ERASMUS UNIVERSITY ROTTERDAM

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The combining effect of overconfidence and personality traits on entrepreneurial intentions of students

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Your character is what makes you special and unique in how you behave and what you make of your life. This also applies to your career and ambitions. In Behavioral Economics, a hot topic is the main reasoning why a person decides to become an entrepreneur. Examples of studies in this field are Nicolaou et al (2008) studying the heritability of entrepreneurship; Oosterbeek, Van Praag & IJsselstein (2010) analyzing the impact of education on entrepreneurial skills and Zhao & Seibert (2006) examining the relationship between the Big Five personality traits and entrepreneurship. In this paper, the effect of personality traits and the level of overconfidence on the entrepreneurial intentions of students is discussed. In order to do this, personality traits are measured via the Big Five Inventory (BFI-10), a renowned tool in Psychology to efficiently measure one's traits. Overconfidence is measured by letting the participants of the study set 90% confidence intervals to very difficult trivia questions. The level of overconfidence is the amount of correct answers minus one, as everyone is allowed one wrong answer. The idea of the quiz is that more overconfident people tend to place more narrow confidence intervals, as these persons are more confident in their ability to estimate answers to questions they do not know the answer to. These people will get more questions wrong on average, resulting in them having a higher overconfidence level in the dataset. We find that there is no correlation between either overconfidence and entrepreneurial intentions or personality traits and entrepreneurial intentions, except for that students who are more extraverted tend to have lower levels of entrepreneurial intentions. The absence of relationships in the dataset for this study can be explained in multiple ways. As this study experienced a lack of time and resources to optimally distribute the survey, the dataset consists of only 59 observations. Moreover, I find that this method of measuring overconfidence is questionable. The task might be too vague and the level of overprecision is taken as a proxy for one's total overconfidence. Future research should adapt to this study by also measuring one's perception of their skill relative to others, which is preferably done via an experiment.

Introduction

Starting a business does not happen overnight, it takes a lot of preparation and motivation to become an entrepreneur. The intention to start a business is called 'entrepreneurial intention' in Behavioral Economics. However, the reason why one would want to become an entrepreneur has been a hot topic of research for decades now.

As entrepreneurial intention is planned behavior, it could be explained by one's character, which is built up out of personality traits (Roberts, Wood and Caspi, 2008). These traits are the cause of the way someone thinks, feels and acts in their own unique way. Therefore it is logical to assume that these traits are also a cause of entrepreneurial intentions. However, the will of an individual to start a business is dependent on more than alone their character. For instance, the degree to which someone overestimates their relative ability might also cause higher levels of entrepreneurial intentions (Camerer and Lovallo, 1999). Self-overestimation of one's abilities is called overconfidence and is widely discussed in both psychology and economics.

Kruger and Dunning (1999) visualize overconfidence in a graph resulting from an experiment they performed among students in New York. The conclusion of their research is that people tend to overestimate their competence when their knowledge about a subject is relatively low. After becoming more knowledgeable, the individual realizes that there remains much more to learn, resulting in a massive drop in their confidence level. From this point onwards, the individual experiences a more justified level of confidence related to their competence. This phenomenon is called the Dunning-Kruger Effect, and is depicted in Figure 1.

Figure 1: Dunning-Kruger Effect
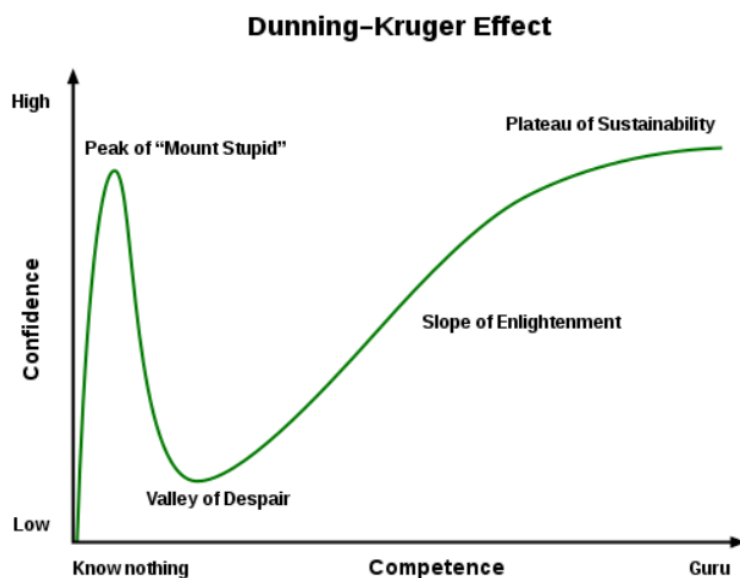
The Dunning-Kruger Effect shows us evidence that individuals tend to overestimate their ability and knowledge when the person is relatively unskilled in a certain subject. There is a high probability that young people with entrepreneurial intentions have little knowledge about what it takes to start their own business, having little to no experience of being an entrepreneur. This would result in nascent entrepreneurs being overconfident, which may lead to a higher probability of failing start-ups (Koellinger, Minniti and Schade, 2007).

