationality* point of view.

[189] The univariate analysis between the categorised Incumbent investment (above or below the encouragement threshold) and higher scoring Entrants on the *emotionality* dimension yielded a negative correlation (as hypothesised as a potential explanation) just above the 0.1 significance threshold ($\beta = -0.119$; p=0.103).

[190] Out of the 79 investments above the encouragement threshold, i.e., encouraging market entry, a striking 77.2 percent of the Entrants decided to enter the market nonetheless.

for an effect of any of the **Big five** personality traits. On the other hand, no support is found for proposition ***P4*** concerned with conflict-seeking personality traits and their effect on entry behaviour in the signalling setting. Most compelling are the findings in the complete information setting, identifying *openness-to-experience* as a driver for *NE-irrational* entry decisions, finding an additional driver for the excess entry phenomenon as well as support for the overarching research question, whether personality can get in the way of optimal market entry behaviour. TABLE 5.23 below summarises each of the propositions and their underlying hypotheses (predicting the effects of the nuisance and personality variables).

		SETTING	
Proposition	**Hypotheses Variables**	SIGNALLING	COMPLETE INFORMATION
P4: Conflict-Seeking Traits	Incumbent Investment	✓ ***	
	Personality Traits	✗	
	Overall	✗	
P5: Action-Seeking Traits	Incumbent Investment	✓ ***	
	Personality Traits	✓ ***	
	Overall	✓ ***	
P6: Action-Seeking Traits	Incumbent Investment		✗
	Personality Traits		✓*
	Overall		✓*

✓ *Proposition confirmed* ✗ *Proposition not confirmed*

Note: The personality trait related hypotheses are accounted for with greater weight.

Ö **, **, & *** correspond to significance levels of 10%, 5%, and 1%, respectively*

TABLE 5.23: Summary of Entrant propositions & findings

V. 3.4 Summary of Empirical Findings

Before moving on to the closing CHAPTER VI, which provides an overarching discussion of the findings, reflection against the background of hitherto published literature, and an overall conclusion, TABLE 5.24 summarises the empirical findings from the hypothesis tests described in this chapter as well as the developed propositions and underlying hypotheses.

In summary, the overarching proposition of personality dimensions affecting market entry behaviour (and potentially driving irrational behaviour) found support in various settings. More specifically, findings for personality affecting Incumbent behaviour yielded inconsistent results, suggesting that pre-entry investment behaviour is dependent on more than just strongly pronounced personality traits (in this case conflict-seeking personality traits). The analysis of entry decisions after the Incumbent investment, on the other hand, provided strong support

for the proposition on action-seeking personality traits to drive market entry. Most compelling are the findings that confirm that the entries in the complete information setting (partly driven by highly pronounced *openness-to-experience* scores) *openness-to-experience* accounts for the *NE-irrational* entries.

Domain	*Propositions* & Supporting Hypotheses		Assessment & Interpretation
Incumbent behaviour	***P1 Conflict-seeking personality traits hinder/reinforce Incumbents to select the best available strategy in the context of potential market entry.***		While this proposition finds empricial support for the hypotheses in the soft investment setting, no support is found in the tough investment setting. It seems that high aggression types do not want to close the door to a cooperative solution when the investment opportunity is of *tough* nature (and, thereby, not act upon it). However, when the investment opportunity is of cooperative (i.e., soft) nature, then it seems high aggression types tend to not invest in it (even in situations where it would be beneficial to do so).
	H1.1: Aggression & dominance endorse 'theory-deviating'[a] decisions when facing a ***tough*** investment opportunity and **allowing** market entry is the underlying objective.	✗ (not confirmed)	
	H1.2: Aggression & dominance endorse 'theory-deviating'[a] decisions when facing a ***soft*** investment opportunity and **allowing** market entry is the underlying objective.	✓ (confirmed)	
	H1.3: Aggression & dominance affirm 'theory-consistent'[a] decisions when facing a ***tough*** investment opportunity and **detering** market entry is the underlying objective.	✗ (not confirmed)	
	H1.4: Aggression & dominance affirm 'theory-consistent'[a] decisions when facing a ***soft*** investment opportunity and **detering** market entry is the underlying objective.	✓ (confirmed)	
	P2 Harmony-seeking personality traits hinder/reinforce Incumbents to select the best available strategy in the context of potential market entry.		This proposition did not find any support in the tough investment setting. For the soft investment and deter entry setting, significant results are found for the opposite effect of high agreeableness types. While it seems that high harmony-seeking dimenions do not affect investment behaviour as much, the non-cooperative behaviour in the soft investment and deter entry setting are striking. Along with previous research findings, it seems that high agreeablness acts upon cooperative moves only in situations where it would also be beneficial for themselves. This would not be the case in the deter entry setting.
	H2.1: Honesty-humility & agreeableness endorse 'theory-deviating'[a] decisions when facing a ***tough*** investment opportunity and **detering** market entry is the underlying objective.	✗ (not confirmed)	
	H2.2: Honesty-humility & agreeableness endorse 'theory-deviating'[a] decisions when facing a ***soft*** investment opportunity and **detering** market entry is the underlying objective.	ϟ (reversed)	
	H2.3: Honesty-humility & agreeableness affirm 'theory-consistent'[a] decisions when facing a ***tough*** investment opportunity and **allowing** market entry is the underlying objective.	✗ (not confirmed)	
	H2.4: Honesty-humility & agreeableness affirm 'theory-consistent'[a] decisions when facing a ***soft*** investment opportunity and **allowing** market entry is the underlying objective.	✗ (not confirmed)	
	P3 Strongly pronounced emotionality sub-traits impact the magnitude of the Incumbents' investment decisions in the context of potential market entry.		The amplified investment behaviour is partially confirmed for *dependence,* but no support is found for *fearfulness* in any of the settings.
	H3.1: Dependence reinforces 'theory-consistent'[a] investing behaviour when the decision maker is dependent on the opponent to enter the market (i.e., **allowing** market entry is the underlying objective).	(✓) (partially confirmed)	
	H3.2: Fearfulness amplifies 'theory-consistent'[a] investing behaviour as the decision maker fears standard behaviour might not be enough (to **allow** or **deter** market entry).	✗ (not confirmed)	
Entrant behaviour	***P4 Signalling setting: Beyond the Incumbent's signalling, conflict-seeking personality traits drive market entry positively when facing remaining uncertainty.***		No support is found for conflict-seeking traits to affect entry decisions in the signalling setting.
	H4.1: The opponent's signal (i.e., price in pre-entry period) impacts market entry decisions negatively.	✓ (confirmed)	
	H4.2: Aggression & dominance impact the market entry decision positively.	✗ (not confirmed)	
	[**H4.3:**] Honesty-humility & agreeableness have no impact on the entry decision.	[✓] (expected results confirmed)	
	P5 Signalling setting: Beyond the Incumbent's signalling, action-seeking personality traits drive market entry positively when facing remaining uncertainty.		Empirical results find strong support for action-seeking traits (namely, *extraversion*) to positively affect entry decisions in the signalling setting.
	H5.1: The opponent's signal (i.e., price in pre-entry period) impacts market entry decisions negatively.	✓ (confirmed)	
	H5.2: Openness-to-experience & extraversion impact the market entry decision positively.	✓ (confirmed)	
	[**H5.3:**] Honesty-humility & agreeableness have no impact on the entry decision.	[✓] (expected results confirmed)	
	P6 Complete information setting: Despite full awareness of the investment implications, action-seeking personality traits drive entry positively, potentially hindering them to select the best available strategy.		Strong support is found for action-seeking traits (namely, *openness-to-experience*) to positively affect market entry decisions in the complete information setting. Furthermore, out of the recorded entries, *openness-to-experience* seems to be a driver for the NE-*irrational*[b] entries.
	H6.1: The preceding investment (i.e., capacity shift) impacts market entry decisions positively.	✗ (not confirmed)	
	H6.2: Openness-to-experience & extraversion impact market entry decisions positively.	✓ (confirmed)	
	H6.3: <u>Entries</u>: Openness-to-experience & extraversion drive 'NE-irrational'[b] market entry decisions positively.	✓ (confirmed)	

a) Based on the market entry framework by Fudenberg & Tirole (1984)
b) Assuming Nash-Equilibrium play and profits in post-entry period

✓ Hypothesis confirmed ✗ Hypothesis not confirmed ϟ Hypothesis reversed
(✓) Hypothesis partially confirmed [✓] Expected results confirmed

TABLE 5.24: Overview of propositions & empirical results

VI CONCLUDING REMARKS

This chapter concludes this research investigation by first synthesising the results into a conclusion and summarising the associated implications, especially in the context of hitherto published literature (SECTION VI.1). Secondly, an assessment towards the objective of this research project is conducted, reviewing the research objectives and associated achievements (SECTION VI.2). Towards the end of the chapter, potential limitations and an outlook for future research are discussed (SECTION VI.3).

VI. 1 Conclusion & Implications

This section draws a conclusion of the empirical findings against the background of the identified research gap (described in SECTION II.4) and discusses the associated implications for research as well as companies facing applicable situations.

Incumbent Behaviour

While entry deterring and encouraging strategies have been thoroughly investigated and substantiated by *theoretical* research, *empirical* research yielded mixed results, not finding strong support for the underlying theoretical concepts (as Incumbent firms did not seem to leverage expected pre-entry behaviour strategies). Potential explanations for this discrepancy, including forward induction, have been experimentally tested but could not provide conclusive results. While experimental research of *individual differences* has not been pursued for the Incumbent's pre-entry behaviour, findings from typical economic games (e.g., the prisoner's dilemma) suggested promising insights about the discrepancy between theoretical and empirical results.

Overall, the empirical results support the proposition that some personality traits account for heterogeneity in observed Incumbent behaviour. Notwithstanding, the results indicated an inconsistency across the different situational settings, confirming previous findings that the effectiveness of personality is, in part, dependent on the context (Pothos et al., 2011). For the hypothesised effect of **conflict-seeking personality traits**, the empirical analysis provided strong support for *aggression* to affect pre-entry behaviour. Although the *unit cost signalling* setting (i.e., tough-appearing investment) did not indicate any significant effects, behaviour in the *capacity shifting* setting (i.e., soft-appearing investment) yields significant results for both the deter and allow entry objective settings (as subjects did not invest or underinvest in the

capacity shift, even though it would have been beneficial in the allow entry setting). Interestingly, the *'aggression-effect'* seems to amplify *framework-consistent* behaviour in the deter setting (as the Incumbent firms underinvest in soft-making investment to manifest a *lean-&-hungry look*). However, this effect drives a *framework-deviating* investment behaviour in the allow setting (as instead of overinvesting [to embody a non-competitive *fat-cat effect*], the applied underinvestment signals a competitive attitude via the *lean-&-hungry look*). Particularly, this may be a problem in situational settings where allowing market entry is sensible or inevitable (e.g., Fudenberg & Tirole, 1984; Ware, 1984). In these settings, the *aggression-effect* potentially causes less profitable or even negative outcomes for the Incumbent. Going forward, companies should be advised to understand who the key decisions maker(s) of the Incumbent company are in order to better anticipate potential Incumbent (re)actions. In the context of previously published literature, these findings yield a few intriguing insights. While personality was confirmed as a driver for certain pre-entry investment behaviour, the *aggression-effect* was found to drive framework-deviating behaviour (in the allow market entry setting), provides a partial explanation for the discrepancy between theoretical findings and empirical study results.

The hypothesised effect that **harmony-seeking personality** dimensions potentially have on pre-entry investment behaviour were not (consistently) confirmed by the empirical results. Although the analyses indicated agreeableness and honesty-humility to affect pre-entry behaviour, the results were not consistent enough to draw sound conclusions from these findings. However, the fact analyses yielded intermittent yet significant results confirms the conjecture that personality affects pre-entry behaviour, even if dependent the situational setting (as indicated by Pothos et al., 2011). Going forward, interesting research fields could include the drivers or situational attributes that account for the activation of these intermittent personality-effects.

While both hypothesised effects of harmony-seeking personality traits as well as emotionality sub-dimensions did not yield the anticipated consistency in their findings (propositions ***P2*** and ***P3***), the consistency of the recorded *aggression-effect* in face of a tough-making investment opportunity confirm the robustness of this findings (***P1***). Furthermore, the consistency suggests a more general applicability to Incumbent investment opportunities that make her appear less competitive in the post-entry stage (i.e., soft).

Entrant Behaviour

Early literature defined market entry (rates) as a function of the market's attractiveness (i.e., combination of factors as density, profitability, or competition), indicating that market entry is attracted to a certain point, beyond which it is accordingly repelled. Although experimental studies found an astonishing coordination between competitors to reach the hypothesised equilibrium (e.g., Kahneman, 1988), numerous empirical studies provide oppositional results of persistent excess entry (e.g., Siegfried & Evans, 1994).

In search for potential explanations for this excess entry phenomenon, a few economical rationales were hypothesised as, for example, the high return in case of – low probability – success (Grieco et al., 2007). However, it is unlikely that these economical explanations account for the entire excess entry phenomenon, i.e., the discrepancy between theoretical and empirical literature findings. Investigations of potential psychological explanations ultimately lead to the analysis of *overconfidence* as a credible driver of market entry. While further research indicated that entrepreneurs are not universally overconfident and '*excess entry is more complicated than simple overconfidence*' (Moore et al., 2007), it is interesting that efforts concerned with individual differences as defined by personality inventories were not pursued to date[191].

In general, the empirical results equally find support for the effect of personality dimensions on the market entry behaviour. This is particularly interesting, as the experimental study by Bergstrom et al. (2016) did not yield any significant results (for any of the Big Five personality dimensions). Although the underlying frameworks of both studies are not identical (HEXACO versus Big Five), the respective dimensions that yielded significant results in our study are congruent for both frameworks[192]. On the other hand, the non-linear consideration of personality effects on behaviour as well as the differing, more realistic[193], experimental design and setup potentially account for the discrepancy in empirical findings.

Similarly to the results for the Incumbent setting, it seems that the situational setting affects the effectiveness of the two **action-seeking personality dimensions** as initially indicated

[191] With the exception of the recently published restaurant-opening experimental study by Bergstrom et al. (2016), which did not find any significant support for the Big Five personality traits affecting entry decisions.

[192] In the Entrant behaviour analysis *extraversion*, *openness-to-experience*, and *conscientiousness* yielded significant results. These dimensions are represented in both the *HEXACO* and *Big Five* inventories. The HEXACO framework differs from the Big Five by adding *honesty-humility* as a sixth factor and slightly alternating the underlying factors for *agreeableness* and *emotionality* (*neuroticism*).

[193] The differences include sequential decision making instead of having the participants to choose a compressed strategy (from a payoff table) as well as the inclusion of a preceding Incumbent action.

by Pothos et al. (2011). In the signalling setting, *extraversion* positively affected decisions to enter the market beyond the effect of the preceding Incumbent signalling, which was potentially interpreted as not credible or with higher scepticism and overall driven by the dimension's pro-social tendency. The fact that this effect was not observed in the complete information setting, where room for interpretation is limited, confirms the synthesis from Chapter II, which noted extroverts to behave more rational than non-extroverts. Accordingly, pro-social and interactive behaviour is preferred, but not at any price.

