

Artinger, Sabrina

Conference Paper

Demand uncertainty in skill-based competition

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Behavioral Economics, Underlying Principles, No. D05-V3

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Artinger, Sabrina (2013) : Demand uncertainty in skill-based competition, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Behavioral Economics, Underlying Principles, No. D05-V3, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/79962>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Demand uncertainty in skill-based competition

Sabrina Artinger

University of Oxford, Sabrina.Artinger@sbs.ox.ac.uk

Abstract

How does demand uncertainty affect entry into skill-based competition? I investigate this question in a market entry experiment with skill-based payoffs by systematically varying two key elements of the market environment: demand risk and expected market size. Results show that people's reactions to demand risk depend on the market size: in small markets people enter more when demand is risky, in large markets they enter less when demand is risky. This leads to substantial inefficiencies in both cases: demand risk significantly amplifies overentry in small markets and underentry in large markets. Skill and confidence have strong main effects but do not moderate reactions to demand risk or market size. This result has important implications for market design and regulation.

Keywords: competition, demand uncertainty, market entry behavior

1. Introduction

Demand is rarely ever certain. Those of us who have been on the academic job market before will have made first-hand experience with this fact as the number of vacant positions varies from year to year (Cawley, 2011). However, not all of us are affected by this in the same way. The highest skilled candidates will find a position even in the tightest market whereas less skilled candidates are likely to drop out when demand is low. Hence, people who are confident to be relatively high skilled should be less threatened by a decline in demand. Their decisions to enter the market are also likely to be less affected by demand volatility as a higher confidence has been discussed to be able to outweigh peoples aversion towards demand risk (March and Shapira, 1987). Understanding how demand risk influences individual market entry decisions and how this impacts on the efficiency of skill-based competition is

essential for market design and regulation.

Research on skill-based competition so far has focussed on the role of judgements about own and other's competence alone. Market inefficiencies such as market overentry have been traced back to people's absolute overconfidence (Bolger et al., 2008), to relative overconfidence caused by underestimating the skill level of competitors - also called reference group neglect (Camerer and Lovo, 1999), myopic self-focus (Moore et al., 2007) or self-assessed competence (Grieco et al., 2007). Demand uncertainty and its interplay with the size of market at focus, i.e. the expected market demand, have not been investigated much in this context. The only study that explicitly examines the influence of demand uncertainty on skill-based competition is by Wu and Knott (2006). They test whether there is a trade-off between overconfidence and aversion towards demand risk. They find that in aggregate market outcomes are well described by modelling entry decisions based on the assumption of such trade-off. Due to the structure of their data, conclusions for behavior in markets that differ in expected demand are limited. An economic experiment would lend itself to complement this research; however, such work is missing so far.

In this paper we address this research gap by experimentally examining how entry into skill-based competition is influenced by demand risk in markets with different size, i.e., with different expected demand. From market entry experiments with skill-*independent* payoffs we know that coordination success, leading to an efficient number of entrants, does depend on the market demand: people have been found to overenter markets with a low demand while underentering markets with a high demand (c.f., Camerer et al., 2004). The effect of market size on skill-based competition is yet to be systematically investigated. Results of Bolger et al. (2008) give a first indication that the market size might also be crucial for the efficiency of skill-based competition: in a 16 player market entry experiment with skill-based payoffs and a demand of eight entrants they find an average overentry of 30 percent while at a demand of four entrants average overentry is 110 percent. In our experiment, we will thus consider a wide range of different market sizes. Furthermore, to enable comparison with previous research, we test whether people differ in their reactions to demand risk depending on their confidence level. Given that high skilled competitors are less if at all affected by a decline in demand, we expect people with high confidence in

their own relative skills to react less negatively to a decline in demand and to be less sensitive to demand volatility than people with low confidence. Testing these hypotheses we investigate how demand risk, market size, and confidence levels interplay in influencing outcomes of skill-based competition.

This study contributes to the literature on skill-based competition by illuminating how demand risk influences entry and market efficiency in markets of different size. Our results highlight the importance for further research into the interplay of demand risk, market size, and of strategic thinking in skill-based competition.