As both personality traits as overconfidence influence one's entrepreneurial intention, the question arises how these concepts interact with each other. Therefore, the main research question of this thesis is:

Which personality traits in combination with overconfidence stimulate a student's entrepreneurial intention?

This paper aims to answer this question by first showing which personality traits affect one's entrepreneurial intentions and the effect of overconfidence on one's ambition to start a business. First, existing literature regarding these topics will be discussed. These papers will also be the foundation of the hypotheses of this thesis. Next, the methodology to perform this study will be discussed, followed by a discussion of the data and results. Finally, the research question will be answered using the data gathered and limitations and recommendations for future research will be described.

Literature review and Hypotheses

Entrepreneurial intentions

To predict whether someone will become an entrepreneur, one should look at someone's intentions. As becoming an entrepreneur is planned behavior, one's intentions prior to starting a business should tell the same story (Krueger and Carsrud, 1993). One's intentions can be explained by their personality traits and characteristics.

Personality traits

Personality traits are defined as "the relatively enduring patterns of thoughts, feelings and behaviors that distinguish individuals from one another" (Roberts, Wood and Caspi, 2008). Someone's traits are a combination of the person's characteristics which makes them distinguishable from other persons. In both economics and psychology, there has been debate about the effect of an individual's traits on

their behavior (Buss, 1989). As at the time of writing his paper there were some saying traits do and others saying they do not influence behavior, Buss shows that personality traits in fact do have a causal effect on the behavior of an individual, and that for someone's personality to exist, it is necessary to define their traits.

Goldberg (1981) defined these traits by inventing the Big Five Personality factors. These five categories consist of binaries, in which two extremes are shown. The first is extraversion-introversion, which measures the extent to which an individual is assertive and sociable. The second is agreeableness-antagonism, which concerns the level of cooperation and sympathy of an individual. Next up is conscientiousness-undisciplined, which shows the extent to which one is hardworking and organized. Fourth is openness-closedness, which is related to the degree to which one is reflective and creative. Last is emotional stability-neuroticism, which measures how calm, self-confident and patient an individual is.

Using the Big Five Personality factors, the Big Five Inventory (BFI) was invented. The BFI is a construct where the personality traits of a person are divided into five categories, which are extraversion, agreeableness, conscientiousness, neuroticism and openness, known as the Big Five Personality factors (John, Donahue and Kentle, 1991). These traits are measured in a 44-item long questionnaire, the BFI-44, which should be filled in by the respondent within five minutes. The items are short statements about one's personality, carefully designed by the authors to make sure that they are straight to the point and not open for interpretation. By doing this, the authors ensure there would be no confusion among the participants about the meaning of the statements, leading to a higher level of reliability of the data. The BFI-44 was a very efficient and fast way to show someone's personality for its time, and is highly renowned among psychologists and economists.

Rammstedt and John (2006) later invented an even more efficient way of measuring one's personality by transforming the BFI-44 into a 10-item list, the BFI-10. This survey determines someone's traits by asking only ten questions, while still using the same five categories of traits used in the BFI-44. The authors show that the BFI-10 retains significant levels of reliability and validity, while being way more easy to use in surveys, as the researcher now only has to ask 10 questions, instead of 44. The BFI-10 is nowadays used in many economic and psychological studies, meaning that in both fields of science, this method proves useful to determine one's traits.