In the complete information setting, on the other hand, openness-to-experience indicated to positively affect market entry decisions. This is particularly striking for the following two reasons. First, the preceding Incumbent investment (i.e., capacity shift), which in contrast did not yield any significant effect, is a binding commitment affecting the profit functions for the post-entry period, thus, not leaving any room for interpretation. Second, a follow-up investigation of the entries (partly driven by *openness-to-experience*) classified into *rational* and *irrational* entries, based on the crucial assumption that both firms would play in line with the Nash Equilibrium (NE) and the associated entry costs for the Entrants. The according analysis in fact confirmed that the entries that were partly driven by *openness-to-experience* were, in fact, *NE-irrational* market entries (and should have been stayout decisions). This provides support for the overarching thesis proposition of personality getting in the way of optimal market entry decisions as well as a potential explanation for the excess entry phenomenon. The latter, however, depends on actual personality profiles by the individuals entering the analysed markets. While my results confirm irrational entry behaviour (assuming NE play in the post-entry period), this is not necessarily linked to the excess entry phenomenon observed by the empirical studies. Notwithstanding, data analysis of this experiment did also record excess entry (from the point of view of expected profits and NE play), which was partly explained by *openness-to-experience*, indicating personality to be one of the explanations of excess entry.

While the underlying situational factors, which activate or unleash the effects on entry decisions, need to be better further investigated and better understood, this could have several crucial implications for real-life situations. For example, investors contemplating whether to invest in entering firms could analyse the personality profile of the key decision maker(s) and draw conclusions with regards to the credibility of the company's decision to enter the market. Alternatively, an Incumbent's assessment of the level of threat associated with the entering

firm might be re-evaluated against the background of the key decision-maker(s) personality profile(s), i.e., whether the entry decision is based on a real competitive advantage or not).

In summary, the hypothesised effect of conflict-seeking personality traits did not yield any significant results (proposition ***P4***). The anticipated behaviours for action-seeking dimensions, on the other hand, were confirmed by the empirical analyses (propositions ***P5*** and ***P6***). The consistency of the action-seeking related effects suggests a more general applicability to market entry behaviour.

VI. 2 Assessment of Thesis Objective

The objective of this thesis was to contribute content-wise to prior research by shedding light on potential explanations on the discrepancies between observed market entry behaviour and underlying theory (for both, the Incumbent as well as the Entrant firm). While the more specific propositions and hypotheses were summarised in SUB-SECTION V.3.4 and SECTION VI.1 synthesised the findings and their potential implications, this section briefly assesses the achievement of the thesis' objective – on a higher level – along the guiding research questions from SECTION I.2.

While the findings concerning the utilisation of entry deterring and encouraging strategies were partly inconsistent with predicted behaviours by underlying theory (thereby, confirming theory-deviating behaviour as observed by empirical studies and laying the ground to identify potential discrepancy drivers), the analyses confirmed personality dimensions to affect market entry behaviour. This is a striking finding, as prior research did not focus on personality dimensions as potential drivers for theory-deviating behaviours.

For the pre-entry behaviour, *aggression* indicated to affect Incumbent behaviour significantly in the soft-making investment setting. The inconsistency of the results in the Incumbent analysis (no significant results in the tough-making setting) does, however, suggest that strongly pronounced personality dimensions are one factor among others. The analysis of entry decisions yields more significant results, indicating in both settings (*signalling* and *complete information*) that action-seeking dimensions are significant predictors for entry decisions. This is particularly interesting, as prior research investigating personality dimensions for entry decisions did not yield any significant findings (Bergstrom et al., 2016), potentially due to the fact that the previous study analysed a linear relationship. More strikingly, the follow-up analysis of recorded entries in the complete information setting provided evidence for

openness-to-experience driving irrational entries (when assuming NE play in the post-entry period).

In summary, the content-related objective of this thesis was achieved as it provided further insights towards drivers of market entry behaviour. Admittedly, the inconsistency of results (especially in the Incumbent setting) suggests that other factors beyond personality dimensions drive market entry behaviour. In contrast, the consistent results for the Entrant analysis further undermines the role of personality in economic decision making, providing strong support for action-seeking personality traits driving market entry decisions.

VI. 3 Limitations & Outlook

This thesis entails some potential limitations – some of which are typical for experimental research studies while others are more specifically tied to this research project. Below, I introduce the potential limitations along with a discussion of outlook for future research efforts. After describing the limiting factors of internal and external validity[194], a broader reflection of the current research design and outlook for this research field closes this thesis.

The **internal validity** of this research project depends on a few factors, of which the most relevant ones are discussed in the following paragraphs. These include (i) inferred causality between personality and observed behaviour, (ii) assessment methodology for personality, (iii) the operationalization of the market entry settings, and (iv) the applied statistical modelling.

First, I discuss the concept of (i) inferring **causality** between two variables due to a proven correlation, which is a common topic in experimental economics. In other words, while finding a correlation between two or more variables might be suggestive, it does not necessarily imply that one is causing the other (Wooldridge, 2015). The experiment has been purposely designed to minimise doubts of a cause-and-effect relationship between identified relationships. Generally, the criteria that must be met include *a) covariation of the cause and effect*, *b) temporal precedence*, and *c) no plausible alternative explanations* (Trochim, 2006). While the statistical thoroughness in the empirical analysis covered the covariation aspect (a), the

[194] While *internal validity* "refers to the ability to draw confident causal conclusions from one's research", *external validity* "refers to the ability to generalize from the research context to the settings that the research is intended to approximate" (Loewenstein, 1999).

sequential design of the personality assessment and market entry games[195] addressed the temporal criterion (b). Ruling out (as far as possible) any potential alternative explanation (c), often referred to as the *confounding* or *missing variable*, for identified relationships requires to apply the notion of *ceteris paribus* in the experiment design as well as statistically controlling for other relevant factors (Wooldridge, 2015). While both of these levers have been applied to the thesis' methodology[196], a residual possibility of alternative factors remains and can rarely be fully excluded (especially in behavioural studies). While this study examines the statistical effect of the selected personality dimensions, these only reflect a representation (i.e., approximation) of the actual underlying personality profile. Accordingly, the strongly pronounced personality dimensions, which yielded significant relationships in the empirical analyses, should be regarded as reliable predictors for market entry behaviour, not its causes. The statistically sound findings for these predictive powers, however, strongly suggests a causal relationship between the underlying personality profiles and recorded behaviours.

Second, it is worthwhile to mention the (ii) method of assessing personality. As discussed in SECTION II.5, this experimental study applied the self-report method to assess the respective personality scores. The fact that the scores for each dimensions are calculated based on self-reported indications entails a potential distortion of the scores due to self-serving biases. While this risk of distorted results cannot be fully eliminated, the utilisation of widely accepted and statistically sound assessment inventories limited this risk as much as possible[197].

Third, the (iii) operationalization of the experiment might be subject to critique. Specifically, a) the conceptualisation of the soft and tough investment settings was pursued based on the examples described in the underlying paper by Fudenberg and Tirole (1984), not on existing experimental games or settings. Notwithstanding, the market entry settings have been developed in proximity of the underlying theoretical model with particular focus on preserving all relevant dynamics of the model. Furthermore, the conceptualisation of the models has been necessary to refine certain aspects of existing designs[198]. On a further note, b) the

[195] The personality assessment was conducted at the very beginning of the experiment to minimise potential distortions of the results due to the experiment experience.

[196] All participants were confronted with identical information sets and decisions to make. Potential influencing factors beyond the experimental design were accounted for in the form of statistical control variables (e.g., gender, education level, age, education field, or economic knowledge).

[197] On a further note, several (widely accepted) publications in this research field equally relied on thoroughly pre-developed personality inventories (e.g., Brandstätter & Königstein, 2001; Hirsh & Peterson, 2009).

[198] Specifically, the drastic complexity reduction of previous market entry games was undesirable for this experimental study.

introduction of different Incumbent objectives represents a novel aspect in the field of experimental market entry research. The endogenous nature of the Incumbent's objective has been modelled through the implementation of an exogenous compensation constraint, which induced the desired objective for each setting. In my view, manipulating the profit function of the Incumbent represented the only effective approach to induce this endogenous objective.

Fourth, the (iv) statistical modelling should be pointed out as a potential limitation of this research study, as linear relationships are modelled between the predictor variables and the dependent variable[199]. As the study by Ben-Ner and Kramer (2011) indicated non-linear effects of personality dimensions on behaviour, I transformed the collected personality scores into dichotomous variables to differentiate between strongly pronounced personality scores for a specific dimension (i.e., value of 1 for scores in the top quartile) and the remainder. For both settings, I conducted transformations of the dependent variables to rule out this potential non-linear relationship[200]. On a further note, the number of predictor variables involved in the empirical analysis, especially for the sub-trait analysis, induces the risk of accidental results and/or overfitting (Gujarati, 2011). Careful interpretation of results (i.e., focus on hypothesised observations based on existing literature findings) as well as application of cautious analysis approaches and robustness tests ensured to limit the associated risks as much as possible.

The **external validity** of this thesis might be subject to critique due to its experimental (i.e., laboratory) nature. Experimental research is naturally subject to critical assessment of its external validity[201], as experiments model real-world settings with a significantly reduced complexity (simultaneously this being their main advantage, as focus variables can be isolated). The following paragraphs, focus on particularly relevant aspects of this thesis, namely, (i) the experimental situation and (ii) the participant pool.

First, the (i) *experimental situation* itself might be subject to critique regarding the study's external validity. Specifically, the laboratory environment significantly reduces the complexity of situations that are, in fact, very complex due to the number of stakeholders (direct and

[199] For the logistic regression, a linear relationship is modelled between the independent variable and the log values of success (i.e., dependent variable equal to 1).

[200] The DVs for both settings have been transformed using a log-function. Additionally, the respective functions defining the relationship of the investment magnitude with the alternative decision unit (ie.e., the price in the tough setting and shifted capacity in the soft setting) have been modelled as well.

[201] For a broader discussion please refer to Davis & Holt (1993).

indirect), range of strategic choices, or other external factors. Notwithstanding, experimental research in economics always faces a conflict between reduction of complexity to distinctly isolate variables in the focus of the research (*reduction*) and the realistic modelling and reflection of real-world settings (*mapping*). SECTIONS IV.1 and IV.2 thoroughly documented the weighting of the different aspects and – in line with existing literature on experimental research – carefully defined the applied market models.

Second, it is noteworthy to discuss the (ii) *participant pool* of this experimental study, since the majority of participants represented students[202]. Experiments conducted with (potentially inexperienced) student subjects drew criticism with respect to the external validity of the results, as students represent a narrow and special segment of the population (Enis et al., 1972; Friedman & Sunder, 1994). However, several studies pointed out that the usefulness of student subjects depends on the context of the study (e.g., Enis et al., 1972) and that professionals can even bear problems in an experimental study[203]. The focus should, therefore, lie on student subjects being acceptable proxies for decision makers in market entry situations, i.e., managers or entrepreneurs.

While no studies – to the best of our knowledge – compare student behaviour in laboratory market entry experiments with managers or equivalent decision makers, overall research showed that results are insensitive to the choice of subject pool for most markets and economic institutions (Cassar & Friedman, 2004; Croson, 2005; Davis & Holt, 1993; Exadaktylos et al., 2013; Fehr & List, 2004; Phillips & Mason, 1992). Accordingly, several widely accepted experimental research efforts on market entry behaviour relied on student subjects[204]. With respect to entrepreneurs, Moore et al. (2007) find, for example, no difference between founders and non-founders when it comes to their decision to enter a market or not, ultimately, displaying excess entry[205].

On a further note, the difference between individual decisions and decisions taken by groups (as usually the case in real-life setting) potentially affects the external validity of this study. On the one hand, this is a more general limitation, not only applicable for experimental

[202] Of the 194 participants, 89 percent represented students (i.e., participants in their Bachelor or Master studies).

[203] For example, Burns (1985) compared results of professional and student wool buyers, finding that students were far more adept at maximising profits, as the aspect of quality (which the professionals focussed on) has not been included in the study.

[204] For example, Brandts & Holt (1992), Brandts et al. (2007) or Mason & Nowell (1998).

[205] Both, founders and non-founders, seemed to focus more on their own abilities than the abilities of the competition, as previously suggested by several other research efforts.

research as micro-economical models usually tend to assume firms to be singular decision-making units (Phillips & Mason, 1992). On the other hand, the context of the examined decisions for both the Incumbent and Entrant suggests a higher share of individual decision-makers. That is, Incumbent reactions to entry represent a strategic action, typically taken by a main decision maker (as seen in the initial Polaroid-Kodak case in SECTION I.1). Equally, this rationale is valid for market entry moves for established firms (e.g., to enter into a new geo-graphical market), whereas decisions in entrepreneurial contexts tend to be made by a single decision maker as well.

In summary, minimal limitations concerning the external validity have to be acknowledged for this thesis. However, given previous research findings as well as the context of the decisions that this thesis analyses, these limitations are not as decisive as they might be for experimental studies in different contexts. Future research efforts could investigate the validity of these findings through an investigation using a subject pool of professionals.

Overall, in spite of the potential limitation to external or internal validity, we trust to have contributed to the existing research and knowledge in the complex field of market entry research, as personality helped to understand additional drivers behind observed behaviour, especially theory-deviating behaviour. Further research efforts should try to validate the generality of these findings with a different subject sample as well as alternative market entry settings but equal underlying market and investment dynamics.

Closing this thesis, I would like to briefly comment on the more **universal outlook** for this research field, especially in the context of the identified findings and recent technological developments. While previous research efforts already proved the predictive power of personality in popular economic situations, this thesis found strong support for a similar relationship in the context of market entry situations – for both the Incumbent as well as the Entrant firms. This is especially noteworthy, as not only hundreds of thousands of markets exist, but also new markets emerge with the development of new technologies, and market entry is omnipresent[206]. On the other side, personality framing used to be very time-consuming and predominantly limited to experimental contexts. The digital age provides nearly unlimited access to this type of information and, potentially, information going beyond personality

[206] As evidenced by Porter (1979) and empirical findings on excess entry.

dimensions with higher predictive power. The emergence of analytical software and increased analytical performance (in short often referred to as *big data*[207]) not only magnified the reach and relevance of existing findings on the predictive power of personality, but also unleashed new dimensions of personality research. The latter refers to the fact that collection of information is no longer limited to complexity-reducing personality frameworks as the Big Five or HEXACO concepts, but personality, preferences, and individual differences in general can be identified on a drastically more granular level due to the availability of data in social media and the computational potential. As initially introduced, the impressive accuracy of the model by Kosinski et al. (2013) or the effectiveness of applications of this model by companies like Cambridge Analytica illustrate the significance of the associated implications of this study. In addition, they also bear an exciting outlook for future research in this field, as personality profiles could be extracted from existing data bases (thereby reducing potential limitations of internal validity) and focus on other aspects of market entry situations, which contribute to recorded behaviour as well as the affectability of certain personality dimensions.

[207] *Big data* refers to "Computing (also with capital initials) data of a very large size, typically to the extent that its manipulation and management present significant logistical challenges; (also) the branch of computing involving such data" (Oxford English Dictionary, 2013).

APPENDIX

A1 Characterisation of Chosen Personality Dimensions

AGGRESSION[208]	Typical behaviour involves forcefully overcoming, attacking or controlling opponents, taking revenge, punishing or injuring them. Individuals scoring high on this scale are being easily provoked, while more likely to provoke themselves as well. They also embody a propensity to violent behaviour.
DOMINANCE[209] (ASSERTIVENESS)	Typical behaviour includes the urge to control, influence or direct another individual's environment. This may involve forceful, dominant, persuasive, assertive, sometimes aggressive, stubborn, bossy/authoritative behaviour. Individuals scoring low on this scale are described as cooperative, humble, submissive, accommodating, easily led, conflict-avoidant, or obedient.
HONESTY-HUMILITY[210]	Similarly to agreeableness, this factor is associated with interpersonal behaviour. High scorers are described as sincere, trusting, honest, faithful/loyal, modest unassuming, fair-minded. Low scorers are typically sly, greedy, pretentious, hypocritical, boastful, sceptical and/or pompous.
EMOTIONALITY[210]	Individuals with high scores on this dimensions are typically characterised as emotional, oversensitive, empathetically concerned, sentimental, anxious, fearful, emotionally attached and/or vulnerable. Low-scorers are described as being brave, tough, independent, emotionally detached from others, self-assured, and/or stable.
EXTRAVERSION[211]	Individuals are typically known to prefer social interaction, be outgoing, lively, extraverted, sociable, talkative, cheerful, and/or active. Contrarily, introverted individuals are described as shy, passive, withdrawn, quite, and/or reserved.
AGREEABLENESS[212]	Characterised as the factor most concerned with interpersonal behaviour expressing a pro-social orientation towards the group. Individuals are described as cooperative, patient, tolerant, likable, peaceful, helpful, lenient, generous, and/or agreeable. Contrarily, low scorers are ill-tempered, stubborn, choleric, and/or quarrelsome. Absence of agreeableness is associated with a lack of concern for others.
CONSCIENTIOUSNESS[210]	High scorers are described as organised, disciplined, diligent, careful, thorough, and/or precise. Low scorers are typically sloppy, negligent, reckless, lazy, irresponsible, and/or absent-minded.