2. Demand risk and market size

Consider a market with a certain demand c . The demand c determines how many competitors will be able to make a profit in this market. Thus we can also think of c as the market size. As skills matter in the competition, only the c best ranked entrants will make a profit. All other entrants will make a loss. When c is certain, only those who believe to be among the c best ranked competitors should enter the market. In reverse, when we observe a competitor to enter the market - according to revealed preference theory - we can induce that he believes to be among the best c competitors.

3. Experiment

3.1. Experimental design and procedure

We conducted a market entry experiment based on the experimental paradigm of Camerer and Lovo (1999). In the experiment, participants decided on entering or not entering a competitive market with a limited demand c . Only the c highest ranked entrants made a profit; all further entrants suffered a loss. Thereby, ranks depended on participants' relative performance in a skill-task; as in Camerer and Lovo (1999) participants in our experiment were ranked according to their performance in a knowledge quiz. When making their entry decision, participants did not know their own or their competitors' ranks and they could not observe their competitors' entry decisions. Hence, participants' entry decisions reflect their confidence in being among the c highest ranked participants that enter. Demand uncertainty was induced by giving one group of participants risky information

about the demand c while a second group received certain demand information. Demand risk was varied between subjects in order to avoid problems related to the comparative ignorance phenomenon¹. Furthermore, the size of the market demand c , or in case of risky demand information the expected size of demand, was varied within subjects and changed in random order from round to round. As we assume people to be particularly sensitive to the possibility of extreme values of demand, such as a zero demand or an extremely high demand where all participants are able to enter at a profit, we also included these values. Extreme values of demand are characterized by eliminating the influence of performance on outcomes: Imagine a market where there is no demand at all. No matter how good you are you will make a loss by entering this market. *Visa versa*, in a market with a higher demand than supply, even the entrants with the lowest performance will make a profit from entering. We assume that people are thus particularly sensitive to extreme values of demand. Confidence levels are measured indirectly as a direct elicitation of people's beliefs about their absolute skill or skill rank would *force* them to calibrate, thereby changing subsequent entry behavior². Thus, we measured participants' confidence level indirectly by comparing entry rates before and after feedback on their rank. To be able to distinguish absolute overconfidence from reference group neglect, participants received partial feedback on their rank: group (a) received feedback on their own number of correct answers in the general knowledge quiz; group (b) received feedback on the distribution of correct answers of their competitors. Comparing individual entry rates before and after this feedback reveals the level of absolute overconfidence for participants in group (a), and the level of relative overconfidence for the participants in group (b). By disentangling the effects of overestimating own absolute skills and underestimating the performance level of competitors³ we address the discussion on the influence of these two

¹According to the comparative ignorance hypothesis of Fox and Tversky (1995) ambiguity aversion is the result of a comparison with less ambiguous events, or with more knowledgeable individuals. In this view, ambiguity aversion is largely an artefact caused by the within-subject design used in most experimental studies on decision making under ambiguity versus risk.

²The authors are grateful to Christian Schade who highlighted this problem and recommended measuring confidence levels indirectly.

³The effect of partial feedback on performance has been studied in other set-ups by Bolger et al. (2008), Grieco and Hogarth (2009), and by Urbig et al. (2009).

effects on market entry outcomes (Camerer and Lovo, 1999; Moore et al., 2007; Bolger et al., 2008).

The experiment was conducted in the experimental laboratory of the School of Business and Economics of a European University. Participants were recruited via an experimental database (ORSEE, Greiner, 2004). Eight sessions were run with 14 participants each, yielding 56 participants in each session and a total of 112 participants in the experiment. 45 percent of the participants were male, 55 percent were female. The majority of the participants had some experience with economic experiments but none of them had taken part in a market entry experiment before. The experiment was computerized using the z-Tree (Fischbacher, 2007).

Upon arrival, participants were paid a show-up fee of 12 Euro in cash that they were asked to pocket. They were then seated in random order at computer desks without visual contact to each other. Communication was not allowed throughout the experiment. All instructions were displayed on the computer monitors guiding participants through the experiment; additional hard copies of core parts of the instructions were distributed. Digital calculators were available on all computer screens. After some general instructions, participants started with the first part of the experiment.