By combining the BFI and entrepreneurial intentions, Şahin, Karadağ & Tuncer (2019) find that only a high level of the openness to experience trait correlates with higher entrepreneurial intentions. However, this study tested their theory on students as well as employees, while the intentions

between these groups could very much differ. However, a study among entrepreneurs and managers show significant differences in traits between the two groups (Zhao and Seibert, 2006). Entrepreneurs scored higher on conscientiousness and openness, while managers scored higher on neuroticism and agreeableness. There was no evidence of a significant difference in extraversion between the two groups. This study shows that there are traits which can be applied to specifically entrepreneurs, meaning that there is reason to suspect that having those traits will lead to higher levels of entrepreneurial intentions. Therefore, the first five hypotheses of this study are as followed:

H1a: Higher levels of conscientiousness lead to higher levels of entrepreneurial intentions

H1b: Higher levels of openness lead to higher levels of entrepreneurial intentions

H1c: Higher levels of neuroticism lead to lower levels of entrepreneurial intentions

H1d: Higher levels of agreeableness lead to lower levels of entrepreneurial intentions

H1e: The level of extraversion has no effect on the level of entrepreneurial intentions

Overconfidence

When an individual overestimates the precision of their information or their ability to do certain tasks, economists and psychologists talk about overconfidence (DellaVigna, 2009). However, in many Behavior Economics studies, the definition of overconfidence is taken a bit further by dividing it into three subtypes, namely overestimation, overplacement and overprecision (Moore and Healy, 2008).

In this structure, overestimation defines the type of overconfidence where an individual overestimates their actual ability, performance, level of control or chance of success (Astebro et al., 2014). This type of overconfidence is very closely related to optimism. As a student expects to have 8 out of 10 questions right on an exam, but actually only got 5 correct answers, one might say that this student overestimated its ability. However, the student might also be seen as optimistic, as they may have a more positive general view about events in their life. Researchers can distinguish between overestimation and optimism by letting the student predict general future events, such as the weather for tomorrow, as well as events where the student can influence the outcome, such as the amount of correct answers on a quiz.

Overplacement describes the form of overconfidence where an individual overestimates their relative ability (Camerer and Lovallo, 1999). For instance, when asked to rank their driving ability relative to all other people in a specific region, the majority of the participants think that they are above average, while statistically only 50% of the respondents should be above average. This example shows that at least a part of the people who think that they are above average in a certain subject are overconfident. However, overplacement is hard to measure on an individual level, as the researcher then has to

confirm whether the surveyed person is actually above average or not. Camerer and Lovallo apply this theory of overconfidence on excess entry in a market. As nascent entrepreneurs might think that their relative ability is higher than others, they grow overconfident and might miscalculate risks which can lead to business failures.

The last subtype is called overprecision or calibration. This form of overconfidence measures the validity of probability assessments, and has been a topic of research for a very long time already. Lichtenstein, Fischhoff and Phillips (1977) performed multiple experiments among different groups of people to measure their level of calibration, which resulted in the conclusion that many people are generally poorly calibrated. The authors also find that the degree of overconfidence among the participants is higher when they are faced with more difficult tasks and that overall, people tend to overestimate their ability to assess probabilities. More recently, a similar study has been performed among students at the Erasmus University Rotterdam and the Montpellier Business School (Bernoster et al., 2018). This paper examines the relationship between overconfidence among nascent entrepreneurs and high failure rates of start-ups. Here, the level of overprecision is taken as a benchmark for the total level of overconfidence of an individual. The authors measure the degree of overprecision of an individual by letting them set 90% confidence intervals as answers to relatively difficult general knowledge questions, such as 'What is the total length of the Nile river?'. The amount of incorrect intervals set by a respondent reflects the degree of overprecision of the person. Overprecision is the only subtype that reflects the level of overconfidence of an individual and is the only type that can be tested via a survey, making it the optimal type to use for this paper.