[208] As described by Murray (1938) and Buss & Perry (1992).

[209] As described by Catell (1973, 1957).

[210] As described by Ashton & Lee (2007) and Ashton & Lee (2005).

[211] As described by Ashton & Lee (2007) and Moberg (2001).

[212] As described by Ashton & Lee (2007), Graziano & Eisenberg (1997), Barrick & Mount (1991), and Moberg (2001).

Openness-to-Experience[210]	High scorers are described as intellectual, creative, unconventional, ironic, innovative. They typically have a high willingness to experience novelty. Contrarily, low scorers are typically shallow, unimaginative, and/or conventional and tend to emphasise riles, order and conformity. They also exhibit a difficulty to understand others' views.

Characterisations of Sub-Dimensions

Sub-Dimensions of Aggression[213]:

Physical Aggression	Known as easily provoked, not opposed to hit a person (back), hot headed with physical discharge, threatening others, and/or destroying things out of fury.
Verbal Aggression	Typically telling others what they think, often disagreeing with people, straightforward, and/or argumentative.
Anger	Characterised as flaring up quickly, but getting over it quickly, letting irritation show when frustrated, hot headed, or having trouble to control their temper.
Hostility	Described as sometimes eaten up by jealousy, thinking have gotten a raw deal out of life, suspicious of overly friendly strangers, or feeling bitter about things.

Sub-Dimensions of Honesty-Humility[214]:

Sincerity	Characterised as genuine in interpersonal relations and unwilling to manipulate others. Low scorers flatter others or pretend to like them to obtain favours.
Fairness	Describes the tendency to avoid fraud and corruption, unwillingness to gain by cheating, stealing, or taking advantage of other individuals or society.
Greed Avoidance	Assesses the tendency to be uninterested in possessing lavish wealth, luxury goods, and signs of high social status. Typically not motivated by monetary considerations. Low scorers want to enjoy and to display wealth and privilege.
Modesty	Described as modest, unassuming, and viewing themselves as ordinary people without any claim to special treatment (versus being entitled to privileges).

Sub-Dimensions of Emotionality[214]:

Fearfulness	Assesses the tendency to experience fear, an inclination to avoid harm, and feel fear of physical pain.
Anxiety	Described as feeling worry and stressed in a variety of contexts, even by relatively small problems.
Dependence	Characterised as being in need for emotional support from others, wanting to share their difficulties with those who will provide encouragement and comfort. Low scorers feel self-assured and able to deal with problems without any help.
Sentimentality	Known to feel strong bonds with others, feeling emotional when saying good-bye and having an empathetic sensitivity to other's feelings.

[213] As described by Buss and Perry (1992).

[214] As described by Lee and Ashton (2008).

Sub-Dimensions of EXTRAVERSION[215]:

Social Self-Esteem	Described as having positive self-regard (particularly in social contexts), being satisfied with themselves and consider themselves to have likable qualities.
Social Boldness	Assesses one's comfort or confidence within a variety of social situations, willingness to approach strangers, and willingness to speak up within a group.
Sociability	Characterises the tendency to enjoy conversation, social interaction, and parties, whereas low scorers generally prefer solitary activities.
Liveliness	Typically known for their enthusiasm and energy. They usually experience a sense of optimism and high spirits.

Sub-Dimensions of AGREEABLENESS[215]:

Forgiveness	Assesses one's willingness to feel trust and liking toward those who may have caused one harm. Do not "hold a grudge" against those who have offended them.
Gentleness	Describes tendency to be mild and lenient in dealings with other people and are reluctant to judge others harshly.
Flexibility	Characterised as having a willingness to compromise and cooperate with others, avoiding arguments, and accommodate others' suggestions, even when these may be unreasonable.
Patience	Typically known as modest, unassuming, and viewing themselves as ordinary people without tendency to remain calm rather than to become angry.

Sub-Dimensions of CONSCIENTIOUSNESS[215]:

Organization	Characterised as seeking order, particularly in one's physical surroundings, keeping things tidy, and preferring a structured approach to tasks.
Diligence	Describes the tendency to work hard, have high self-discipline, a strong "work ethic", and are willing to exert themselves.
Perfectionism	Assesses the tendency to be thorough and concerned with details, not tolerating some errors in their work, and checking carefully for mistakes & improvements.
Prudence	Described as deliberating carefully, considering their options thoroughly, and tending to be cautious and self-controlled.

Sub-Dimensions of OPENNESS-TO-EXPERIENCE[215]:

Aesthetic Appreciation	Characterised as enjoying the beauty in art and in nature, having a strong appreciation of various art forms and of natural wonders.
Inquisitiveness	Describes the tendency to seek information about, and experience with, the natural and human world, read widely and are interested in travel.
Creativity	Assess one's preference for innovation and experiment. They actively seek new solutions to problems and express themselves in art.
Unconventionality	Described as accepting the unusual, being receptive to ideas that might seem strange or radical, and prefer out eccentric persons.

[215] As described by Lee and Ashton (2008).

A2 Details on Implementation of Experiment

A2.1 Invitation Email Text for Experiment Sessions

Subject: Spieltheoretisches Experiment am IBU

"Hallo <firstname> <lastname>,

anbei laden wir Sie zu einem Experiment am IBU (*Institut für Unternehmensführung, Geb. 05.20 Raum 2A im 2. OG; Kaiserstr. 89, 76133 Karslruhe*) ein.

Es werden Teilnehmer für folgende Termine gesucht:

<list of sessions [date, start time]>

Sie können sic hunter folgendem Link anmelden: <link to website>

Die Sessions dauern ca. 75 Minuten. Die durchschnittliche Auszahlung wird ca. 12,00 € betragen. Bitte erscheinen Sie pünktlich zu Ihrer Session.

Wir freuen uns auf Ihre Teilnahme,

Ihre Experimentleitung"

A2.2 Part 1: Personality Testing

A2.2.1 Instruction Handouts for Participants

ANLEITUNG I

Auf den folgenden Seiten finden Sie eine Liste mit Aussagen, die mehr oder weniger auf Sie zutreffen können. Es gibt **keine** richtigen oder falschen Antworten. Bitte geben Sie an, wie sehr Sie den einzelnen Aussagen zustimmen oder sie ablehnen.

Bitte Antworten Sie auf jede Aussage, auch wenn Sie sich Ihrer Antwort nicht ganz sicher sind.

Legen Sie den ausgefüllten Fragebogen rechts von Ihnen hin, sobald Sie alle Aussagen beantwortet haben, und warten bis das Experiment weitergeht.

A2.2.2 Personality Questionnaire

#	Aussage	Trifft nicht zu	Trifft eher nicht zu	Neutral	Trifft eher zu	Trifft zu
1	Der Besuch einer Kunstausstellung würde mich ziemlich langweilen.	O	O	O	O	O
2	Ich plane im Voraus und organisiere, damit in letzter Minute kein Zeitdruck aufkommt.	O	O	O	O	O
3	Ich habe selten Wut im Bauch, nicht mal gegen Leute, die mich sehr ungerecht behandelt haben.	O	O	O	O	O
4	Im Allgemeinen bin ich mit mir ziemlich zufrieden.	O	O	O	O	O
5	Ich hätte Angst, wenn ich bei schlechten Wetterbedingungen verreisen müsste.	O	O	O	O	O
6	Ich würde keine Schmeicheleien benutzen, um eine Gehaltserhöhung zu bekommen oder befördert zu werden, auch wenn ich wüsste, dass es erfolgreich wäre.	O	O	O	O	O
7	Ich nehme Dinge selbst in die Hand.	O	O	O	O	O
8	Ich bin daran interessiert, etwas über die Geschichte und Politik anderer Länder zu lernen.	O	O	O	O	O
9	Ich treibe mich oft selbst sehr stark an, wenn ich versuche, ein Ziel zu erreichen.	O	O	O	O	O
10	Andere sagen mir manchmal, dass ich zu kritisch gegenüber anderen bin.	O	O	O	O	O
11	Bei Gruppentreffen sage ich nur selten meine Meinung.	O	O	O	O	O
12	Ich kann manchmal nichts dagegen machen, dass ich mir über kleine Dinge Sorgen mache.	O	O	O	O	O
13	Wenn ich wüsste, dass ich niemals erwischt werde, wäre ich bereit, eine Million zu stehlen.	O	O	O	O	O
14	Ich übernehme die Führung.	O	O	O	O	O
15	Ich würde es genießen, ein Kunstwerk zu schaffen, etwa einen Roman, ein Lied oder ein Gemälde.	O	O	O	O	O
16	Wenn ich an irgendetwas arbeite, beachte ich kleine Details nicht allzu sehr.	O	O	O	O	O
17	Andere sagen mir manchmal, dass ich zu dickköpfig bin.	O	O	O	O	O
18	Ich ziehe Berufe, in denen man sich aktiv mit anderen Menschen auseinandersetzt solchen vor, in denen man alleine arbeitet.	O	O	O	O	O
19	Wenn ich wegen einer schmerzvollen Erfahrung leide, brauche ich jemanden, der mich tröstet.	O	O	O	O	O
20	Viel Geld zu haben ist nicht besonders wichtig für mich.	O	O	O	O	O
21	Ich überlasse die Entscheidungen anderen.	O	O	O	O	O
22	Ich denke, dass es Zeitverschwendung ist, radikalen Ideen Aufmerksamkeit zu schenken.	O	O	O	O	O
23	Ich treffe Entscheidungen eher aus dem Bauch heraus als durch sorgfältiges Nachdenken.	O	O	O	O	O
24	Andere halten mich für jähzornig.	O	O	O	O	O
25	An den meisten Tagen bin ich fröhlich und optimistisch.	O	O	O	O	O
26	Ich könnte weinen, wenn ich andere Personen sehe, die weinen.	O	O	O	O	O
27	Ich denke, dass ich mehr Respekt verdiene als ein durchschnittlicher Mensch.	O	O	O	O	O
28	Ich warte darauf, dass andere die Richtung vorgeben.	O	O	O	O	O
29	Wenn ich die Gelegenheit dazu hätte, würde ich gerne ein Konzert mit klassischer Musik besuchen.	O	O	O	O	O
30	Wenn ich arbeite, habe ich manchmal Schwierigkeiten, weil ich unorganisiert bin.	O	O	O	O	O
31	Meine Einstellung gegenüber Personen, die mich schlecht behandelt haben, ist "vergeben und vergessen".	O	O	O	O	O
32	Ich bin der Meinung, dass ich nicht beliebt bin.	O	O	O	O	O
33	Wenn es um körperliche Gefahren geht, bin ich sehr ängstlich.	O	O	O	O	O
34	Wenn ich von jemandem etwas will, lache ich auch noch über dessen schlechteste Witze.	O	O	O	O	O

bitte wenden...

#	Aussage	Trifft nicht zu	Trifft eher nicht zu	Neutral	Trifft eher zu	Trifft zu
35	Ich will die Verantwortung tragen.	O	O	O	O	O
36	Ich habe es noch nie wirklich gemocht, eine Enzyklopädie durchzublättern.	O	O	O	O	O
37	Ich arbeite nur so viel wie nötig, um gerade so durchzukommen.	O	O	O	O	O
38	Ich neige dazu, nachsichtig zu sein, wenn ich andere beurteile.	O	O	O	O	O
39	In sozialen Situationen bin ich gewöhnlich der, der den ersten Schritt macht.	O	O	O	O	O
40	Ich mache mir viel weniger Sorgen als die meisten Leute.	O	O	O	O	O
41	Ich würde niemals Bestechungsgeld annehmen, auch wenn es sehr viel wäre.	O	O	O	O	O
42	Ich stelle Dinge nie infrage.	O	O	O	O	O
43	Man hat mir schon oft gesagt, dass ich eine gute Vorstellungskraft habe.	O	O	O	O	O
44	Ich versuche immer, fehlerfrei zu arbeiten, auch wenn es Zeit kostet.	O	O	O	O	O
45	Ich bin gewöhnlich ziemlich flexibel in meinen Ansichten, wenn andere Leute mir nicht zustimmen.	O	O	O	O	O
46	Das erste, was ich an einem neuen Ort tue, ist, Freundschaften zu schließen.	O	O	O	O	O
47	Ich kann mit schwierigen Situationen umgehen, ohne dass ich emotionale Unterstützung von irgendjemandem brauche.	O	O	O	O	O
48	Es würde mir viel Freude bereiten, teure Luxusgüter zu besitzen.	O	O	O	O	O
49	Ich lasse mich herumkommandieren.	O	O	O	O	O
50	Ich mag Leute, die unkonventionelle Ideen haben.	O	O	O	O	O
51	Ich mache viele Fehler, weil ich nicht nachdenke, bevor ich handele.	O	O	O	O	O
52	Die meisten Leute werden schneller ärgerlich als ich.	O	O	O	O	O
53	Die meisten Leute sind aufgedrehter und dynamischer als ich es im Allgemeinen bin.	O	O	O	O	O
54	Ich fühle starke Emotionen, wenn jemand, der mir nahe steht, für eine längere Zeit weggeht.	O	O	O	O	O
55	Ich will, dass alle wissen, dass ich eine wichtige angesehene Person bin.	O	O	O	O	O
56	Ich sage, was ich denke.	O	O	O	O	O
57	Ich halte mich nicht für einen künstlerischen oder kreativen Menschen.	O	O	O	O	O
58	Andere nennen mich oft einen Perfektionisten.	O	O	O	O	O
59	Selbst wenn Leute viele Fehler machen, sage ich nur selten etwas Negatives.	O	O	O	O	O
60	Manchmal habe ich den Eindruck, dass ich wertlos bin.	O	O	O	O	O
61	Selbst in einem Notfall würde ich nicht in Panik geraten.	O	O	O	O	O
62	Ich würde nicht vortäuschen, jemanden zu mögen, nur um diese Person dazu zu bringen, mir Gefälligkeiten zu erweisen.	O	O	O	O	O
63	Ich habe keine Angst Kritik zu äußern.	O	O	O	O	O
64	Ich finde es langweilig, über Philosophie zu diskutieren.	O	O	O	O	O
65	Ich ziehe es vor, das zu tun, was mir gerade in den Sinn kommt, anstatt an einem Plan festzuhalten.	O	O	O	O	O
66	Wenn mir andere sagen, dass ich falsch liege, ist meine erste Reaktion, mit ihnen zu streiten.	O	O	O	O	O
67	Wenn ich in einer Gruppe von Leuten bin, bin ich oft derjenige, der im Namen der Gruppe spricht.	O	O	O	O	O
68	Ich bleibe emotionslos, selbst in Situationen, in denen die meisten Leute sehr sentimental werden.	O	O	O	O	O
69	Ich würde in die Versuchung geraten, Falschgeld zu benutzen, wenn ich sicher sein könnte, damit durchzukommen.	O	O	O	O	O
70	Ich kann drastische Maßnahmen ergreifen.	O	O	O	O	O

#	Aussage	Extrem Uncharak-teristisch	Uncharak-teristisch	Eher Uncharak-teristisch	Eher Charak-teristisch	Charak-teristisch	Extrem Charak-teristisch
71	Es passiert oft, dass ich mit Leuten nicht einverstanden bin.	O	O	O	O	O	O
72	Manchmal habe ich das Gefühl, dass ich ungerecht behandelt werde.	O	O	O	O	O	O
73	Ich habe Leuten, die ich kenne, gedroht.	O	O	O	O	O	O
74	Ich frage mich, warum ich manchmal so verbittert bin.	O	O	O	O	O	O
75	Ich habe Schwierigkeiten, mein Temperament zu kontrollieren.	O	O	O	O	O	O
76	Meine Freunde sagen ich sei streitlustig.	O	O	O	O	O	O
77	Ich bin schnell aufbrausend, beruhige mich aber anschließend schnell wieder.	O	O	O	O	O	O
78	Bei ausreichender Provokation könnte ich jemanden schlagen.	O	O	O	O	O	O
79	Ich kann es nicht lassen mich in Auseinandersetzungen zu verwickeln, wenn Leute nicht meiner Meinung sind.	O	O	O	O	O	O
80	Andere scheinen es immer einfacher im Leben zu haben.	O	O	O	O	O	O
81	Es gibt Leute, die mich so weit gebracht haben, dass wir physisch aneinandergeraten sind.	O	O	O	O	O	O
82	Manchmal fahre ich ohne guten Grund aus der Haut.	O	O	O	O	O	O

Abcshließend, bitten wir Sie im Folgenden um einige Angaben zu Ihrer Person.