In the first part of the experiment, participants completed a general knowledge quiz consisting of 14 binary choice questions knowing that their payoff from the subsequent experiment would also depend on their performance in this quiz. Having completed the quiz, participants did not receive feedback about their performance. Part two of the experiment was the market entry game. After some general instructions and comprehension questions, participants were matched in groups of seven players. Then they played five rounds of the market entry game. In each round they decided on entering or not entering an experimental market. The payoff from entering depended on the skill-rank of the participant and on the demand in the respective round. Ranks were determined by the participants' performance in the general knowledge quiz in part one of the experiment. The player with the highest number of correctly answered questions obtained rank one, the player with the second highest number of correct answers rank two, etc. The demand c varied from round to round. In each round the c best entrants would make a gain of 7.50 Euro by entering, all further entrants would make a loss of 10 Euro. In half of the sessions participants were confronted with a

certain demand. In the other half of the sessions participants faced a risky demand. In each round participants were randomly re-matched with another group of six competitors. In order to avoid learning effects, no feedback about the round outcomes or the number of entrants was given until the very end of the experiment. After completing the first block of five rounds, participants played a second block of five rounds. In this block, they were given partial information about their true rank. Group (a) received feedback on their own number of correct answers in the quiz. Group (b) received information about the performance dispersion among their competitors.

In part three of the experiment people’s beliefs about the number of entrants in each condition were elicited. For correct estimates the participants received a small additional payoff. In part four, risk attitudes were measured using the lottery choice task by Holt and Laury (2002). Part five contained a demographic questionnaire. Finally, in part six participants received a detailed overview of the results of all rounds and feedback about their own and the reference group performance in the general knowledge quiz. A random device determined one of the rounds. Participants were paid for the market entry game in accordance to their payoff in this round. Payoffs from all parts were added. The final payments were made privately. Table 1 below gives an overview over the different parts of the experiment.

Table 1: Experimental design

Part 1:	General knowledge quiz [14 binary choice questions]
Part 2:	Market entry game 5 rounds with varying demand [two conditions: (1) and (2)] (1) certain information about the demand (2) risky information about the demand 5 rounds with varying demand and feedback [two sub-groups: (a) and (b)] (a) feedback about own skill (b) feedback about skill dispersion in reference group
Part 3:	Belief elicitation, incentive compatible
Part 4:	Holt and Laury (2002), incentive compatible
Part 5:	Demographic questionnaire
Part 6:	Overview of all results, payments

The order of quiz and market entry game differed from the original design of Camerer and Lovo (1999). In the experiment by Camerer and Lovo (1999) the quiz was conducted after the market entry game. In this experiment the quiz was conducted before, but participants did not receive feedback about their performance. This change in task order was made to avoid potential confound of overconfidence and effects of illusion of control. Previous research has shown that people prefer betting on future events rather than on past events (Rothbart and Snyder, 1970). This finding has been attributed to people’s illusion of control. It can also be explained by people’s aversion to take bets with outcomes that could generally be known but are not known to them (Heath and Tversky, 1991; Fox and Tversky, 1995). In order to avoid these potential confounds, the general knowledge quiz was conducted before the market entry game. Also, this set-up is closer to real world situation where people compete about resources based on their previous achievements. Examples for such situations are job markets, the competition about research funds, or applications for universities.

4. Nash equilibria

If players knew their rank, the best c players in a group should enter. All others should stay out. As ranks are unknown to the players at the time they make their decisions, entry decisions mirror the players’ beliefs about their own ranks. Assuming, however, that players are risk-neutral and have common ignorant priors, i.e., that they believe to have equal chances to be among the c best-ranked players, following equilibrium predictions can be derived: each of the seven players decides whether to enter, denoted by strategy $s_i = 1$, or not to enter, denoted by $s_i = 0$. If a player decides to stay out of the market her payoff is zero. If a player decides to enter, the payoff from entering depends on her rank. If she is among the best c ranked entrants, she will gain 7.50 Euro, if not, she will lose 10 Euro by entering. The payoff function is given by:

$$\pi_i(s_i, m) = \begin{cases} 0 & \text{if } s_i = 0 \\ 7.50 & \text{if } s_i = 1 \text{ and } m \leq c \\ (7.50c - 10(m - c))/m & \text{if } s_i = 1 \text{ and } m > c \end{cases}$$

where π_i denotes the payoff for player i given his strategy choice and the total number of entrants m including player i . The demand is given by c .