Bernoster et al. (2018) is only one of many economic studies that show that overconfidence might lead to higher failure rates and excess entry to the market. However, the question arises whether overconfident people show higher levels of entrepreneurial intentions. Hence, the next hypothesis of this paper is:

H2: Overconfident students have higher levels of entrepreneurial intentions

Lastly, Schaefer et al. (2004) studied the relationship between the Big Five personality traits and overconfidence. The participants of this study are first asked to complete Goldberg's Big Five personality inventory, consisting of 100 items, after which their level of overprecision is measured. The authors find that there are no significant associations between agreeableness, neuroticism or conscientiousness on overconfidence, while openness does in fact show a relationship with confidence. However, the association between openness and confidence also holds for openness on accuracy, meaning that there is also no case of overconfidence here. Meanwhile, the authors conclude

that extraversion does significantly predict overconfidence, meaning that higher levels of extraversion lead to higher levels of overconfidence. These findings lay the foundation for the last hypothesis of this paper, which is:

H3: In combination with overconfidence, higher levels of extraversion lead to higher levels of entrepreneurial intentions

By testing the hypotheses formulated above, the research question can be answered. How these hypotheses are going to be tested, is explained in the Methodology section of this paper.

Methodology

In order to answer the research question of this paper, a survey will be distributed among dutch students across the Randstad. The survey, masked as a trivia game, consists of general questions about someone (such as age and gender), after which the participant is asked to rank their entrepreneurial intentions. Next, the respondent has to fill in the BFI-10 to measure their personality traits. Finally, the person gets to play the "Trivia Survey" which consists of 10 difficult trivia questions, meant to measure the level of overconfidence of the person.

Measuring the level of entrepreneurial intention is done in the same way as Liñán and Chen (2009) have done. Here, the authors ask the respondent to answer six questions about their entrepreneurial ambition, which include "I am ready to do anything to be an entrepreneur", "My professional goal is to become an entrepreneur", "I will make every effort to start and run my own firm", "I am determined to create a firm in the future", "I have very seriously thought of starting a firm", and "I have the firm intention to start a firm someday". All these items are scored on a 5-point Likert scale, a renowned and frequently used tool to measure one's preferences by letting the respondent choose one option that fits them the best (Joshi et al., 2015). As the person is asked to answer six items on a 5-point scale, the minimum and maximum scores for entrepreneurial intention are respectively 6 and 30. These scores are finally divided by 6, resulting in a 1 to 5 scale for entrepreneurial intention.

Using the BFI-10 invented by Rammstedt and John (2007), one's personality traits are measured by a 10-item questionnaire, which again are answered on a 5-point Likert scale. The questionnaire consists of 2 items per personality trait, where one item is normally scored while the other is reverse scored. As each trait is scored with 2 items on a 5-point scale, they will all end up with minimum and maximum scores of respectively 2 and 10. The final scores will be divided by 2, so that each trait will end up with a 1 to 5 scale.

Finally, the respondents get to play the trivia game. This game is based on the way Bernoster et al. (2018) measured overconfidence. Here, the level of overprecision of the individual is measured by asking them 10 questions of which they are not expected to know the answer to. However, the respondent gets to set an interval for each answer, for which they are 90% confident that they are right. This way, someone who is not overconfident should get 9 out of 10 questions right. Meanwhile, someone who is overconfident, should get less than 9 questions right, as they overestimate their ability to guess the answers, by setting too narrow intervals. The fewer questions answered correctly, the more overconfident one is. As this task might seem vague for the participant, there is a clear instruction shown to the respondent right before they begin the quiz. The instructions are attached in the appendix A in this paper, appendix B shows the Dutch translation for the instructions.

The questions consist of "Number of students following a program at Erasmus in 2020", "Number of cars registered in Germany", "Length of the Tour de France 2021", "World record of home runs by one player in the MLB", "Average number of babies born per day", "Population of earth in the year 1600", "Number of years since the last Glacial Period", "Number of bones in a dog", "Total revenue of Netflix in 2020" and "Average glasses of beer per person during carnaval". On the last page of the survey, the answers to these questions are given such that the respondent can check how good they did if they would like to. The level of confidence is finally measured as the amount of incorrect answers minus one, as every person is allowed to have one question wrong. This results in a scale of -1 to 9, where -1 denotes underconfidence and 9 extreme overconfidence. Thus, the more questions incorrect, the higher the level of overprecision, thus the higher the level of overconfidence.

With this data multiple ordered logistic regression analyses will be performed, where personality traits and the level of overconfidence will predict the level of entrepreneurial intentions. These analyses, alongside the descriptive statistics of the data, are represented in the Data and Results section of the paper.