Geschlecht (bitte umkreisen): Weiblich Männlich

Alter: _____ Jahre

A2.3 Part 2: Market Entry Game Instructions

A2.3.1 Instruction Handouts for Participants Part 2

ANLEITUNG II

HERZLICH WILLKOMMEN ZUM ZWEITEN TEIL DES EXPERIMENTS. BITTE LESEN SIE DIE ERKLÄRUNGEN AUFMERKSAM DURCH. ZU BEGINN WERDEN DIESE VOM EXPERIMENTLEITER NOCH EINMAL VERLESEN. DANACH KÖNNEN SIE KLÄRENDE FRAGEN STELLEN, BEVOR DAS EXPERIMENT BEGINNT.

GENERELLES:

Das Experiment findet an den zur Verfügung gestellten Computern statt. Auf den Computern darf die Experiment-Software sowie die bereits geöffnete Excel-Datei verwendet werden *(zwischen der Software und Excel wechseln Sie, indem Sie die **Alt-Taste** und **Tabulatortaste** [⇆] drücken).*

Des Weiteren stehen Ihnen Tabellen zu den jeweiligen Spielen als Hilfe zur Seite. Bitte verwenden Sie keine Stifte, Papier oder anderes Material im Verlauf des Experiments.

Jegliche Form von Kommunikation mit anderen Teilnehmern und/oder externen Personen ist während des gesamten Experimentablaufs nicht erlaubt.

Schalten Sie Ihre Handys/Smartphones – sofern noch nicht getan – bitte aus.

BITTE BEACHTEN SIE DIE REGELN – SONST WERDEN SIE VOM EXPERIMENT AUSGESCHLOSSEN.

VERGÜTUNG:

Im folgenden Teil des Experiments können Sie durch Entscheidungen Punkte gewinnen, die am Ende in Bargeld umgerechnet und am Ende ausgezahlt werden *(Wechselkurs: 45 Punkte = 1.00 EUR)*. Dazu werden 3,00 € *Show-Up Fee* addiert, die Sie fürs reine Erscheinen bekommen.

Die Höhe der finalen Auszahlung bzw. Punkte ist abhängig von Ihren Entscheidungen, sowie den Entscheidungen Ihrer entsprechenden Gegenspieler. Die Auszahlung des Bargelds wird am Ende des Experiments stattfinden – bitte warten Sie nach Abschluss des Experiments an Ihrem Platz, bis der Experimentleiter Ihre Platznummer aufruft.

Eine vollständige Rückgabe dieser Materialien ist Voraussetzung für die Auszahlung (nehmen Sie bitte alle Unterlagen, die an Ihrem Platz liegen mit).

Der maximale Auszahlungsbetrag ist auf 25,- EUR limitiert.

DAS EXPERIMENT:

Im folgenden Teil des Experiments werden Sie jeweils **MARKT-EINTRITTS-SPIELE** gegen andere Teilnehmer spielen. Jedes Markt-Eintritts-Spiel wird zwischen 2 Teilnehmern gespielt (wobei jeder jeweils eine Rolle zufällig zugewiesen bekommt):

1) dem ***Monopolisten***, die Firma die als einzige zur Zeit im Markt tätig ist; und
2) dem ***Eintretenden*** (auch: *Entrant*), die Firma die in den Markt eintreten kann.

Jedes Markt-Eintritts-Spiel (auch: „*MES*") **besteht aus 2 Perioden**: Periode 1, in der nur der *Monopolist* im Markt aktiv ist und vom *Entrant* beobachtet wird, und Periode 2, in der entweder nur der *Monopolist* oder beide, Monopolist und *Entrant*, im Markt aktiv sind.
Zwischen Periode 1 und Periode 2 trifft der *Entrant* die Eintritts-Entscheidung.

Periode 1 → *Eintritts-Entsch.* → Periode 2

Sie bekommen am Anfang **eine Rolle** (*Monopolist* oder *Entrant*) zugeteilt, **die sich während des gesamten Experiments nicht ändert.**

Es werden insgesamt **5 MES** gespielt – **1 Probespiel** (das keinerlei Auswirkungen auf Ihre Punkte/Vergütung hat) **und 4 wirksame Spiele** (bzw.: MES #1, MES #2, MES #3 und MES #4).

Vor jedem MES werden die Teilnehmer neu miteinander gepaart, **sodass Sie in keinem der 4 wirksamen Spiele gegen einen anderen Teilnehmer mehr als 1-mal spielen.**

In den MES werden Sie, als *Monopolist* oder *Entrant*, jeweils Preise setzen.

MARKT-SITUATIONEN:

1) NUR DER MONOPOLIST IST IM MARKT

Die Nachfrage „Q" errechnet sich basierend auf dem Preis „P" (z.B.: Q = 6 – P).

Der jeweilige Profit errechnet sich basierend auf dem Preis und der Nachfrage (also: Profit = Q * P) und ggf. den Stückkosten (falls vorhanden: Profit = Q * [P – c])

➔ *Entsprechend dem genannten Beispiel würde beim Preis von P = 2.50 die Nachfrage Q = 6 – 2.50 also Q = 3.5 und der Profit = Q * P also Profit = 3.5 * 2.5 = 8.75*

Auf der rechten Seite ist entsprechend dem Beispiel eine Hilfs-Tabelle mit der Profitberechnung abgebildet.

Q = 6 - 1*p

Preis Sp. A		Preis Spieler B: n/a	
	0	0.00	0
	0.5	2.75	0
	1	5.00	0
	1.5	6.75	0
	2	8.00	0
	2.5	8.75	0
	3	9.00	0
	3.5	8.75	0
	4	8.00	0

DIE BEILIEGENDEN HILFS-TABELLEN STELLEN JEWEILS DEN PROFIT BEI EINEM ENTSPRECHEND GESETZTEN PREIS DAR.

2) MONOPOLIST & ENTRANT SIND IM MARKT

Sind beide im Markt, ist die Nachfrage (und der Profit) **abhängig von der Art der jeweils angeboten Produkte**:

1) **Homogene Produkte** – *unterscheiden sich nicht voneinander*; der Preis ist für den Kunden das Hauptmerkmal (Beispiele: **Benzin, Mehl, Strom**). Heißt konkret: der Anbieter mit dem niedrigeren Preis bekommt die ganze Nachfrage. Bei gleichem Preis, jeder Anbieter jeweils die Hälfte.

Nachfrage:

Q = 6 - 1*p		Preis Spieler B		
		0.5	1.0	1.5
Preis Spieler A	0.5	2.75 2.75	0 5.5	0 5.5
	1	5.5 0	2.5 2.5	0 5.0
	1.5	5.5 0	5.0 0	2.25 2.25

Profit:

Q = 6 - 1*p		Preis Spieler B		
		0.5	1.0	1.5
Preis Spieler A	0.5	1.38 1.38	0 2.75	0 2.75
	1	2.75 0	2.5 2.5	0 5.0
	1.5	2.75 0	5.0 0	3.38 3.38

2) **Differenzierte Produkte** – *unterscheiden sich voneinander;* der Preis spielt zwar eine Rolle, aber eine nebensächliche (Beispiel: **Coca-Cola & Pepsi**). Heißt konkret: je höher der eigene Preis desto geringer die eigene Nachfrage, während die Nachfrage des Gegners dadurch ansteigt (ein Teil der Kunden entscheidet sich für das Produkt des Gegners)

Profit:

$Q = 6 - p_A + p_B$		Preis Spieler B		
		1.0	2.0	3.0
Preis Spieler A	1.0	6.0 6.0	10.0 7.0	12.0 8.0
	2.0	7.0 10.0	12.0 12.0	15.0 14.0
	3.0	8.0 12.0	14.0 15.0	18.0 18.0

3) STÜCKKOSTEN:

Wie zuvor erwähnt kann es auch Stückkosten (bzw. variable Kosten) geben. In dem Fall berechnet sich der Profit wie oben genannt:
Profit = Q * [P – c], wobei ‚c' die Stückkosten repräsentiert.

Anbei finden Sie ein Beispiel für eine Hilfs-Tabelle, die – abhängig von den Stückkosten und dem gesetzten Preis – den Profit berechnet.

D = 10 - 1 * p

Profit (gegeben Preis & Stückkosten)

	c=	1.0	2.0	3.0
Preis	1	0.00	-9.00	-18.00
	2	8.00	0.00	-8.00
	3	14.00	7.00	0.00

SPIELABLAUF:

Jedes Markt-Eintritts-Spiel wird aus 3 Phasen bestehen:

1) **Periode 1**, in der nur der Monopolist im Markt ist und vom Entrant beobachtet wird (*hierbei kann die beobachtete Aktion des Monopolisten die Preissetzung oder aber ein Investment, dass der Monopolist tätigt, sein)*
2) **Eintritts-Entscheidung**, in der der Entrant die Entscheidung trifft in den Markt einzutreten oder nicht
3) **Periode 2 (optional),** die je nach Entscheidung des Entrants und/oder Art des Spiels stattfinden kann.

Sie werden während der Phasen auf dem Bildschirm alle notwendigen Informationen erhalten.

Am Ende jedes MES (meist Periode 2) wird der Profit für das aktuelle Spiel eingeblendet. Die Gewinne aus den 4 Markt-Eintritts-Spielen ergeben am Ende Ihren Gewinn. Negative Ergebnisse pro MES werden zwar angezeigt, werden aber am Ende nicht negativ angerechnet (als 0 gezählt).

- Jegliche Investments, die Sie während eines MES tätigen werden Ihnen für dieses MES negativ angerechnet (ggf. mit dem Budget für das MES verrechnet)

Zeit:

Es gibt zeitliche Vorgaben, die oben am Bildschirmrand eingeblendet werden. Die Software wird jedoch nicht ohne Ihre Eingabe fortfahren. Dies ist lediglich ein Richtwert.

ENDE DES EXPERIMENTS:

Nachdem das letzte MES abgeschlossen ist und die finalen Gewinne eingeblendet wurden, endet der spieltheoretische Teil des Experiments.

Im Anschluss werden Sie einen Fragebogen mit demographischen und Verständnis-Fragen beantworten. Diese Antworten haben keinerlei Auswirkung auf Ihre Vergütung.

BITTE WARTEN SIE AM ENDE DES EXPERIMENTS BIS DER EXPERIMENTLEITER SIE BEIM NAMEN ODER DER PLATZNUMMER AUFRUFT

Sollten Sie während des Experiments Fragen haben, heben Sie bitte die Hand und sagen kurz „Frage". (Haben Sie jedoch Verständnis dafür, dass ggf. zu diesem Zeitpunkt bestimmte Fragen nicht mehr beantwortet werden können.

A2.3.4 Profit-Tables

Soft Investment Setting (i.e., Complete Information Setting)

Hilfs-Tabellen für Markt-Eintritts-Spiele #1 und #3

Markt: Deutschland

Q = 25 - 7.5*P(eigen) + 7.5*P(gegenspieler)

Beide Spieler im Markt / Profit (100%)	Preis Entrant 2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10
Preis Monopolist 2.0	50 50	52 65	40 80	12 95	0 100	0 100	0 100	0 100	0 100
3.0	65 52	75 75	70 97	50 120	15 142	0 150	0 150	0 150	0 150
4.0	80 40	97 70	100 100	87 130	60 160	17 190	0 200	0 200	0 200
5.0	95 12	120 50	130 87	125 125	105 162	70 200	20 237	0 250	0 250
6.0	100 0	142 15	160 60	162 105	150 150	122 195	80 240	22 285	0 300
7.0	100 0	150 0	190 17	200 70	195 122	175 175	140 227	90 280	25 332
8.0	100 0	150 0	200 0	237 20	240 80	227 140	200 200	157 260	100 320
9.0	100 0	150 0	200 0	250 0	285 22	280 90	260 157	225 225	175 292
10	0 100	0 150	0 200	0 250	0 300	25 332	100 320	175 292	250 250

Markt: Deutschland

Q = 75 - 7.5*p

Nur Mono-list im Markt / Profit (100%)	Preis Entrant n/a
Preis Monopolist 2.0	0 120
3.0	0 158
4.0	0 180
5.0	0 188
6.0	0 180
7.0	0 158
8.0	0 120
9.0	0 68
10	0 0

Markt: Frankreich

Q = 50 - 2.5*p

Nur Mono-list im Markt / Profit (100%)	Preis Entrant n/a
Preis Monopolist 2.0	0 90
3.0	0 128
4.0	0 160
5.0	0 188
6.0	0 210
7.0	0 228
8.0	0 240
9.0	0 248
10	0 250

DIE PROFIT-HILFSTABELLEN STELLEN JEWEILS DEN PROFIT FÜR DIE VOLLE KAPAZITÄT (VON 100%) DAR.
Sollte ein Teil der Kapazität verlagert werde (z.B. 50%), muss der Profit entsprechend veringert werden (z.B. x0.5)

Logistik-Investition:

Kosten = 200*x^2

Kapazität -> FR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Kosten (Punkte)	*0*	*2*	*8*	*18*	*32*	*50*	*72*	*98*	*128*	*162*	*200*

-> würden in Frankreich vertrieben, der Rest weiterhin in Deutschland

Tough Investment Setting (i.e., Signalling Setting)

Hilfs-Tabellen für Markt-Eintritts-Spiele #2 und #4

Homogene Produkte (z.B. Strom, Mehl, ...)

Q = 500 - 100 * p

Profit (gegeben Preis & Stückkosten 'c')

	c=	2.0	2.5	3.0	3.5	4.0
Preis	2.5	125	0	-125	-250	-375
	2.75	169	56	-56	-169	-281
	3	200	100	0	-100	-200
	3.25	219	131	44	-44	-131
	3.5	225	150	75	0	-75
	3.75	219	156	94	31	-31
	4	200	150	100	50	0
	4.25	169	131	94	56	19
	4.5	125	100	75	50	25
	4.75	69	56	44	31	19
	5	0	0	0	0	0

Nachfrage (beide Firmen im Markt)

$$Q_X = \begin{cases} P_A > P_Y: & 0 \\ P_A = P_Y: & 0.5 \times [\,500 - 100*p\,] \\ P_A < P_Y: & 500 - 100*p \end{cases}$$

dargestellt Nachfrage für Firma 'X', wobei Firma 'Y' der Gegenspieler ist

Konkret: Die Firma mit dem niedrigeren Preis bekommt alle Kunden, die Firma mit dem höheren Preis geht leer aus.