If the total number of entrants does not exceed the demand, the average entrants profit is 7.50 Euro. If the total number of entrants does exceed the demand, the payoff of the average entrant equals the industry profit divided by the number of entrants. The industry profit is the accumulated payoff (gains and losses) of all entrants, whereby c entrants make a profit of 7.50 Euro and $m - c$ entrants make a loss of 10 Euro. In equilibrium, players must be indifferent about entering or staying out of the market. If, entering is a dominant strategy as 7.50 Euro is more than 0 Euro. If $m > c$, the average player should be indifferent between entering and staying out when . This happens when $m = 1.75c$. Consequently, in pure strategy equilibria the number of entrants is $m = 1.75c$; e.g., the highest integer of entrants below $1.75 c$. To derive the mixed strategy equilibrium, let p denote the probability with which each player selects to enter and let $(1 - p)$ be the probability with which each player stays out of the market. Then the probability that m players enter and $N - m$ players stay out is

$$p(m) = p(s_1)^m(1 - p(s_1))^{N-m} \binom{N}{m} \quad (1)$$

In the mixed strategy equilibrium, players enter with probability solving:

$$7.5p^*(s_1) + (1 - p^*(s_1)) \sum_{m>1.75c}^N \left(\frac{7.5c - 10(m - c)}{m} \right) = 0 \quad (2)$$

Table 2 shows the total number entrants for which the players are indifferent between entering and staying out for different values of c , the number of entrants in pure strategy equilibria and the corresponding mixed strategy equilibrium.

Table 2: Overview equilibria

c^*	m^*	<i>enter if</i>	m in pure equilibria	p^*
1	1.75	$m - 1 \leq 1.75$	1	0.14
2	3.50	$m - 1 \leq 3.50$	3	0.43
3	5.25	$m - 1 \leq 5.25$	5	0.71
4	7.00	<i>always enter</i>	6 or 7	-
5	8.75	<i>always enter</i>	7	-

The effect of demand risk was tested by giving one group of participants risky information about the demand while another group received certain information about the demand. Instead of the certain values of demand $c = 1$, $c = 2$, $c = 3$, $c = 4$, and $c = 5$, participants in the risky demand condition knew that the demand would be $c = [0; 1; 2]$, $c = [1; 2; 3]$, $c = [1; 3; 5]$, $c = [2; 4; 6]$, and $c = [3; 5; 7]$, respectively. All possible values in a round would realize with a chance of $1/3$. Assuming that risk-neutral players formed expected values and believed other players to be risk-neutral as well, the equilibrium predictions above also hold for the risky condition.

5. Results

5.1. Independent variables

On average people answered 8.0 out of 14 questions correctly ($SD = 2.05$). After receiving feedback, 23.2 percent of the participants entered more indicating that the feedback was better than they expected and that they were relatively underconfident. 42.0 percent did not change their entry rate indicating that they were well calibrated. The remaining 34.8 percent entered less after the feedback indicating that feedback was worse than they expected and that they were relatively overconfident. The degree of risk aversion in the group was moderate ($M = 5.8$, $SD = 2.04$). Correlations between confidence and rank (relative performance in the quiz) and between confidence and risk aversion were $r_{pb} = 0.240$ and $r_{pb} = 0.091$, respectively. There was no correlation between risk aversion and rank.

5.2. Regressions

We estimated several logit models of entry employing subject-specific random-effects to control for unobserved heterogeneity. The dependent variable *entry* is binary and coded with '1' when a participant decided to enter and '0' when a participant decided not to enter. The variable *demand* represents the expected demand, i.e. the expected market size. *Demand risk* is coded '1' for risky information about demand and '0' for certain information about demand. The variable *rank* represents the relative performance of the respective participant in the quiz. The variable *confidence* represents the entry differences before and after the partial feedback about the rank. It is positive for people who entered more before the feedback, indicating