Data and Results

Using the survey described in the Methodology section, a total of 78 students from the Randstad voluntarily participated in this study. All of the respondents confirmed that they are still studying and currently living in the Randstad. However, not all respondents managed to completely fill in the survey. All 78 participants filled in the general characteristics and entrepreneurial intentions parts, after which 4 seemed to have abandoned the rest of the survey. The remaining 74 went on to fill in the personality traits part, after which another 10 stopped right before the trivia part of the survey. These incomplete

responses result in gaps in the dataset. Table 1 shows the descriptive statistics of the sample, including their gender (0 = female, 1 = male), age (in full years), whether they are a business student or not, if they are a Dutch or international student and the type of program they are following (0 = bachelor's programme, 1 = master's programme).

Table 1: Descriptive statistics of the sample

	Observations	Mean	Std. dev.	Min	Max
Male	78	0.551	0.501	0	1
Age	78	22.141	2.237	18	28
Business	78	0.602	0.493	0	1
Dutch	78	0.885	0.322	0	1
Master	78	0.385	0.490	0	1

Notes: Male, Business, Dutch and Master are all dummy variables where the variables imply that the individual is respectively a male, business student, Dutch and following a master's programme if the value of the variable is 1.

From Table 1 we learn that the sample is made out of 63% males, 42% are business students, almost 85% is a Dutch student, 39% is following a master's programme and that the mean age is a little above 22 years. Likewise, Table 2 shows the means of the variables for entrepreneurial intentions, overconfidence and the Big Five personality traits.

Table 2: Statistics of entrepreneurial intentions and the predicting variables

	Observations	Mean	Std. Dev.	Min	Max
Entrepreneurial Intentions	78	2.499	1.280	1	5
Overconfidence	64	6.141	2.581	-1	9
Extraversion	74	3.318	0.527	2	4.5
Agreeableness	74	3.182	0.719	1.5	5
Conscientiousness	74	3.547	0.580	2.5	4.5
Neuroticism	74	3.284	0.556	2	5
Openness	74	3.480	0.622	2.5	5

Notes: The number of observations differ between variables due to incomplete responses. Scales of the personality traits as well as the entrepreneurial intentions are 1 to 5. Scale of overconfidence is -1 to 9.

Furthermore, we can say some things about the characteristics of the individuals who began the survey, but did not manage to complete it. First, a dummy variable "Completed" is created which returns the value 1 for a respondent who completed the survey and 0 for those who did not manage to fill in all the answers. Then, an ordered logistic model predicts the value for this dummy variable, with the independent variables being Male, Age, Study, Dutch and Master. Table 3 shows the results of this model. Ordered logistic is used here as the dependent variable of this model is a binary variable, one which can only take the value of either 1 or 0. Standard OLS regression fails here as this assumes the dependent variable to be continuous, resulting in the model not accounting for the boundaries of the values which the dependent variable can take. OLS would make it possible for the Y variable to take a value greater than 1 and smaller than 0, which should be impossible. Ordered logit solves this problem by returning probabilities for the dependent variable to have the value 1. This way, this method assures the value of the predicted variable does not go out of bounds.

The ordered logistic model for predicting whether the participant has fully completed the survey is shown in Table 3. None of the variables show statistical significance, which means that no relationship is to be concluded between these characteristics and the probability of one completing the survey.

Table 3: Ordered logistic regression analysis on predicting whether an individual completed the survey

	Completed
Male	0.891
	(1.35)
Age	-0.039
	(-0.53)
Study	0.206
	(0.31)
Dutch	-15.23
	(-0.01)
Master	1.141
	(1.40)
N	78

Notes: Male, Business, Dutch and Master are all dummy variables where the variables imply that the individual is respectively a male, business student, Dutch and following a master's programme if the value of the variable is 1. The independent variable Completed is a proxy for whether a participant fully completed the survey. N equals the total observations. t-statistics in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

Analysis

With the data described above, ordered logistic regression analyses are performed where the level of entrepreneurial intentions of an individual is predicted. In these models, the predicting variables are the levels of overconfidence, extraversion, agreeableness, conscientiousness, neuroticism and openness. As entrepreneurial intention is an ordinal variable, an ordered logistic regression model is preferred over standard OLS regression. This method of analyzing data is preferred for the same reason as previously discussed in the Results section.