Bei gleichem Preis teilen sich die Kunden 50-50.

DIE STÜCKKOSTEN DES GEGENSPIELERS SIND JEWEILS UNBEKANNT - LEDIGLICH DIE SPANNE [2.00 - 4.00]

DIE PROFIT-HILFSTABELLE STELLT DEN PROFIT NUR FÜR EINE AUSWAHL VON KOSTEN DAR (2.0, 2.5, 3.0, 3.5, 4.0)

Im Profit-Kalkulator kann eine genaue Berechnung gemacht werden. ***Sie müssen jedoch eine Annahme zum Preis Ihres Gegenspielers machen.***

A2.3.5 Profit Calculator

Soft Investment Setting (i.e., Complete Information Setting)

Deutschland (beide im Markt) — befüllen

Ergebnis entspricht 100% Kapazität

Nachfrage: $Q^{100\%} = 25 - 7.5*p_1 + 7.5*p_2$

P1 =	6.00	*Werte zwischen 0.00 und 9.00*		
P2 =	5.00	*Werte zwischen 0.00 und 9.00*		
$Q1^{100\%}$ =	17.50	$P1^{100\%}$ =	105.00	
$Q2^{100\%}$ =	32.50	$P2^{100\%}$ =	162.50	

Deutschland (nur Monopolist) — befüllen

Ergebnis entspricht 100% Kapazität

Nachfrage: $Q^{100\%} = 75 - 7.5*p$

P1 =	4.00	*Werte zwischen 0.00 und 9.00*		
$Q1^{100\%}$ =	45.00	$P1^{100\%}$ =	180.00	

Frankreich — befüllen

Ergebnis entspricht 100% Kapazität

Nachfrage: $Q^{100\%} = 50 - 2.5*p$

P1 =	6.00	*Werte zwischen 0.00 und 9.00*		
$Q1^{100\%}$ =	35.00	$P1^{100\%}$ =	210.00	

Tough Investment Setting (i.e., Signalling Setting)

Nur Monopolist im Markt

befüllen

Nachfrage: $Q = 500 - 100*p$

c_1 =	3.33	= [2.00 ; 4.00]
P_1 =	4.00	= [0.00 ; 5.00]
Q_1 =	100.00	
$Profit_1$ =	67.00	

Beide im Markt:

befüllen

Nachfrage: Q_A =

- pA > pB : **0**
- pA = pB : **(500 - 100*p)/2**
- pA < pB : **500 - 100*p**

c_1 =	3.12	= [2.00 ; 4.00]		
P_1 =	3.00	= [0.00 ; 5.00]		
c_2 =	3.00	= [2.00 ; 4.00]		
P_2 =	4.00	= [0.00 ; 5.00]		
Q_1 =	200.0		$Profit_1$ =	-24.0
Q_2 =	0.0		$Profit_2$ =	0.0

A2.4 Part 3: Demographic & Comprehension Questionnaire

Fragen zur statistischen Kontrolle

Geben Sie zum Abgleich bitte Ihre Platz-Nummer an:
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8

I Demographische Fragen:

Geschlecht:
- ◯ Männlich
- ◯ Weiblich

Alter:

Aktueller Bildungsstand (höchster Abschluss):
- ◯ Postdoktorales Studium
- ◯ Promotion/PhD Studium
- ◯ Master/Diplom
- ◯ Bachelor/Vordiplom
- ◯ Kaufmännische Ausbildung
- ◯ Abitur/Hochschulreife
- ◯ Andere

Fachrichtung:
- ◯ Wirtschaftswissenschaften
- ◯ Ingenieurswissenschaften
- ◯ Naturwissenschaften
- ◯ Geisteswissenschaften
- ◯ Andere

II Bisherige Exeriment-Erfahrung:

An wie vielen Laborexperimenten haben Sie bisher tielgenommen?
- ◯ Keine
- ◯ 1-2
- ◯ 3-5
- ◯ 6-9
- ◯ >9

Wie viele der Experimente bestanden aus spieltheoretischen Verhandlungen und/oder Entscheidungsproblemem?
- ◯ Keine
- ◯ 1-2
- ◯ 3-5
- ◯ 6-9
- ◯ >9

Wie viele der Experimente waren von psychologischer Natur?
- ◯ Keine
- ◯ 1-2
- ◯ 3-5
- ◯ 6-9
- ◯ >9

III Kenntnisse im Bereich der Spieltheorie:

Wie würden Sie Ihre Psychologie-Kenntnisse einschätzen?
- ◯ Keine
- ◯ Wenige
- ◯ Basis
- ◯ Gut
- ◯ Sehr Gut

Wie würden Sie Ihre volkswirtschaftlichen Kenntnisse (konkret: Marktmodelle, Berechnung von Angebot/Nachfrage, Preissetzung) einschätzen?
- ◯ Keine
- ◯ Wenige
- ◯ Basis
- ◯ Gut
- ◯ Sehr Gut

Wie würden Sie Ihre Kenntnisse im Bereich Spieltheorie (konkret: Optimale Reaktionen, Nash-Gleichgewichte, Ultimatum Spiel, Gefangenen Dilemma) einschätzen?
- ◯ Keine
- ◯ Wenige
- ◯ Basis
- ◯ Gut
- ◯ Sehr Gut

Wie haben Sie sich Ihre Kenntnisse im Bereich Spieltheorie (konkret: Optimale Reaktionen, Nash-Gleichgewichte, Ultimatum Spiel, Gefangenen Dilemma) angeeignet?
- ◯ Keine Kenntnisse
- ◯ Privat angeeignete Grundkenntnisse
- ◯ Privat angeeignete fortgeschrittene Kenntnisse
- ◯ Im Rahmen des Studiums/Ausbildung erlangte Grundkenntnisse
- ◯ Im Rahmen des Studiums/Ausbildung erlangte fortgeschrittene Kenntnisse
- ◯ Schwerpunkt während meines Studiums/Ausbildung

IV Ablauf des Experiments:

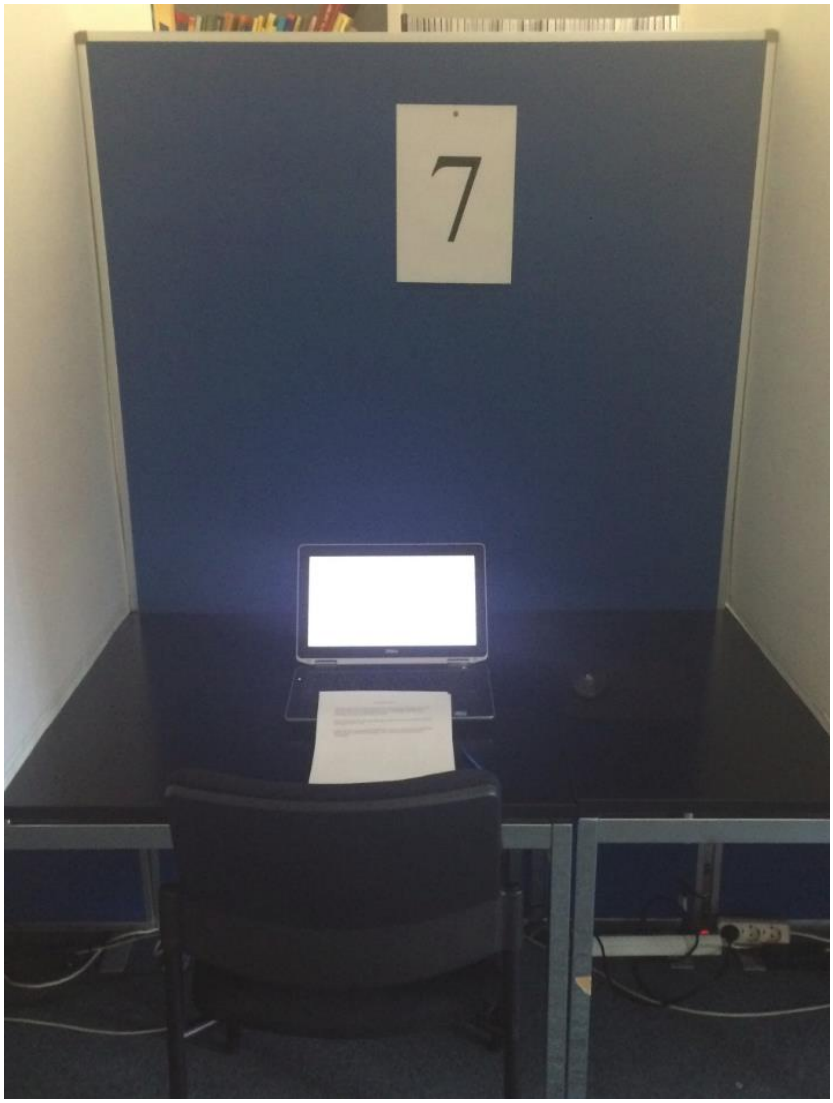
Was war Ihre grundsätzliche Zielsetzung während des Experiments?
- ◯ Maximierung meiner eigenen Punktezahl/Auszahlung
- ◯ Maximierung der Gesamtpunktzahl/-auszahlung beider Spieler
- ◯ Minimierung der Punktezahl meiner Gegenspieler
- ◯ Andere

Welche Materialien haben Sie während Ihrer Entscheidungen verwendet (alle zutreffenden ankreuzen)?
- ☐ Erläuterungs-Handout
- ☐ Profit-Hilfstabellen
- ☐ Excel-Profit-Kalkulator
- ☐ Keine

Aus den vier Experimentphasen, wie oft haben Sie den Profit-Kalkulator verwendet?
- ◯ Keiner
- ◯ In Einer
- ◯ In Zwei
- ◯ In Drei
- ◯ In Vier

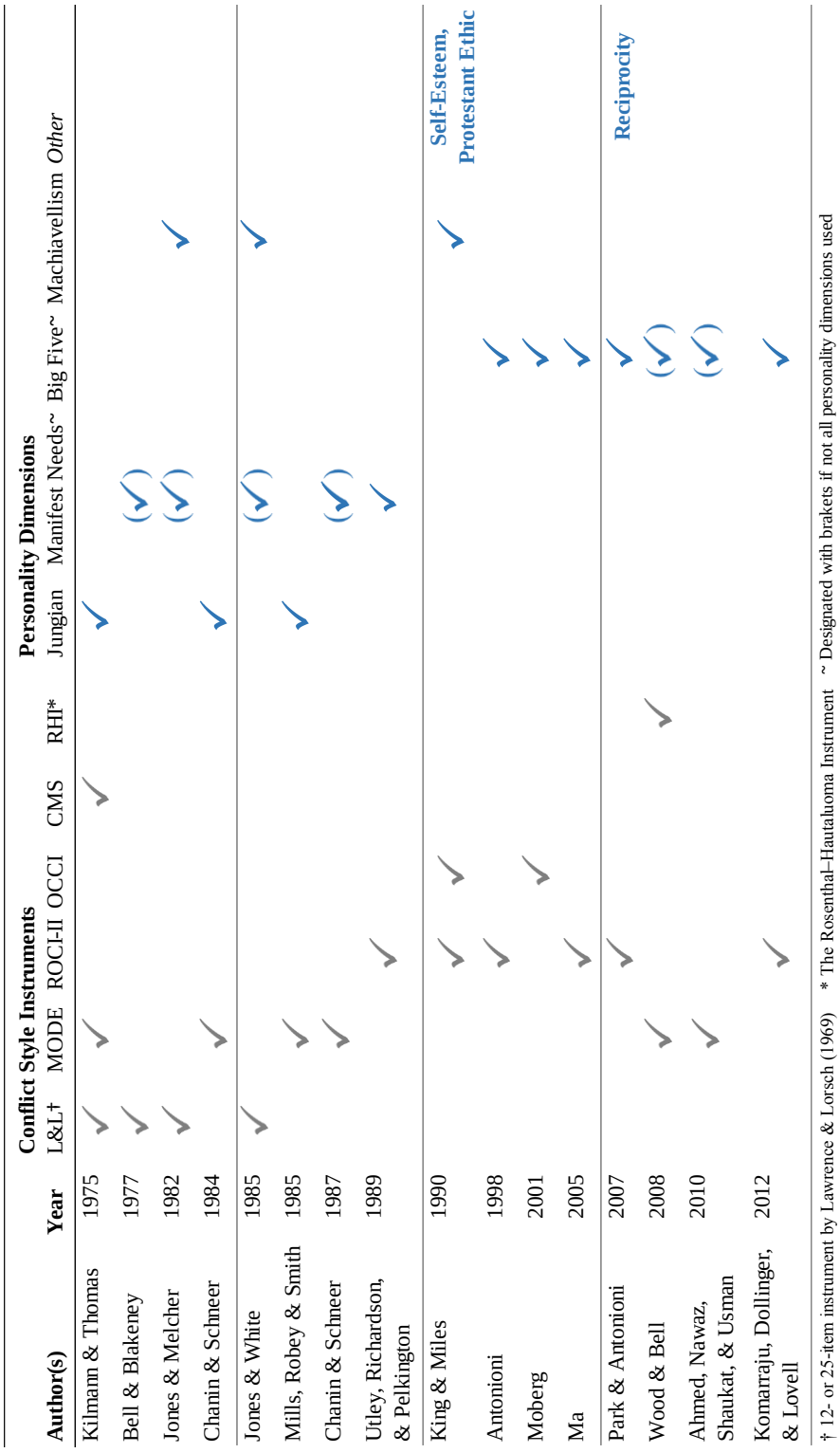
Wie war Ihre Erfahrung in diesem Experiment (alle zuteffenden ankreuzen)?
- ☐ Ich habe den Ablauf des Experiments auch nach der Erklärung nicht verstanden.
- ☐ Ich habe ein oder zwei Spiele im Experiment nicht verstanden
- ☐ Ich habe die mir verfügbaren Eingabemöglichkeiten in den Experimentphasen/-spielen und/oder Konsequenzen meiner Entscheidung nicht verstanden
- ☐ Ich hatte Schwierigkeiten mit der Bedienung der Experiment Platform
- ☐ Ich habe mindestens einmal wegen Schwierigkeiten mit der Bedienung eine ungewollte Auswahl getroffen.
- ☐ Ich habe mich mindestens einmal bei der Entscheidung in meiner Rolle geirrt
- ☐ Ich stand während des gesamten Experiments unter Zeitdruck
- ☐ Ich hatte Spaß am Experiment
- ☐ Keine der Angaben

A2.5 Laboratory Experiment Setup



A3 Supporting Documentation – Literature Review

A3.1 Linking Conflict Styles to Personality



Author(s)	Year	Conflict Style Instruments					Personality Dimensions				
		L&L†	MODE	ROCI-II	OCCI	CMS	RHI*	Jungian	Manifest Needs~	Big Five~	Machiavellism	*Other*
Kilmann & Thomas	1975	✓	✓			✓		✓				
Bell & Blakeney	1977	✓							(✓)			
Jones & Melcher	1982	✓							(✓)		✓	
Chanin & Schneer	1984		✓					✓				
Jones & White	1985	✓							(✓)		✓	
Mills, Robey & Smith	1985		✓					✓				
Chanin & Schneer	1987		✓						(✓)			
Utley, Richardson, & Pelkington	1989			✓					✓			
King & Miles	1990			✓	✓						✓	**Self-Esteem, Protestant Ethic**
Antonioni	1998			✓						✓		
Moberg	2001				✓					✓		
Ma	2005			✓						✓		
Park & Antonioni	2007			✓						✓		**Reciprocity**
Wood & Bell	2008		✓				✓			(✓)		
Ahmed, Nawaz, Shaukat, & Usman	2010		✓							(✓)		
Komarraju, Dollinger, & Lovell	2012			✓						✓		