overconfidence, and negative for people who entered less before the feedback, indicating underconfidence. For this part of the analyses we consider confidence effects in general and aggregate participants who have received feedback on their own and participants who have received feedback on their competitors' performance. A separate analyses for the effects of absolute (over-/ under-)confidence and reference group neglect is described below in section 4.4. *Risk aversion* represents the participants switching point in the lottery comparison task. A higher value is equivalent to a higher degree of risk aversion. Participants' beliefs about the number of entrants in the respective situation are captured by the variable *belief*. Finally, gender is coded '1' for male participants and '0' for female participants. Collinearity statistics report uncritical values (variance inflation factor $VIF = 1.221 < 10$, tolerance statistic = $0.819 > 0.2$). Models have been estimated for the entry data of the first five rounds. In all four models the dependent variable is *entry*. Model 1 contains *demand*, *demand risk*, and the interaction effect of both as independent variables. Model 2 adds *rank*, *confidence*, and *risk aversion*. Model 3 additionally considers participants' beliefs and the interactions of *confidence*demand*, and *confidence*demand risk*, respectively. Finally, model 4 further includes *gender*. Table 3 shows the results.

Table 3: Random-effects logit models

MODEL	(1)	(2)	(3)	(4)
Demand	1.877*** (0.290)	1.750*** (0.302)	2.028*** (0.337)	1.988*** (0.335)
Demand risk	2.112*** (0.519)	1.833*** (0.520)	1.790** (0.545)	1.910*** (0.543)
Demand*demand risk	-0.754*** (0.165)	-0.701*** (0.173)	-0.721*** (0.179)	-0.718*** (0.178)
Rank		-0.701*** (0.173)	-0.138*** (0.031)	-0.113*** (0.030)
Confidence		2.696*** (0.568)	2.885* (1.503)	2.488* (1.477)
Risk aversion		-0.148** (0.054)	-0.148** (0.057)	-0.111** (0.056)
Belief			-0.237** (0.092)	-0.202** (0.090)
Demand*confidence			-0.017 (0.394)	-0.037 (0.389)
Demand risk*confidence			0.317 (1.255)	0.771 (1.207)
Gender				0.667** (0.247)
Constant	-2.832*** (0.418)	-0.794 (0.528)	-0.723 (0.560)	-1.496 (0.620)
$ln\sigma_\mu^2$	-0.634 (0.523)	-3.778 (8.247)	-1.895 (1.523)	-3.507 (6.790)
σ_μ	0.728 (0.191)	0.151 (0.623)	0.388 (0.295)	0.173 (0.588)
ρ	0.139 (0.063)	0.007 (0.057)	0.044 (0.064)	0.009 (0.061)
χ^2	76.55	77.43	76.25	79.69
Number of obs	560	482	482	482
Number of subjects	112	97	97	97

Dependent variable = entry (0/1)

Random-effects specification = subject id

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

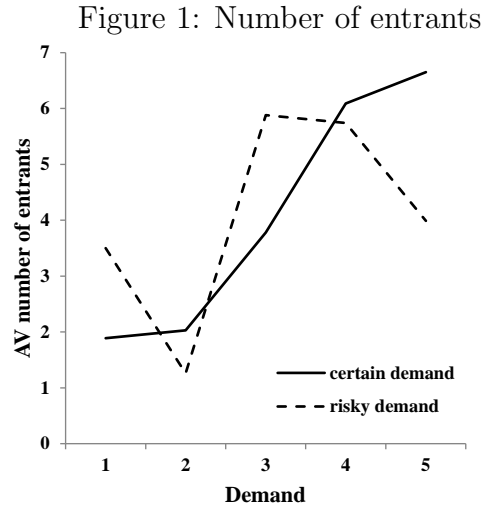
Results show that *demand*; i.e. market size, has a large positive main

effect on entry rates. The higher the demand, the more likely people were to enter. This effect is highly significant and robust across model specifications. *Demand risk* has a highly significant, robust main effect on entry when controlling for the interaction of *demand* and *demand risk*. Interestingly, this effect is positive indicating that people were more likely to enter under risky demand information than under certain demand information. However, as indicated by the negative interaction effect of *demand* and *demand risk*, demand risk negatively influenced entry in markets with higher demand. We will take a closer look at this patterns in section 4.3 below. Model two shows that people with lower (better) ranks were significantly more likely to enter and that *confidence* had a strong positive main effect on entry. *Risk aversion* had the expected negative effect on entry. Furthermore, model three shows that the more other people participants believed to enter the less they entered themselves. Against our expectations, we do not find interaction effects of either *confidence* and *demand* or *confidence* and *demand risk*. Model four finally shows that even when controlling for risk aversion, confidence, ranks, and beliefs, men entered more than women.