First the models with every separate variable predicting entrepreneurial intentions will be shown, alongside a model with all predicting variables. The output for these regressions are shown in Table 4. In Table 5, the same methods are used while also including the control variables and a constant presence of the level of overconfidence.

Table 4: Multiple ordered logistic regression analyses with the level of entrepreneurial intentions as the dependent variable

Entrepreneurial intention	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overconfidence	-0.027 (-0.31)							-0.039 (0.46)
Extraversion		-1.328** (-3.03)					-1.383** (-3.12)	-1.591*** (-3.29)
Agreeableness			-0.029 (-0.10)				-0.030 (-0.10)	-0.161 (-0.46)
Conscientious-ness				-0.135 (-0.48)			-0.300 (-0.85)	-0.467 (-1.13)
Neuroticism					-0.278 (-0.78)		-0.286 (-0.77)	-0.382 (-0.99)
Openness						0.131 (-0.39)	0.191 (0.53)	-0.178 (-0.46)
N	64	74	74	74	74	74	74	64

Notes: N equals the total observations. t-statistics in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

Table 5: Multiple ordered logistic regression analyses with the level of entrepreneurial intentions as the dependent variable, including control variables and the level of overconfidence

Entrepreneurial intention	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	-0.227	-0.196	-0.215	-0.275	-0.228	-0.224	-0.226	-0.274
	(-0.46)	(-0.40)	(-0.43)	(-0.55)	(-0.46)	(-0.45)	(-0.49)	(-0.56)
Age	0.181	0.168	0.174	0.219	0.219	0.191	0.167	0.210
	(1.36)	(1.24)	(1.32)	(1.58)	(1.58)	(1.41)	(1.35)	(1.47)
Business	0.873	0.897	0.856	0.974	0.850	0.874	1.314**	0.962
	(1.62)	(1.65)	(1.58)	(1.79)	(1.56)	(1.63)	(2.62)	(1.73)
Dutch	0.707	0.499	0.782	0.665	0.686	0.706	0.488	0.523
	(0.99)	(0.67)	(1.07)	(0.91)	(0.95)	(0.98)	(0.67)	(0.66)
Master	-0.525	-0.325	-0.508	-0.682	-0.517	-0.566	-0.282	-0.513
	(-0.85)	(-0.52)	(-0.82)	(-1.09)	(-0.84)	(-0.91)	(-0.50)	(-0.82)
Overconfidence	0.030	0.032	0.031	0.017	0.027	0.030		0.012
	(0.32)	(0.34)	(0.33)	(0.19)	(0.29)	(0.32)		(0.13)
Extraversion		-1.388**					-1.330**	-1.531**
		(-2.94)					(-2.99)	(-3.16)
Agreeableness			-0.210				0.063	-0.134
			(-0.60)				(0.19)	(-0.37)
Conscientiousness				-0.495			-0.516	-0.660
				(-1.20)			(-1.38)	(-1.54)
Neuroticism					-0.121		-0.127	-0.234
					(-0.32)		(-0.34)	(-0.60)
Openness						-0.175	0.128	-0.217
						(-0.47)	(0.35)	(-0.54)
N	64	64	64	64	64	64	74	64

*Notes: N equals the total observations. t-statistics in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001*

As can be observed in Table 4 and 5, almost none of the predicting variables is statistically significant. In both the regression analyses only the extraversion variable is statistically significant, which means that we can only conclude a relationship between this variable and entrepreneurial intention. The negative coefficient of extraversion implies that with an increase of 1 level of extraversion, the probability that the level of entrepreneurial intention of the individual decreases by one unit is 0.873 (or 87,3%; according to model 8 of Table 5) with a significance level of $p < 0.01$ (or with 99% certainty). In reality, this means that more extraverted persons are less likely to become entrepreneurs, as their entrepreneurial intention is relatively lower than less extraverted persons.