† 12- or 25-item instrument by Lawrence & Lorsch (1969) * The Rosenthal–Hautaluoma Instrument ~ Designated with brakets if not all personality dimensions used

FIGURE A3.1: Extensive overview of literature linking personality variables to conflict styles

Figure A3.2: Overview of correlation results between *Manifest Needs* and selected conflict styles

	Bell & Blakeney (1977)		**Jones & Melcher** (1982)		**Jones & White** (1985)		**Chanin & Schneer** (1987)		**Utley et al.** (1989)	
Personality Variable	*Forcing (A)*	*Smoothing (B)*	*Forcing (A)*	*Smoothing (B)*	*Forcing (A)*	*Smoothing (B)*	*Competing (A)*	*Accommodating (B)*	*Dominating (A)*	*Obliging (B)*
Affiliation		0.12	- 0.14*	0.22**	- 0.19**	0.23***	- 0.24***	0.19***	0.05	0.14
Aggression	0.29**		0.10		- 0.00	- 0.40***			0.40***	- 0.11
Dominance	0.01		0.24				0.37***	- 0.19***	0.36***	0.08
Nurturance			0.23**						- 0.13	0.01
Succorance			0.34***						- 0.18**	0.04
Autonomy									0.11	- 0.03
Defendence									0.25**	- 0.20***
Achievement									- 0.04	0.13
Abasement									- 0.16**	0.06
Change									- 0.01	0.06
Cognitive Structure									0.01	- 0.00
Endurance									- 0.04	0.16**
Exhibition									0.16**	0.06
Harm Avoidance									- 0.23***	- 0.11
Impulsivity									0.15	0.03
Order									- 0.02	0.15
Play									0.10	- 0.07
Sentience									0.19**	0.02
Social Recognition									0.09	0.20***
Understanding									0.29***	- 0.16**
Infrequency									0.03	0.06
Desirability									0.02	- 0.01
Sample Size	*N = 49*		*N = 89*		*N = 114*		*N = 212*		*N = 153*	
Conflict Instrument	*L&L*		*L&L*		*L&L*		*MODE*		*ROCI-II*	
Personality Instrument	*EPPS* ~		*EPPS* ~		*EPPS* ~		*MNQ* ¯		*PRF* †	

Note: Order of variables by utilisation frequency ~Edwards Personal Preference Schedule (Edwards, 1959) ¯Manifest Needs Questionnaire (Steers & Braunstein, 1976) †Personality Research Form (Jackson, 1967)

** p < 0.1* *** p < 0.05* **** p < 0.01*

Literature	Big Five Personality Dimensions: Extraversion	Openness-to-Exp.	Conscientiousness	Agreeableness	Neuroticism	Background Information
Antonioni (1998)						*N = 351*
Dominating (A)	0.13**	0.11	- 0.11	- 0.41***	- 0.04	*ROCI-II*
Obliging (B)	0.10	- 0.02	- 0.04	0.34***	0.16***	*NEO-FFI*
Moberg (2001)						*N = 249*
Controling (A)	0.06	- 0.02	- 0.07	- 0.45***	0.02	*OCCI*
n/a						*NEO-PI-R*
Ma (2005)						*N = 138*
Competing (A)	0.34***	0.24***	0.06	- 0.09	- 0.09	*ROCI-II*
Accommodating (B)	- 0.09	- 0.07	0.07	0.05	- 0.03	*IPIP ~*
Park & Antonioni (2007)						*N = 256*
Competing (A)	0.09	- 0.03	- 0.06	- 0.19***	0.08	*ROCI-II*
Accommodating (B)	- 0.06	0.07	0.07	0.14**	- 0.02	*9 bi polar..?*
Wood & Bell (2008)						*N = 288*
Competing (A)	0.39***			- 0.39***		*RHI †*
Accommodating (B)	- 0.38***			0.43***		*IPIP ~*
Komarraju et al. (2012)						*N = 621*
Dominating (A)	0.18***	0.05	0.14***	- 0.40***	0.02	*ROCI-II*
Obliging (B)	0.11***	0.01	- 0.06	0.23***	0.16***	*NEO-PI-R*

$* p < 0.1$ $** p < 0.05$ $*** p < 0.01$ ~International Personality Inventory (Goldberg, 1999) † The Rosenthal–Hautaluoma Instrument

FIGURE A3.3: Overview of correlation results between the *Big Five* and selected conflict styles

A4 Supporting Documentation – Empirical Analysis

A4.1 Descriptive Analysis

	Dimensions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	**Aggression**															
(2)	Physical Aggression	0.74														
(3)	Verbal Aggression	0.73	0.43													
(4)	Anger	0.76	0.36	0.45												
(5)	Hostility	0.66	0.28	0.37	0.47											
(6)	**Assertiveness**	-0.09	-0.04	0.06	-0.09	-0.31										
(7)	**Honesty-Humility**	-0.35	-0.34	-0.29	-0.17	-0.20	-0.06									
(8)	Sincerity	-0.24	-0.28	-0.24	-0.08	-0.10	0.03	0.74								
(9)	Fairness	-0.22	-0.24	-0.16	-0.03	-0.15	-0.02	0.70	0.33							
(10)	Greed Avoidence	-0.22	-0.17	-0.18	-0.19	-0.14	-0.12	0.58	0.31	0.16						
(11)	Modesty	-0.27	-0.20	-0.20	-0.19	-0.16	-0.11	0.55	0.29	0.12	0.28					
(12)	**Emotionality**	0.15	-0.04	0.03	0.28	0.27	-0.31	0.06	-0.03	0.19	-0.01	0.02				
(13)	Fearfulness	0.11	-0.07	-0.01	0.22	0.21	-0.32	0.03	0.01	0.07	0.01	-0.02	0.66			
(14)	Anxiety	0.26	0.03	0.19	0.30	0.34	-0.18	-0.12	-0.17	0.06	-0.10	-0.12	0.67	0.29		
(15)	Dependence	0.03	-0.11	0.00	0.12	0.14	-0.23	0.17	0.09	0.26	0.03	0.08	0.72	0.38	0.33	
(16)	Sentimentality	0.02	-0.03	-0.10	0.12	0.11	-0.16	0.11	0.01	0.18	0.05	0.07	0.76	0.26	0.34	0.47
(17)	**Extraversion**	-0.23	-0.10	-0.14	-0.13	-0.43	0.47	0.04	-0.01	0.19	0.02	-0.14	-0.17	-0.24	-0.20	-0.07
(18)	Social Self-Esteem	-0.30	-0.12	-0.18	-0.22	-0.46	0.42	0.05	0.05	0.08	-0.01	-0.03	-0.15	-0.22	-0.22	-0.01
(19)	Social Boldness	-0.03	0.03	0.04	0.00	-0.25	0.55	-0.11	-0.05	0.07	-0.12	-0.25	-0.18	-0.19	-0.10	-0.14
(20)	Sociability	-0.12	-0.11	-0.13	-0.03	-0.15	0.11	0.00	-0.10	0.20	0.04	-0.17	0.07	-0.06	0.03	0.09
(21)	Liveliness	-0.21	-0.16	-0.13	-0.09	-0.32	0.27	0.13	0.05	0.15	0.13	-0.01	-0.18	-0.19	-0.23	-0.10
(22)	**Agreeableness**	-0.52	-0.31	-0.46	-0.47	-0.25	-0.28	0.38	0.23	0.19	0.33	0.27	-0.03	-0.07	-0.09	0.00
(23)	Forgiveness	-0.32	-0.21	-0.25	-0.29	-0.22	-0.09	0.34	0.24	0.25	0.23	0.13	-0.16	-0.18	-0.20	-0.10
(24)	Gentleness	-0.36	-0.21	-0.33	-0.33	-0.12	-0.36	0.27	0.15	0.14	0.24	0.23	0.06	0.01	-0.02	0.01
(25)	Flexibility	-0.27	-0.13	-0.38	-0.17	-0.11	-0.29	0.26	0.15	0.12	0.24	0.18	0.13	0.09	0.12	0.11
(26)	Patience	-0.58	-0.36	-0.36	-0.63	-0.31	-0.05	0.22	0.16	0.03	0.21	0.25	-0.17	-0.16	-0.20	-0.08
(27)	**Conscientiousness**	-0.15	-0.17	-0.09	-0.03	-0.10	0.34	0.13	0.05	0.26	-0.10	0.05	0.19	0.03	0.17	0.23
(28)	Organisation	-0.08	-0.02	-0.08	-0.01	-0.14	0.21	0.02	0.02	0.14	-0.10	-0.06	0.13	0.07	0.10	0.19
(29)	Diligence	-0.08	-0.10	-0.07	0.05	-0.10	0.34	0.12	0.03	0.27	-0.05	0.01	0.15	0.04	0.14	0.14
(30)	Perfectionism	-0.09	-0.17	-0.06	0.03	0.03	0.25	0.15	0.13	0.19	-0.08	0.11	0.17	-0.02	0.17	0.14
(31)	Prudence	-0.17	-0.19	-0.04	-0.11	-0.10	0.20	0.09	-0.01	0.18	-0.05	0.07	0.14	0.06	0.14	0.21
(32)	**Openness-to-Experience**	-0.11	-0.19	-0.04	-0.12	-0.04	0.16	0.20	0.20	0.10	0.20	0.01	-0.08	-0.09	-0.07	-0.06
(33)	Aesthetic Appreciation	0.00	-0.08	0.03	0.02	0.07	0.06	0.12	0.11	0.16	0.07	-0.09	0.00	-0.13	-0.02	0.01
(34)	Inquisitiveness	-0.11	-0.10	0.02	-0.10	-0.17	0.24	0.08	0.09	0.00	0.15	0.02	-0.16	-0.17	-0.09	-0.10
(35)	Creativity	-0.11	-0.09	-0.08	-0.16	-0.01	0.01	0.17	0.22	0.08	0.12	0.01	0.03	0.02	0.03	-0.02
(36)	Unconventionality	-0.06	-0.15	0.02	-0.05	-0.03	0.19	0.15	0.13	0.04	0.13	0.09	-0.13	-0.05	-0.10	-0.09

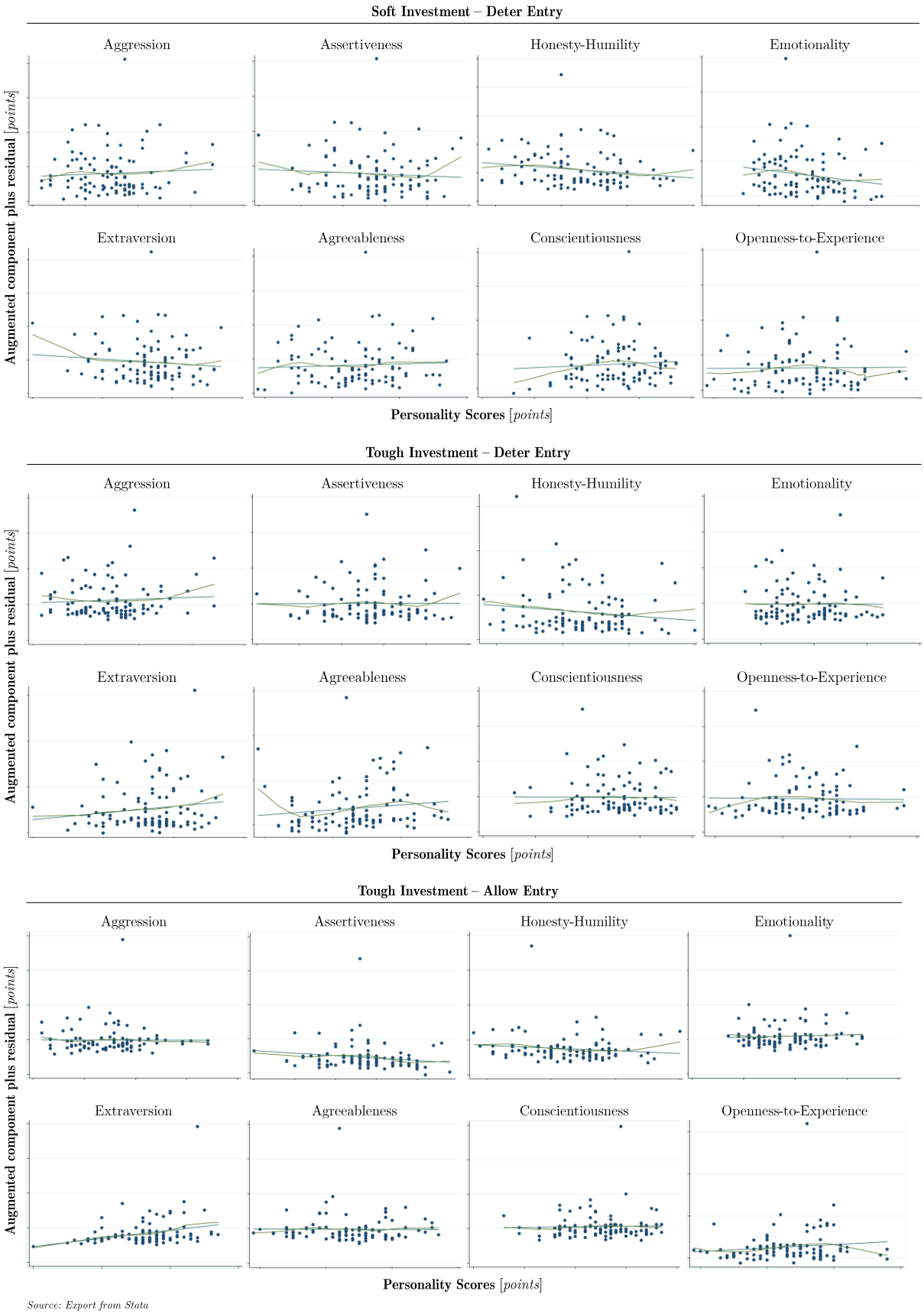
Note: Correlation coefficients $|r_i| > 0.18$ correspond to a significance level of 0.01

TABLE A4.1: Spearman's correlation coefficients of collected personality variables

(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)
0.02																			
0.03	0.68																		
-0.07	0.76	0.38																	
0.19	0.65	0.23	0.34																
-0.04	0.71	0.31	0.40	0.42															
0.06	0.06	0.05	-0.11	0.12	0.15														
-0.04	0.18	0.11	0.11	0.08	0.18	0.66													
0.13	-0.06	-0.03	-0.20	0.04	0.06	0.80	0.38												
0.07	-0.07	-0.09	-0.16	0.07	0.02	0.73	0.30	0.46											
-0.03	0.14	0.19	-0.03	0.15	0.14	0.66	0.35	0.43	0.29										
0.14	0.17	0.28	0.12	0.07	0.02	-0.11	-0.12	-0.21	-0.03	0.03									
0.07	0.13	0.25	0.08	0.01	0.04	-0.18	-0.16	-0.23	-0.04	-0.07	0.70								
0.13	0.22	0.22	0.17	0.13	0.13	-0.05	-0.05	-0.09	0.01	0.01	0.69	0.39							
0.16	0.08	0.10	0.04	0.07	0.05	-0.07	-0.09	-0.16	-0.04	0.04	0.77	0.33	0.44						
0.07	0.09	0.27	0.08	0.00	-0.11	-0.07	-0.08	-0.17	-0.02	0.06	0.77	0.49	0.40	0.40					
-0.02	0.12	0.02	0.12	0.03	0.17	0.05	0.11	0.02	-0.06	0.10	-0.01	-0.12	0.05	0.00	0.02				
0.11	0.03	-0.02	0.07	0.02	0.04	0.07	0.12	0.07	-0.01	0.04	-0.07	-0.12	-0.04	-0.03	-0.01	0.69			
-0.07	0.15	0.12	0.19	-0.03	0.13	-0.04	0.06	-0.09	-0.13	0.04	0.08	-0.01	0.14	0.05	0.10	0.56	0.34		
0.02	0.08	0.01	0.08	0.00	0.12	0.08	0.11	0.03	0.01	0.16	-0.03	-0.10	-0.03	0.03	-0.06	0.70	0.32	0.15	
-0.11	0.10	0.01	0.01	0.07	0.21	-0.02	0.02	0.01	-0.08	-0.01	0.05	0.00	0.11	0.02	0.04	0.66	0.24	0.21	0.30