5.3. Number of entrants

Figure 1 shows the mean number of entrants in for the certain demand and the risky demand condition as a function of market size. For the certainty condition, the mean number of entrants is almost linear in demand and between c and $1.75c$, except for $c = 1$ where entry is slightly higher. This entry pattern is largely in line with equilibrium predictions. Mean payoffs from entering are positive for all values of c except for $c = 1$ where the mean payoff is just below zero with -0.64 Euro. For the risky condition, the relationship between the mean number of entrants and demand is s-shaped: when the expected demand is low, i.e., when $c = [0; 1; 2]$, people overenter the market. In this situation the average number of entrants is 3.5 leading to a loss of 5 Euro for the average entrant. When the expected demand is high, i.e., when $c = [3; 5; 7]$, people underenter the market and do not fully use the opportunities to make a profit. The average number of entrants is 3.9 in this situation. Thus, we observe almost as many entrants in markets with $c = [0; 1; 2]$ as in markets with $c = [3; 5; 7]$ which constitutes a considerable coordination failure and leads to highly inefficient market outcomes. Figure 1 shows the linear and s-shaped relation of entrants and demand in both

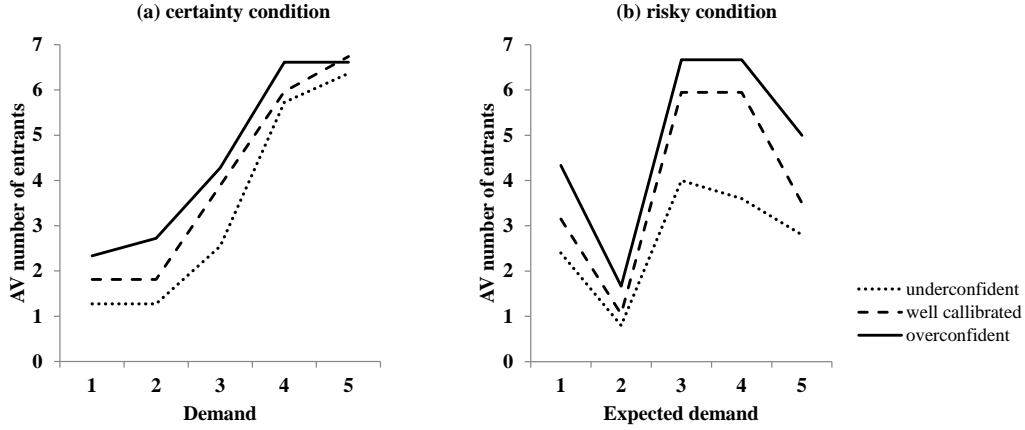
conditions.



5.4. Rank and confidence

Based on previous research, we expected people's rank and confidence level to have an important influence on entry behavior. The regression analyses confirm highly significant main effects of both, rank and confidence, on entry: the higher a participant's rank and the higher his confidence, the more likely the participant is to enter the market. Both effects are plausible. The effect of ranks on entry behavior shows that people have some sense for their true performance and that they act accordingly by entering more if they have better chances. The effect of confidence captures the influence of people's miscalibration. We find that overconfident people entered more and underconfident people less than well calibrated people. This is in line with previous research. Furthermore, we can confirm a considerable main effect of confidence in a set-up that controls for illusion of control. Against our expectations, however, we do not find interaction effects of demand risk and confidence (or demand risk and rank) on entry. Also there are no interaction effects of demand, i.e. market size, and confidence or rank. The lack of these interaction effects is surprising as people who believe to be higher ranked should also believe to be less affected by a decrease in demand and their entry rate should be less affected by demand volatility. Figures 2 (a) and (b) illustrate the independence of these effects:

Figure 2: Number of entrants by confidence level

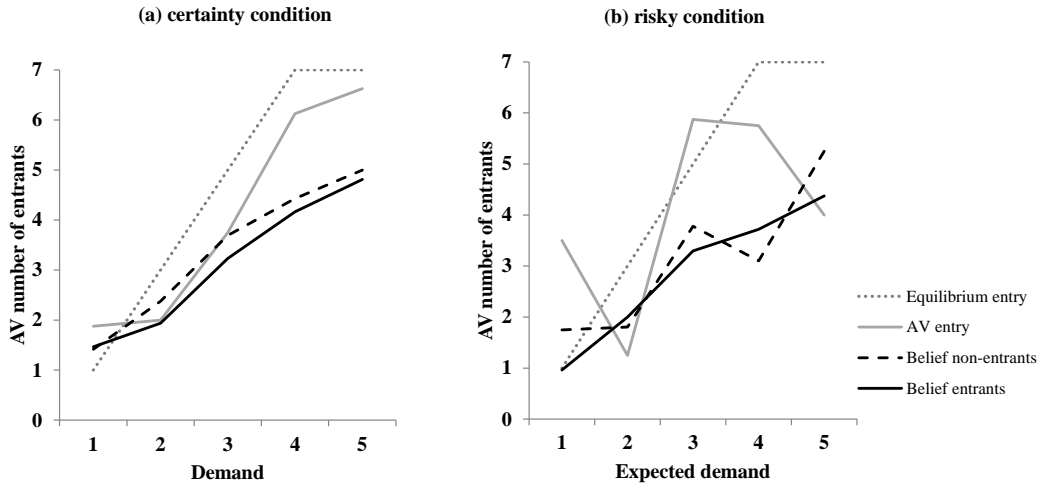


5.5. Beliefs

One possible explanation for the observed entry pattern is related to participants' beliefs about the entry behavior of competitors. For market entry games with skill-*independent* payoffs, Camerer et al. (2004) show that over-entry in small markets and underentry in large markets can be explained by heterogeneous beliefs about competitors' entry behavior. Heterogeneous beliefs about competitors' entry behavior might also underly the entry pattern we observe. Below we consider the beliefs of entrants and non-entrants to study potential differences. Figure 3 shows the average belief of entrants and non-entrants, both for the certainty and the risky condition: (a) Participants who were confronted with certain demand information believed more people to enter the larger the demand was. Both the belief functions of entrants and non-entrants were almost linear in demand. Thereby non-entrants had slightly higher beliefs than entrants. (b) Beliefs of entrants and non-entrants were less similar in the risky demand condition. While the beliefs of entrants were linearly increasing with the expected demand, the beliefs of non-entrants deviate significantly from a linear pattern. Non-entrants in the risky condition had higher beliefs than entrants for $c = [0; 1; 2]$, $c = [1; 3; 5]$,

and $c = [3; 5; 7]$ and lower beliefs than the entrants for $c = [1; 2; 3]$, and $c = [2; 4; 6]$. Considering the distribution of beliefs in the risky condition, we find that non-entrants differ much more than entrants in how many of their competitors they believed to enter. This suggests that building beliefs about the strategic decisions of others becomes more difficult under demand risk than building beliefs under certain demand information.

Figure 3: Beliefs



6. Discussion and conclusion

Our results show that demand risk can cause substantial degrees of market inefficiencies in skill-based competition. Thereby demand risk has a different impact on market entry depending on the market size: in small markets demand risk amplifies overentry. In large markets it amplifies underentry. While the results confirm a large and highly significant main effect of confidence on entry, confidence effects cannot explain the pattern of over- and underentry we observe. Most researcher assume, like Wu and Knott (2006), that people are always averse with respect to demand risk. Our results indicate that this might not hold for all markets. In very small markets people

seem to seek demand risk while they dislike demand risk in larger markets. This might be related to their effort to strategically best respond to their competitors and to their difficulties to form beliefs about their competitors entry behavior in the presence of demand risk. For example, a participant who believes his competitors to be deterred from entry by demand risk in a very small market, where a certain loss is possible, might think his own chances of making a profit by entering would increase. This participant would enter more in very small markets exactly because there is more risk and because he thinks others will respond to this differently than he does. Similarly, using the same logic this participant would see his chances of making a profit shrink in a large market with demand risk, where a certain gain is possible, and he believes all his competitors to enter. This way of reasoning would be able to explain the general pattern we observe. Camerer et al. (2004) explain the pattern of over- and underentry via a very similar logic. For our set up this would require that people do not adjust their strategic reasoning much to their confidence in their own rank. Our results support the lack of such adjustment.