Regarding the other four personality traits, there is no relationship to be concluded between these traits and the level of entrepreneurial intention of an individual, which is contrary to our expectations. The same holds for the effect of overconfidence on entrepreneurial intentions, as this variable also seemed not to be significant for this sample. The statistical insignificance of the predicting variables lead to the inability to test the hypotheses and thus answer the research question. However, this does not necessarily imply that the theory behind this study is invalid. How and why the predictors for this study show no relationship with entrepreneurial intentions, is explained in the Conclusion and Discussion section of this paper.

Conclusion and Discussion

As shown in the Data and Results section, there are no relationships to be concluded between the independent variables and a student's entrepreneurial intentions, except for that higher levels of extraversion tend to come along with lower levels of entrepreneurial intention. Contrary to the expectations, the latter is independent of the presence of overconfidence among the individual. This means that we cannot confirm hypothesis H3, which states that in combination with overconfidence, higher levels of extraversion should lead to higher levels of entrepreneurial intentions. Regarding all other hypotheses, as none of the personality traits variables nor overconfidence showed statistical significance, these hypotheses cannot be tested. As this is the case, the research question remains unanswered. Either the methods used in this study proved to be not flawless or they were used in the wrong manner. Following is a list of possible explanations of why this study did not reach its preset goal and recommendations for how future research should approach this field of study differently.

Limitations

Due to lack of resources, this study was forced to be carried out via a survey. If there had been more time and money to perform this study, the preferable way to test the hypotheses and thus answer the research question would be to conduct an experiment, where the participant's overconfidence and personality traits could be tested in a much more extensive manner. Mainly overconfidence is hard to measure via a survey. As is mentioned in the Literature review and Hypotheses section, overconfidence is divided into three subparts. Out of these subparts, only overprecision can be measured on an individual basis via a survey. This implies that the overconfidence levels in this study are based on only the overprecision levels of a person, as the levels of overestimation and overplacement remain unknown. In order to have a better view of one's overconfidence levels, all subparts of overconfidence should be measured, which can only be done via an experiment.

Moreover, the way overprecision is measured might not be flawless as well. Overprecision is still an underresearched type of overconfidence (Bernoster et al., 2018), implying that the method to measure it is also still to be improved. The method used in this study has two pitfalls in my opinion, which are (1) the inability of one to estimate difficult intervals and (2) the vagueness of the task. These pitfalls are based upon a dozen participants of this study who reached out to me with quite similar feedback, saying that the questions were too difficult. The first pitfall results in a problem where people who are not necessarily overconfident look very overconfident, only because they are generally bad at this type of task. This type of person will in general have more questions wrong, making them look relatively more overconfident even though this has nothing to do with overconfidence. One could argue that these persons should set bigger intervals, as this would compensate for their relatively lower skill, which leads me to the second pitfall: the vagueness of the task. The goal of the task was to set 90% confidence intervals as answers to the questions, but it can be very hard for someone to know whether they are 90% confident in their answer. How do you know for sure that you are 90% correct when you are faced with a question you should not know the answer to? I believe a lot of people failed to do the task correctly, but instead were just treating it as a guessing game. This results in a problem for the overconfidence variable, as not everyone followed the instructions correctly. Because of this, this variable does not necessarily represent overconfidence, but rather the ability of someone to answer hard questions as well as possible.

Furthermore, due to lack of time the dataset used in this study was made out of only 59 participants. The higher the number of respondents in a survey study, the higher the validity of the results. As 59 participants is relatively low and not that representative for all students in the Randstad, the external validity of this study is very low. To increase this, the number of participants should be way higher.

Overall, a bigger sample size is always preferable as this increases both the reliability as well as the validity of the study, leading to more accurate conclusions.

Future research

The implications named above should be taken into consideration for future research. As mentioned, this method of measuring overprecision is not valid enough for determining the level of overconfidence of an individual. When measuring overprecision the inability of one to make realistic intervals should also be accounted for. This could possibly be done by asking the participants to make a guess of how many questions they got correct at the end of the survey. By doing this, you can measure the difference between how many questions the person thinks they got correct and the actual number of correct answers. This also partly takes away the vagueness of the task, as one does not necessarily have to put 90% confidence intervals.