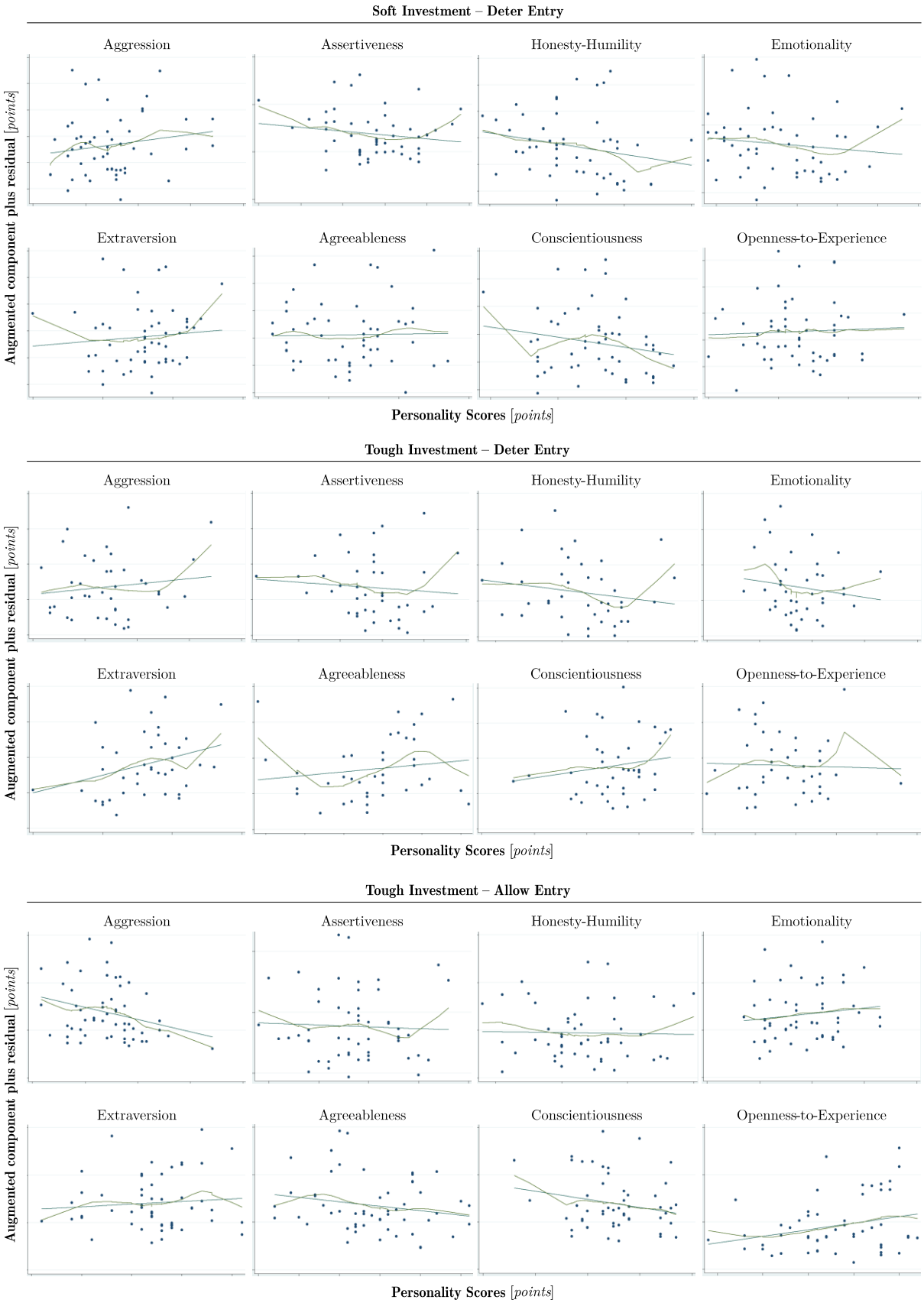
A4.2 Multivariate Analysis – Applied Empirical Models & Potential Problem Areas

A4.2.1 Checking the Linearity Assumption: cpr-plot analysis (full data)



Source: Export from Stata

A4.2.2 Checking the Linearity Assumption: cpr-plot analysis (non-zero data & excl. outliers)



Source: Export from Stata

A4.3 Multivariate Analysis – Empirical Results

A4.3.1 Results Incumbent Behaviour – Soft Investment

Dependent Variable:		2pmSoftAllowInvest															
		ALLOW ENTRY															
		(1) Control				(2) Aggression				(3) Honesty-Humility				(4) Emotionality			
		MODEL SA3				MODEL SA4.2				MODEL SA4.3				MODEL SA4			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	Variables	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Person. Variables	Aggression																
	Physical Aggression					-1.05**	.04	-5.26	.57								
	Verbal Aggression					0.38	.50	6.65	.42								
	Anger					0.65	.28	-12.54	.15								
	Hostility					0.06	.90	-1.43	.84								
	Assertiveness																
	Honesty-Humility																
	Sincerity									0.31	.60	-5.90	.43				
	Fairness									-0.39	.44	13.17	.13				
	Greed Avoidence									-0.66	.19	24.23***	.00				
	Modesty									0.39	.45	7.70	.30				
	Emotionality																
	Fearfulness													-0.22	.63	-5.10	.55
	Anxiety													0.25	.62	0.13	.99
	Dependence													-0.13	.80	21.81**	.02
	Sentimentality													-0.89*	.09	-9.31	.34
	Extraversion																
	Social Self-Esteem																
	Social Boldness																
	Sociability																
	Liveliness																
	Agreeableness																
	Forgiveness																
	Gentleness																
	Flexibility																
	Patience																
	Conscientiousness																
	Organisation																
	Diligence																
	Perfectionism																
	Prudence																
	Openness-to-Experience																
	Aesthetic Appreciation																
	Inquisitiveness																
	Creativity																
	Unconventionality																
Control Variables	Gender (female)	-0.83	.10	9.16	.27	-1.09*	.07	11.77	.24	-0.72	.20	7.33	.34	-0.54	.31	9.97	.31
	Consequences	-0.55	.46	-2.14	.83	-0.43	.56	0.63	.96	-0.57	.45	-3.89	.66	-0.35	.66	-0.11	.99
	Experiment experience	0.78*	.08	-9.05	.25	0.74	.12	-8.29	.31	0.78*	.09	-9.00	.19	0.86*	.07	-4.96	.54
Intercept	constant	0.63*	.07	50.11***	.00	0.72	.14	52.34***	.00	0.79*	.07	38.33***	.00	0.80*	.07	45.69***	.00
Model	N	99		67		99		67		99		67		99		67	
	F-statistic (p-value)	-		0.33		-		0.39		-		0.01		-		0.13	
	R^2	-		0.05		-		0.10		-		0.24		-		0.15	
	Pseudo/Adjusted R^2	0.06		0.00		0.10		-0.01		0.08		0.15		0.08		0.05	
	Root MSE	-		27.94		-		28.06		-		25.73		-		27.32	
Tests	LR χ^2 (versus *MODEL SA3*)[a]	-		-		5.44*	.07	-		2.66	.26	-		3.37	.19	-	
	AUC for ROC curve[b]	0.67		-		0.69		-		0.69		-		0.67		-	
	Mean RMSE (5-fold CV)[c]	-		28.09		-		29.87		-		15.87		-		29.23	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively;* 2pmSoftAllowInvest = 0 *when* SoftAllowInvest ≤ 10 & 2pmSoftAllowInvest = Softi

a) The LR test results indicate the probability of the additional variables (versus Model SA3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating*

TABLE A4.2: Stepwise two-part regression (logistic & OLS) for sub-dimensions

The table above documents the stepwise regression approach applied for the sub-dimension analysis. After the initial base model including only the control variables [(1) *MODEL SA3*], the sub-dimensions of each main personality dimensions have been sequentially included in the two-part regression model [(2)-(8)]. Ultimately, the significant sub-dimensions (i.e., *physical aggression*, *greed avoidance*, *dependence*, and *sentimentality*) were included in the model with relevant sub-dimensions [(9) *MODEL SA4.9*].

In order to limit the risk of *overfitting* (due to the stepwise approach and selection of significant

	2pmSoftAllowInvest																			
	Allow Entry																			
	(5) Extraversion				(6) Agreeableness				(7) Conscientiousness				(8) Openness-to-Experience				(9) Relevant			
	Model SA4.5				*Model SA4.6*				*Model SA4.7*				*Model SA4.8*				*Model SA4.9*			
	1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
																	-0.80*	.10	-5.70	.42
																	-0.76	.12	19.06**	.02
																	-0.03	.95	15.52*	.09
																	-0.91*	.09	-4.34	.63
	0.29	.55	-0.30	.97																
	0.74	.17	-1.40	.85																
	0.14	.77	-1.11	.90																
	-0.36	.46	0.06	.99																
					0.55	.29	6.10	.42												
					-0.44	.40	2.11	.80												
					-0.04	.95	2.78	.70												
					-0.03	.96	-4.64	.54												
									-0.29	.60	-5.88	.55								
									0.02	.96	2.84	.70								
									0.11	.84	-7.03	.35								
									0.20	.72	17.70	.05								
													-0.76	.16	6.65	.49				
													0.70	.21	0.21	.98				
													-0.29	.56	7.52	.36				
													0.39	.44	-2.04	.79				
	-0.90*	.09	9.53	.28	-0.68	.22	8.38	.35	-0.84	.14	7.42	.42	0.72	.19	6.29	.44	-0.71	.19	5.07	.58
	-0.35	.65	-2.50	.81	-0.67	.38	-1.40	.87	-0.55	.47	4.58	.68	-0.64	.38	0.50	.96	-0.36	.66	-0.28	.98
	0.89*	.05	-9.03	.27	0.80*	.09	-8.01	.32	0.78*	.08	-9.82	.22	0.64	.17	-9.72	.24	0.88*	.07	-8.21	.25
	0.37	.45	51.05***	.00	0.60	.17	47.29***	.00	0.61	.17	46.15***	.00	0.70*	.10	47.51***	.00	1.35***	.01	42.23***	.00
	99		67		99		67		99		67		99		67		99		67	
	-		0.82		-		0.60		-		0.26		-		0.45		-		0.00	
	-		0.05		-		0.07		-		0.12		-		0.08		-		0.25	
	0.08		-0.06		0.07		-0.04		0.06		0.02		0.09		-0.03		0.12		0.16	
	-		28.86		-		28.61		-		27.75		-		28.37		-		25.64	
	2.92	.23	-		1.53	.47	-		0.31	.86	-		3.61	.16	-		7.32**	.03	-	
	0.69		-		0.67		-		0.67		-		0.71		-		0.71		-	
	-		31.26		-		29.44		-		29.12		-		30.29		-		27.98	

`AllowInvest` *when* `SoftAllowInvest` > 10

Characteristic (ROC) curve *c) Avereage recorded RMSE for 5-fold cross-validation run 5 times*

in the soft investment & allow entry setting

variables), the *area under curve (AUC) test*[216] for the 1) logistic regression and a *5-fold CV*[217] for the 2) OLS regression have been conducted. While the model (9) indicates a strong predictive power (i.e., likelihood-ratio test: p=0.026 and F-statistic: p=0.001), the *AUC test* does not indicate overfitting (AUC=0.708). The *RMSE test* does indicate potential overfitting (higher error).

[216] AUC for the *Receiver Operating Characteristic Curve* (ROC).

[217] Note: The 5-fold *cross-validation* has been conducted 5 times (to ensure random division of the sample). Equivalently, the reported average RMSEs represent the average of all 25 RMSE values.

Dependent Variable:		2pmSoftDeterInvest															
		DETER ENTRY															
		(1) Control				(2) Aggression				(3) Honesty-Humility				(4) Emotionality			
		MODEL SD3				MODEL SD4.2				MODEL SD4.3				MODEL SD4			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	Variables	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Person.	Aggression																
Variables	Physical Aggression					0.01	.99	18.07**	.03								
	Verbal Aggression					-0.66	.21	6.54	.53								
	Anger					-0.12	.83	-13.16	.12								
	Hostility					0.80	.10	-1.24	.86								
	Assertiveness																
	Honesty-Humility																
	Sincerity									-0.16	.76	-8.13	.38				
	Fairness									-0.17	.73	-9.10	.18				
	Greed Avoidence									0.05	.92	9.12	.28				
	Modesty									-0.51	.28	-5.02	.56				
	Emotionality																
	Fearfulness													-0.17	.73	-13.77*	.09
	Anxiety													0.43	.37	-4.47	.59
	Dependence													-0.87	.11	7.72	.52
	Sentimentality													0.01	.99	2.36	.75
	Extraversion																
	Social Self-Esteem																
	Social Boldness																
	Sociability																
	Liveliness																
	Agreeableness																
	Forgiveness																
	Gentleness																
	Flexibility																
	Patience																
	Conscientiousness																
	Organisation																
	Diligence																
	Perfectionism																
	Prudence																
	Openness-to-Experience																
	Aesthetic Appreciation																
	Inquisitiveness																
	Creativity																
	Unconventionality																
Control Variables	Gender (female)	-0.14	.78	-12.64	.20	-0.13	.82	-4.80	.65	-0.08	.89	-9.86	.35	0.08	.89	-10.15	.30
	Consequences	-0.33	.60	33.65***	.00	-0.43	.48	32.12***	.00	-0.38	.56	30.00***	.00	-0.38	.56	26.27**	.02
	Experiment experience	1.22***	.00	-2.65	.75	1.23***	.01	-0.21	.98	1.26***	.00	0.26	.98	1.30***	.00	-2.88	.75
Intercept	constant	-0.47	.16	47.66**	.00	-0.54	.19	42.40***	.00	-0.27	.50	48.08***	.00	-0.44	.27	52.21***	.00
Model	N	99		4.74		99		67		99		67		99		3.31	
	F-statistic (p-value)	-		0.01		-		0.00		-		0.01		-		0.01	
	R^2	-		0.17		-		0.30		-		0.24		-		0.24	
	Pseudo/Adjusted R^2	0.00		0.12		0.09		0.19		0.07		0.12		0.00		0.12	
	Root MSE	-		23.64		-		22.73		-		23.62		-		23.71	
Tests	LR χ^2 (versus *MODEL SA3*)[a]	-		-		4.01	.13	-		1.44	.49	-		3.53	.17	-	
	AUC for ROC curve[b]	0.66		-		0.70		-		0.67		-		0.71		-	
	Mean RMSE (5-fold CV)[c]	-		24.23		-		25.62		-		26.30		-		26.84	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively;* 2pmSoftDeterInvest = 0 *when* SoftDeterInvest ≤ 10 & 2pmSoftDeterInvest = Softl

a) The LR test results indicate the probability of the additional variables (versus Model SA3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating*

TABLE A4.3: Stepwise two-part regression (logistic & OLS) for sub-dimensions

The table above documents the stepwise regression approach applied for the sub-dimension analysis. In line with the approach described for the allow-entry setting, the sub-dimensions of each main personality dimensions have been sequentially included in the two-part regression model [(2)-(8)], before selecting the significant sub-dimension for the (9) relevant-dimensions model (specifically, *physical aggression*, *fearfulness*, and *diligence*). Interestingly, fearfulness did not yield significant results in the (9) selection model, which indicates a limited robustness of the results.

