ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis [programme Behavioural Economics]

THE IMPACT OF EMOTIONS ON OVERCONFIDENCE BIAS,
IN THE CONTEXT OF FINANCIAL LITERACY

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Abstract

This study wants to explore the relationship between positive and negative emotional states and overconfidence levels in the context of financial literacy. It does so by using a randomized control trial. A survey was designed to determine emotional levels and overconfidence levels when assessing the percentage of correct answers to some questions of financial literacy, with two treatments to elicit positive and negative emotions, in the middle of the survey. This was done to measure the level of confidence in the assessment of correct answers to the questions before and after the treatment.

It was found that a higher level of positive emotional state leads to an increase in overconfidence levels; more in detail, a point more on the scale assessing positive emotions led to an increase of 0.079 points in the overconfidence levels (on a scale from -5 to 5), ceteris paribus (effect statistically significant at the 10% level). It must be noted that this effect has not a great magnitude and that the significance level is relatively high. No significant relation was observed between negative emotional states and a decrease in overconfidence levels.
Also, being more overconfident by 1 point pre-treatment led to a decrease in overconfidence levels of 0.453 points, ceteris paribus (effect statistically significant at the 1% level), meaning that, the more the respondents assessed their percentage of correct answers to the financial literacy questions, the less overconfident they became, and this is what is referred to in the thesis as learnings effects.

This implies that individuals could regulate themselves by controlling their positive emotional state and could periodically test themselves to assess their confidence in financial literacy, to decrease overconfidence level in this context.

Acknowledging the weaknesses and limitations of this study is fundamental. The results, at the same time, are promising, and could further stimulate research in this context. This is of high importance, as being overconfident in financial literacy can lead to some adverse effects on personal financial management.

Summary

1. Introduction

The main focus of this thesis is to analyse the impact of emotions on overconfidence levels in the context of financial literacy. The decision to analyse this behavioural bias in this specific context is because being overconfident about an individual's financial knowledge has several important implications. Individuals that overestimate their knowledge of financial literacy are more prone to engage in risky behaviours when it comes to investments (Tokar Asaad, C., 2015), less likely to seek financial advice to invest (Porto, N. & Xiao J.J., 2016), and more probable to participate in the financial markets (Xia T. & al., 2014). It comes then natural to assume that being overconfident about one's financial literacy can translate into riskier behaviour and that this can be detrimental to one's financial management.

Therefore, analysing whether emotions can have a role in increasing or decreasing overconfidence levels can be relevant in studying this behavioural bias, as individuals could then self-regulate their emotions if that would be the case (it is beyond the scope of this thesis to define self-regulation strategies).

Although the relevance of measuring the level of overconfidence in the context of financial literacy and comparing it to the effect of, for example, overconfidence in trading performances may not be immediate, it is still relevant, and of primary importance, to see how overconfidence can affect us in our perception of financial knowledge. Even if it may be true that most people will never have the same responsibilities as a Chief Financial Officer of an important firm, financial economics is still an important part of our daily life, and so financial literacy is. At a certain point in their life, individuals will be surely trying to understand what inflation is and how it is affecting their life, they will have to choose what is more effective and efficient for them in terms of retirement plans, or they will have to calculate which is the most favourable option when considering different loan alternatives.

This study is relevant because understanding whether there are some alterations in our perception of our financial knowledge due to emotions through overconfidence could improve our life. For example, an altered perception of our knowledge could lead us to be miscalibrated about our estimates in a real-life decision-making scenario. Individuals could either be overestimating their future returns while investing in pension funds, or they could not consider transaction costs while investing in a mutual fund, or misunderstanding why they are losing buying power due to inflation.

Understanding more about how overconfidence works, especially from a relatively innovative perspective, the one of emotions, could help to gain new insights on this bias and further advance the knowledge in the field of behavioural economics. Nonetheless, as discussed in the chapters "Literature Review" and "Discussion", whenever significant results are found, it could stimulate new ways to decrease possible adverse effects of overconfidence in the decision-making process, other than stimulating new research on the topic.

The main articles this study focused on, studying the role of emotions on overconfidence, are the ones of Filiz, I. (2020) and of Im, M. & Oh, J. (2016) (they are discussed more in detail in the "Literature Review" paragraph).

Filiz I. (2020) studies the role of positive and negative emotions on overconfidence levels, but not for individual investors and not in the financial decision-making process, but in a more general context of general knowledge and mathematics. He, in any case, does not find any statistically significant effect on overconfidence by inducing positive and negative emotions.

Im, M. & Oh, J. (2016) study the regulation of positive emotions as a de-biasing mechanism for overconfidence in the context of stock investments. They propose a variety of emotion-regulating strategies.