Furthermore, overconfidence is preferably measured via an experiment. This way, you can account for all subparts of overconfidence. As overprecision is only one element, overestimation and overplacement also play vital roles in one's overconfidence. This paper takes the level of overprecision of an individual as a proxy for their overconfidence level as a whole, while this part only tells something about their own performance. The other two parts of overconfidence tell us more about someone's perception of their skills relative to others, which may also be a determinant to entrepreneurial intentions. By performing an experiment, future research could also look more into what role the Dunning-Kruger effect may play in one's entrepreneurial intentions. As it is very difficult to measure one's competence via a survey, this was not an option for this study. However, this is a possibility when conducting an experiment, as the researcher has the possibility to also test someone's knowledge on different subjects.

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Appendix A Survey text (English version)

Front page:

Welcome to the Trivia Survey! This survey is part of my bachelor thesis and will only take 5-8 minutes to fill in. Thank you in advance for participating!

The Trivia Survey is made out of 10 difficult general knowledge questions, which I don't expect you to know the answer to. To make it a bit easier for you, you get to set an interval for each answer, so you won't have to be spot on to have a correct answer. Before we start with the Trivia Survey, I'd like for you to answer some general questions about yourself. Afterwards, I will explain the rules of the game carefully to make sure that you are fully prepared.

All data will only be used for this study and will be destroyed afterwards.

If you have any questions regarding the survey, you can contact me by sending me an e-mail to bartegmond@outlook.com.

Good luck and have fun!

Instructions trivia game

The Trivia Survey will start on the next page. Before you continue, please read the following instructions.

The game is made up out of 10 difficult trivia questions, which I expect you do not know the answer to. To make it a bit easier for you, you do not have to fill in the exact answer. All I ask you is to fill in a 90% confidence interval for each question. This means that for every question, you set a lower bound and an upper bound, such that you are 90% sure you're correct. For instance:

What is the weight (in kg) of an empty Boeing 747?
Lower bound: 100.000
Upper bound: 300.000
Actual answer: 187.000

In this case you would be correct, as the actual answer falls within the interval.

At the end of the survey, you will get a summary of your responses. All the way down on that page, I will give you the answers to the game, so that you can check how many questions you got correct.

Appendix B Survey text (Dutch version)

Front page

Welkom bij de Trivia Survey! Deze enquête is onderdeel van mijn bachelor scriptie en duurt slechts 5 tot 8 minuten om in te vullen. Bij voorbaat dank voor je deelname!

De Trivia Survey bestaat uit 10 lastige algemene kennis vragen, waar ik niet van verwacht dat jij het antwoord er op weet. Om je tegemoet te komen, hoef je ook niet het exacte antwoord te geven, maar vraag ik je om slechts een interval te plaatsen waarbij jij 90% zeker weet dat het correcte antwoord er tussen valt. Voordat we met de quiz beginnen, vraag ik eerst nog een aantal algemene vragen aan je. Hierna leg ik de regels van de quiz nog een keer uit, zodat we zeker zijn dat je volledig voorbereid bent.

Alle data verzameld met deze enquête wordt alleen gebruikt voor dit onderzoek en zal na afloop worden vernietigd.

Als je vragen hebt omtrent de enquête, kan je deze stellen door een mail te sturen naar bartegmond@outlook.com.

Succes en vooral veel plezier!

Instruction trivia game

De Trivia Survey start op de volgende pagina. Voordat je doorgaat raad ik je aan om de volgende instructie te lezen.

De quiz bestaat uit 10 lastige trivia vragen, waarvan ik verwacht dat je het exacte antwoord niet weet. Om je tegemoet te komen, vraag ik je slechts een interval te plaatsen waarin jij 90% zeker bent dat het antwoord daar invalt. Dit houdt in dat je voor elke vraag een onder- en bovengrens plaatst, zodat je 90% zeker weet dat je het goed hebt. Als je de opdracht op de juiste manier uitvoert, zou je uiteindelijk 9 antwoorden goed hebben. Een voorbeeld:

Hoeveel weegt een lege Boeing 747? (in kg)
Ondergrens: 100.000
Bovengrens: 300.00
Antwoord: 187.000

In dit geval zou je het correct hebben, gezien het antwoord binnen het interval valt.

Aan het einde van de enquête krijg je een samenvatting van de antwoorden die je hebt gegeven. Als je op die pagina helemaal naar beneden scrolt, zou je je eigen antwoorden kunnen controleren om erachter te komen hoe goed je het hebt gedaan.