Our results show that demand uncertainty substantially influences the outcome of skill-based competition and that this influence differs with the size of the respective market. This has important implications for the design of skill-based competitions, such as job market tournaments, business start-ups which typically take place in highly uncertain environments and competition in many other markets which experience an increase in demand volatility.

ACKNOWLEDGEMENTS

7. References

- Bolger, F., Pulford, B.D., Colman, A.M., 2008. Market Entry Decisions: Effects of Absolute and Relative Confidence. *Experimental Psychology*. **55**, 113–120.
- Brandts, J., Yao, L., 2010. Ambiguous information and market entry: an experimental study. *Munich Personal RePEc Archive Working Paper*, 25276.

- Camerer, C., Ho, T.-H., Chong, J.-K., 2004. A cognitive hierarchy model of games. *The Quarterly Journal of Economics*. **3**, 861-898.
- Camerer, C., Lovo, D., 1999. Overconfidence and excess entry: an experimental approach. *The American Economic Review*. **89**, 306-318.
- Cawley, J., 2011. A Guide (and Advice) for Economists on the U. S. Junior Academic Job Market. *American Economic Association*, featured article.
- Cohen, J., Hansel, M., 1959. Preferences for different combinations of chance and skill in gambling. *Nature*. **183**, 841-842.
- Fischbacher, U., 2007. Z-Tree: Zurich Toolbox for Ready-made Economic Experiments. *Experimental Economics*. **10**, 171-178.
- Fox, C.R., Tversky, A., 1995. Ambiguity Aversion and Comparative Ignorance. *The Quarterly Journal of Economics*. **110**, 585-603.
- Greiner, B., 2004. The online recruitment system orsee 2.0 a guide for the organization of experiments in economics. Working paper, Department of Economics, University of Cologne.
- Grieco, D., Hogarth, R., 2009. Overconfidence in absolute and relative performance: The regression hypothesis and Bayesian updating. *Journal of Economic Psychology*. **30**, 756-771.
- Grieco, D., Hogarth, R., Karelaia, N., 2007. Risk Taking and Excess Entry: The Roles of Confidence and Fallible Judgment. Working paper.
- Heath, C., Tversky, A., 1991. Preference and Belief: Ambiguity and Competence in Choice under Uncertainty. *Journal of Risk and Uncertainty*. **4**, 5-28.
- Hogarth, R., Karelaia, N., 2009. Entrepreneurial success and failure. Confidence and fallible judgement. Working paper, Universitat Pompeu Fabra, Barcelona.
- Holt, C.A., Laury, S.K., 2002. Risk Aversion and Incentive Effects. *The American Economic Review*. **92**, 1644-1655.

- Karelaia, N., Hogarth, R., 2010. The attraction of uncertainty: Interactions between skill and levels of uncertainty in market entry games. *Journal of Risk and Uncertainty*. **41**, 141-166.
- Koeszegi, B., 2010. Ego utility, overconfidence, and task choice. *Journal of the European Economic Association*. **4**, 673-707.
- March, J.G., Shapira, Z., 1987. Managerial Perspectives on Risk and Risk Taking. *Management Science*. **33**, 1404-1418.
- Moore, D.A., Oesch, J.M., Zietsma, C., 2007. What competition? Myopic self-focus in market entry decisions. *Organization Science*. **18**, 440-454.
- Rothbart, M. and Snyder, M., 1970. Confidence in the prediction and post-diction of an uncertain outcome. *Canadian Journal of Behavioural Science*, **2**, 3843.
- Wu, B., Knott, A.M., 2006. Entrepreneurial Risk and Market Entry. *Management Science*. **52**, 1315-1330.