This thesis revolves around a randomized control trial where participants in the survey are asked to answer some questions about financial literacy and to assess the percentage of questions they think they correctly responded to (the relation between the percentage of correct answers and the self-assessment identifies the levels of overconfidence pre-treatment). After these questions, participants are randomly and evenly assigned to one of two treatments. The treatments are designed to elicit positive (for the positive emotions treatment group) or negative (for the negative emotions treatment group) emotions. The final sample of the experiment consists only of observations of individuals that successfully showed positive scores regarding the emotions elicitation, through PANAS surveys (surveys where individuals state how intense they feel certain emotions on a scale), meaning that for these respondents the treatment fulfilled its purpose. After the treatment, the participants are asked to answer some more questions about financial literacy, and again they have to assess the percentage of correct answers (to identify the levels of overconfidence after the treatment, which is the dependent variable of this experiment).

This experiment was designed to test whether the emotional state of individuals can affect their levels of overconfidence in their self-assessment of correct answers (*H1*), whether positive emotional states increase levels of overconfidence (*H1a*) and whether negative emotional states decrease them (*H1b*), and whether individuals, when experiencing positive and negative emotional states have learning effects, intended as a decrease in overconfidence levels by simply proceeding through the survey (*H2*).

These hypotheses were analysed in the more general setting of the research question of this thesis, which is asking whether eliciting positive and negative emotions in individuals has an impact on their overconfidence levels in the assessment of correct answers to the survey.

The main results found in this experiment are that eliciting positive emotions increases overconfidence levels after the treatment, confirming *H1a*, as an additional point in the score variable assigned to assess positive emotions, increases overconfidence levels by 0.079 points, ceteris paribus, and with a significance level of 10%, and that the level of overconfidence pre-treatment is the main driver of the decrease of the level of overconfidence post-treatment, suggesting that individuals, after being elicited with positive and negative emotions, experience a learning effect, confirming *H2*.

Overconfidence is a cognitive bias, relevant in the economics context, and in the financial literacy scenario, as better discussed in the "Literature Review" chapter. There are several definitions of overconfidence, but each one of them slightly differs due to the context in which it is studied.

In a general context, "*Psychologists have determined that overconfidence causes people to overestimate their knowledge, underestimate risks, and exaggerate their ability to control events*" (Nofsinger J.R., 2017, p. 42).

Another definition of overconfidence is given by Im, M. & Oh J. (2016), p. 210, who affirm that overconfidence is a "*cognitive bias in which subjective certainty is higher than objective accuracy*".

This thesis revolves around these two definitions of overconfidence, as the overall level of overconfidence calculated through the randomized control trial is based on a dissonance between subjective certainty and objective accuracy, or, in other words, an overestimation of individuals' knowledge.

With the premise that overconfidence is divided into two separate effects, according to Nofsinger J.R. (2017), miscalibration and the better than the average effect, these two definitions relate to the concept of miscalibration, while the better than the average effect has not been addressed.

Nofsinger defines miscalibration in the following way: "*The miscalibration facet is that people's probability distributions are too tight*", meaning that, in making predictions or estimating probabilities, individuals are overly confident and tend to focus on narrower distributions of probability, instead of considering a wider set of outcomes.

On the other hand, Nofsinger defines the better-than-average effect as when overconfident individuals tend to think to be above average in a certain field of skills and competencies: "*The better-than-average effect simply means that people have unrealistically positive views of themselves*".

The overestimation of knowledge, the underestimation of risks and the exaggeration of an individual's ability to control events are factors that can heavily influence an individual's self-assessment of his/her knowledge in financial literacy, and possibly their performances in the financial markets and their daily life concerning financial decisions, as a direct consequence of an overestimation of their objective capabilities when it comes to financial capabilities.

2. Literature Review

In the "Literature Review", this thesis is initially reviewing papers that are relating emotions to overconfidence, even if not in the same context of this study. This is because there are no specific studies (or at least the author of this thesis could not determine otherwise) that are studying the role of affects on the overconfidence bias in financial literacy, excluding the ones present in this paragraph. After these studies, the literature review is focusing on the specific role of overconfidence in financial literacy. It follows that this chapter is trying to link the role of emotions on overconfidence levels in the specific context of financial literacy.

Affects have been linked to overconfidence in the context of financial decision-making, but not in the one of financial literacy. Im, M. & Oh, J. (2016) study overconfidence as related to emotions, in the sense that they claim that overconfidence is a direct result of emotional states felt by the participants of the study. They work in the context of individual investors while this thesis focuses on the context of financial literacy.

Filiz, I. (2020) analysed how emotions affect overconfidence through a different emotion-elicitation method (via some movie clips instead of pictures as it was implemented in this thesis) and in the context of general knowledge.