Testing for potential *overfitting* (due to the stepwise approach and selection of significant variables), similarly to the allow entry results, the *RMSE test* indicated a potential risk of overfitting for the second, OLS regression, part of the model ($RMSE_{MODELSD4.9}$=22.42 versus $RMSE_{5\text{-}FOLDSD4.9}$=25.11). The *AUC test* for the logistic regression, however, disarmed any potential overfitting conjectures, indicating a *fair* accuracy of the diagnostic (AUC=0.706), yet, far from potential *overfitting*-levels (AUC>0.95).

	2pmSoftDeterInvest																			
	Deter Entry																			
	(5) Extraversion				(6) Agreeableness				(7) Conscientiousness				(8) Openness-to-Experience				(9) Relevant			
	Model SD4.5				*Model SD4.6*				*Model SD4.7*				*Model SD4.8*				*Model SD4.9*			
	1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
																	0.10	.83	17.31**	.03
																	-0.44	.35	-11.52	.12
	0.24	.60	7.05	.35																
	0.28	.54	-0.22	.97																
	-0.64	.17	11.63	.16																
	-0.36	.43	-9.83	.15																
					0.62	.19	-2.51	.71												
					0.02	.97	5.27	.51												
					-0.31	.53	-10.98	.23												
					-0.17	.74	6.66	.42												
									0.07	.91	10.48	.21								
									1.36***	.01	5.21	.48					1.10**	.02	3.78	.57
									-0.60	.27	-10.05	.15								
									-0.49	.41	-7.80	.38								
													-0.19	.73	8.61	.36				
													0.32	.55	-2.32	.79				
													-0.15	.77	-1.87	.82				
													-0.71	.15	-6.73	.41				
	-0.14	.80	-13.42	.17	-0.12	.83	-12.23	.22	-0.58	.31	-14.69	.11	-0.09	.87	-14.89	.15	-0.48	.42	-6.02	.57
	-0.23	.73	34.92***	.00	-0.44	.48	35.14***	.00	-0.30	.65	32.51***	.00	-0.14	.84	34.80***	.00	-0.24	.71	25.50**	.04
	1.25***	.01	0.13	.99	1.28***	.00	-5.29	.57	1.33***	.00	-2.44	.79	1.18***	.01	-1.28	.88	1.33***	.00	-1.42	.85
	-0.29	.54	43.80***	.00	-0.53	.22	49.46***	.00	-0.80*	.06	47.23***	.00	-0.21	.59	48.22***	.00	-0.87*	.05	43.50***	.00
	99		52		99		52		99		52		99		52		99		52	
	-		0.06		-		0.01		-		0.01		-		0.01		-		0.00	
	-		0.22		-		0.21		-		0.25		-		0.21		-		0.30	
	0.09		0.10		0.08		0.08		0.12		0.13		0.09		0.08		0.11		0.21	
	-		23.96		-		24.20		-		23.56		-		24.18		-		22.42	
	3.56	.17	-		1.87	.39	-		7.58**	.02	-		3.12	.21	-		5.87*	.05	-	
	0.70		-		0.69		-		0.71		-		0.69		-		0.71		-	
	-		27.10		-		26.11		-		25.14		-		27.11		-		25.11	

DeterInvest *when* SoftDeterInvest > 10

Characteristic (ROC) curve *c) Avereage recorded RMSE for 5-fold cross-validation run 5 times*

in the soft investment & deter entry setting

Results for both parts of the two-part model indicate a high predictive power of the (9) model (i.e., likelihood-ratio test: p=0.053 and F-statistic: p=0.001). However, as noted before, the OLS results have to be interpreted with caution, due to potential overfitting.

A4.3.2 Results Incumbent Behaviour – Tough Investment

Dependent Variable:		2pmToughAllowInvest															
		ALLOW ENTRY															
		(1) Control				(2) Aggression				(3) Honesty-Humility				(4) Emotionality			
		MODEL TA3				*MODEL TA4.2*				*MODEL TA4.3*				*MODEL TA4*			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Person.	Aggression																
Variables	Physical Aggression					-0.17	.74	-11.88*	.10								
	Verbal Aggression					-0.63	.23	-8.83	.39								
	Anger					0.31	.57	5.05	.66								
	Hostility					0.03	.95	-1.23	.88								
	Assertiveness																
	Honesty-Humility																
	Sincerity									-0.09	.86	-5.86	.45				
	Fairness									0.45	.36	0.86	.94				
	Greed Avoidence									0.42	.36	-0.79	.93				
	Modesty									0.53	.27	10.22	.28				
	Emotionality																
	Fearfulness													0.62	.20	-4.92	.58
	Anxiety													0.25	.58	11.79	.19
	Dependence													-0.31	.55	-5.97	.50
	Sentimentality													-0.11	.82	-4.19	.69
	Extraversion																
	Social Self-Esteem																
	Social Boldness																
	Sociability																
	Liveliness																
	Agreeableness																
	Forgiveness																
	Gentleness																
	Flexibility																
	Patience																
	Conscientiousness																
	Organisation																
	Diligence																
	Perfectionism																
	Prudence																
	Openness-to-Experience																
	Aesthetic Appreciation																
	Inquisitiveness																
	Creativity																
	Unconventionality																
Control	Gender (female)	0.12	.80	4.21	.65	-0.09	.87	-1.90	.87	0.00	.99	4.92	.56	-0.03	.95	8.51	.40
Variables	Consequences	1.28	.12	32.50***	.00	1.32	.14	35.95***	.00	1.39	.11	32.53***	.00	1.44	.10	33.87***	.00
	Experiment experience	0.12	.78	-2.47	.76	0.07	.87	-2.93	.70	0.11	.79	-3.05	.71	0.11	.81	0.22	.98
Intercept	constant	-0.02	.95	39.54***	.00	0.18	.68	44.72***	.00	-0.41	.32	37.74***	.00	0.22	.60	37.01***	.00
Model	N	99		54		99		54		99		54		99		54	
	F-statistic (p-value)	-		0.03		-		0.00		-		0.01		-		0.01	
	R^2	-		0.16		-		0.20		-		0.19		-		0.20	
	Pseudo/Adjusted R^2	0.02		0.11		0.04		0.08		0.05		0.06		0.04		0.07	
	Root MSE	-		28.65		-		29.04		-		29.39		-		29.18	
Tests	LR χ^2 (versus *MODEL SA3*)[a]	-		-		1.67	.43	-		3.01	.22	-		2.07	.36	-	
	AUC for ROC curve[b]	0.54		-		0.62		-		0.63		-		0.63		-	
	Mean RMSE (5-fold CV)[c]	-		28.09		-		31.08		-		46.99		-		29.44	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively;* 2pmSoftAllowInvest = 0 *when* SoftAllowInvest ≤ 10 & 2pmSoftAllowInvest = SoftA

a) The LR test results indicate the probability of the additional variables (versus Model SA3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating*

TABLE A4.4: Stepwise two-part regression (logistic & OLS) for sub-dimensions

	2pmToughAllowInvest																			
	Allow Entry																			
	(5) Extraversion				(6) Agreeableness				(7) Conscientiousness				(8) Openness-to-Experience				(9) Relevant			
	Model TA4.5				*Model TA4.6*				*Model TA4.7*				*Model TA4.8*				*Model TA5*			
	1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
																	-0.16	.75	-9.43	.25
	0.27	.53	-4.89	.53																
	-0.27	.56	3.15	.73																
	0.66	.17	14.37*	.08													0.71	.12	12.08	.14
	0.09	.85	-7.06	.34																
					0.90*	.07	-9.23	.36									0.98**	.05	-10.85	.17
					-0.84	.12	19.27*	.06									-0.80	.11	11.11	.20
					0.34	.47	-8.62	.36												
					0.02	.97	-1.57	.90												
									-0.02	.97	-5.10	.64								
									0.41	.39	14.68	.23								
									0.19	.71	-6.61	.38								
									0.04	.94	4.87	.65								
													0.03	.95	6.20	.51				
													-0.90	.06	3.49	.69				
													0.40	.41	0.77	.92				
													-0.08	.87	8.15	.44				
	0.07	.88	3.36	.66	0.47	.37	0.42	.95	-0.11	.84	-1.44	.88	0.20	.68	1.24	.88	0.41	.44	-1.02	.90
	1.29	.11	31.06***	.01	1.20	.14	32.75***	.00	1.41	.09	35.01***	.00	1.17	.18	35.79***	.00	1.19	.14	33.89***	.00
	0.20	.64	1.83	.81	0.13	.77	-3.18	.69	0.13	.76	-2.82	.75	0.19	.67	-2.20	.78	0.22	.61	1.62	.83
	-0.37	.42	36.45***	.00	-0.25	.56	42.73***	.00	-0.26	.52	34.45***	.00	0.11	.79	34.63***	.00	-0.39	.43	36.45***	.00
	99		54		99		54		99		54		99		54		99		54	
	-		0.00		-		0.00		-		0.00		-		0.06		-		0.00	
	-		0.23		-		0.25		-		0.21		-		0.18		-		0.28	
	0.04		0.11		0.06		0.14		0.03		0.08		0.05		0.06		0.08		0.17	
	-		28.62		-		28.19		-		29.03		-		29.42		-		27.57	
	2.72	.26	-		5.54*	.06	-		1.23	.54	-		3.95	.14	-		7.64**	.02	-	
	0.63		-		0.66		-		0.60		-		0.66		-		0.68		-	
	-		30.53		-		29.44		-		30.65		-		30.63		-		28.72	

`AllowInvest` *when* `SoftAllowInvest` > 10

Characteristic (ROC) curve *c) Avereage recorded RMSE for 5-fold cross-validation run 5 times*

in the tough investment & allow entry setting

Dependent Variable:		2pmToughDeterInvest															
		DETER ENTRY															
		(1) Control				(2) Aggression				(3) Honesty-Humility				(4) Emotionality			
		MODEL TD3				*MODEL TD4.2*				*MODEL TD4.3*				*MODEL TD4*			
		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
Field	**Variables**	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Person.	Aggression																
Variables	Physical Aggression					-0.13	.80	-2.63	.91								
	Verbal Aggression					0.18	.74	-8.47	.66								
	Anger					0.01	.99	1.38	.95								
	Hostility					-0.23	.63	0.63	.97								
	Assertiveness																
	Honesty-Humility																
	Sincerity									0.27	.62	-21.57	.23				
	Fairness									0.00	.99	10.97	.67				
	Greed Avoidence									0.22	.64	2.55	.89				
	Modesty									0.71	.15	5.38	.74				
	Emotionality																
	Fearfulness													0.27	.57	2.25	.90
	Anxiety													0.10	.83	-1.20	.94
	Dependence													0.11	.84	2.03	.90
	Sentimentality													-0.59	.30	28.55*	.08
	Extraversion																
	Social Self-Esteem																
	Social Boldness																
	Sociability																
	Liveliness																
	Agreeableness																
	Forgiveness																
	Gentleness																
	Flexibility																
	Patience																
	Conscientiousness																
	Organisation																
	Diligence																
	Perfectionism																
	Prudence																
	Openness-to-Experience																
	Aesthetic Appreciation																
	Inquisitiveness																
	Creativity																
	Unconventionality																
Control	Gender (female)	-1.41**	.01	-19.31	.27	-1.44**	.02	-20.81	.40	-1.52***	.01	-17.26	.53	-1.40**	.01	-17.05	.40
Variables	Consequences	0.79	.32	-7.94	.64	0.85	.31	-8.28	.69	0.92	.26	-16.18	.44	0.99	.25	-22.48	.15
	Experiment experience	-0.47	.29	13.62	.34	-0.47	.29	14.26	.34	-0.54	.24	14.99	.35	-0.44	.33	14.25	.33
Intercept	constant	0.09	.79	70.59***	.00	0.16	.72	73.23***	.00	-0.24	.57	70.69***	.00	0.04	.93	65.20***	.00
Model	N	99		40		99		67		99		67		99		1.4	
	F-statistic (p-value)	0.06		0.30		-		0.70		-		0.71		-		0.24	
	R^2	-		0.06		-		0.06		-		0.10		-		0.11	
	Pseudo/Adjusted R^2	0.06		-0.02		0.07		-0.14		0.09		-0.09		0.00		-0.08	
	Root MSE	-		45.41		-		47.97		-		46.90		-		46.67	
Tests	LR χ^2 (versus *MODEL SA3*)[a]	-		-		0.41	.82	-		3.40	.18	-		1.48	.48	-	
	AUC for ROC curve[b]	0.64		-		0.66		-		0.67		-		0.65		-	
	Mean RMSE (5-fold CV)[c]	-		46.93		-		51.32		-		55.34		-		51.24	

*Note: *, **, and *** correspond to significance levels of 10%, 5%, and 1%, respectively;* 2pmSoftDeterInvest = 0 *when* SoftDeterInvest ≤ 10 & 2pmSoftDeterInvest = SoftI

a) The LR test results indicate the probability of the additional variables (versus Model SA3) not improving the model fit *b) Area under curve (AUC) for Receiver Operating*

TABLE A4.5: Stepwise two-part regression (logistic & OLS) for sub-dimensions

2pmToughDeterInvest

Deter Entry

(5) Extraversion				(6) Agreeableness				(7) Conscientiousness				(8) Openness-to-Experience				(9) Relevant			
Model TD4.5				*Model TD4.6*				*Model TD4.7*				*Model TD4.8*				*Model TD5*			
1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS		1) Logit		2) OLS	
β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
0.17	.73	28.52**	.05													0.45	.88	23.41*	.07
0.03	.96	-22.15	.18																
0.98*	.08	1.79	.91																
-1.32**	.01	21.47	.22													-1.10**	.02	24.98*	.06
				0.03	.96	-31.98**	.03									0.59	.22	-27.16**	.03
				0.85	.12	18.53	.16												
				0.40	.42	12.15	.32												
				-0.48	.35	15.06	.46												
								-0.29	.62	-3.06	.90								
								0.38	.43	7.41	.68								
								0.26	.63	-21.57	.12								
								0.02	.98	18.00	.38								
												-0.05	.92	36.55*	.06				
												0.77	.17	-32.04**	.02				
												-0.92*	.08	-3.37	.84				
												0.54	.29	-6.57	.66				
-1.55***	.01	-27.01	.10	-1.84***	.00	-30.88*	.09	-1.60	.01	-18.97	.36	-1.51**	.02	-22.20	.26	-1.22**	.03	-30.08**	.05
0.84	.37	-12.10	.45	0.98	.21	9.79	.65	0.85	.27	-6.99	.71	0.77	.38	-24.47	.16				
-0.18	.72	11.83	.44	-0.39	.38	5.27	.77	-0.44	.33	5.80	.73	-0.54	.27	29.05*	.07				
0.12	.80	58.55***	.00	-0.18	.67	66.40***	.00	-0.09	.82	71.94***	.00	0.04	.93	70.10***	.00	0.14	.73	70.01***	.00
99		40		99		40		99		40		99		40		99		40	
-		0.11		-		0.02		-		0.39		-		0.18		-		0.01	
-		0.22		-		0.23		-		0.11		-		0.18		-		0.25	
0.12		0.05		0.10		0.07		0.07		-0.08		0.11		0.01		0.09		0.16	
-		43.69		-		43.38		-		46.63		-		44.77		-		41.13	
7.82**	.02	-		4.61*	.10	-		1.18	.55	-		6.28**	.04	-		4.23	.12	-	
0.71		-		0.69		-		0.67		-		0.72		-		0.69		-	
-		47.91		-		48.93		-		49.98		-		50.86		-		42.99	

DeterInvest *when* SoftDeterInvest > 10

Characteristic (ROC) curve *c) Avereage recorded RMSE for 5-fold cross-validation run 5 times*

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