Im, M. & Oh, J. (2016) work on the assumption that overconfidence is closely related to strong emotions, and therefore, strong emotions impact the decision-making process. They analyse the relationship between overconfidence, positive emotional reactions, and strategies for regulating emotions after a gain in the financial market.

They show that more overconfident investors have inferior control over pride and other positive emotions than investors. Overconfidence is also related to poorer performances due to strong emotional reactions. They also discover how different tendencies of overconfidence have a different use of cognitive regulation strategies after experiencing a gain. Higher overconfidence brings investors to self-attribute the profit earned, increasing even more overconfidence. By reinterpreting the gain experience from a different perspective, in particular by thinking about the possibility that the same individual could incur in a loss the next time, Im and Oh arrive to decrease the self-attribution of the gain. They ultimately suggest that investors should think and reflect more on their financial performances.

Filiz, I. (2020) successfully induce emotions through some movie clips, but the overconfidence level observed in his sample is not significantly higher between the three different moods he

elicited (negative, neutral and positive). He finds that the individuals in the group where he induced neutral emotions have greater learning effects regarding overconfidence, as they assess their performances more accurately after seeing the movie clips. It cannot be said the same for the groups where positive and negative emotions were induced.

It must be noted that his research was not conducted in a financial context. Filiz asked 25 questions about general knowledge and 25 about mathematics in five rounds (each round contains five questions about general knowledge and five about mathematics). After each round, the participants are shown some movie clips to induce emotions (positive or negative or neutral), after which the participants are asked to self-assess their performance and how each respondent performed compared to the others.

Even though not conducted in the same settings and context, this paper is still relevant to this thesis as it studies the role of emotions on learning effects. Based on its findings, this thesis formulated its second hypothesis *H2*, which states that individuals should not have any kind of learning effect during the course of the survey, intended as a decrease in overconfidence levels due to individuals' acknowledgement of their financial literacy knowledge and their self-assessment of correct answers given.

Ifcher, J., & Zarghamee, H. (2014) conduct a similar experiment to the one of Filiz and find that inducing positive emotions increases overconfidence levels but only in men. They do not find significant results regarding negative emotions. They find that positive emotions are positively associated with dopamine release, which increases overconfidence as the individuals self-enhance their own accuracy levels.

All these studies were not conducted in the specific context of financial literacy, contrary to this thesis, which wants to bridge the gap between the affects implications on overconfidence levels and overconfidence in financial literacy.

The following studies have successfully linked higher overconfidence levels to some real-world effects, as explained in the "Introduction" chapter. It follows that being overconfident regarding financial literacy results in potentially detrimental investors' behaviours.

Tokar Asaad, C. (2015) discovered that US citizens with a higher confidence in self-assessed knowledge have a higher propensity in engaging in risky behaviour in the context of finance, compared to individuals that have a lower overconfidence regarding their financial knowledge. They tend to overestimate their knowledge of the financial world and underestimate risk when facing decisions in a financial context.

Porto, N. & Xiao J.J. (2016) show how overconfident individuals in the context of financial literacy are less likely to seek financial advice as a means to invest and complement their financial capabilities, and more likely to follow financial advice when it comes to managing debt and taxes.

Xia, T. et al. (2014) state that for individuals, being overconfident about their financial knowledge increases the probability of participating in the stock market by 20% compared to underconfident individuals, at a similar rate as individuals that have a higher objective financial knowledge. They also state that this is risky behaviour on behalf of these individuals, and it may result in a financial loss.

2.1 Research Questions and Hypotheses

The main research question of the thesis is the following:

"*Does eliciting positive or negative emotions on individuals, have an impact on their overconfidence levels in the assessment of their capabilities of financial literacy?*"

Based on the literature review, the thesis formulates the following hypotheses.

H1.   Based on the paper of Im, M. & Oh, J. (2016), the emotional state of individuals affects their overconfidence level in the assessment of their levels of financial knowledge, in the context of financial literacy.

    H1a.   Positive emotional states will imply higher overconfidence levels.

    H1b.   Negative emotional states will imply lower levels of overconfidence.

H2.   Based on the paper of Filiz, I. (2020), and assuming that overconfidence in self-assessment is not related to the kind of questions asked (as that study was not focusing on financial literacy but on general knowledge), overconfident individuals when feeling positive and negative emotions, do not have any kind of learning effect over the confidence in self-assessment of correct answers. In this thesis, a learning effect is intended as a decrease in overconfidence levels after the treatment driven by the overconfidence levels pre-treatment. Therefore, learning effects indicate that individuals lower their overconfidence levels as they go through the survey.

To test these hypotheses, this study will measure the participants' emotional levels, positive or negative depending on the assignment of the treatment, and compare their level of overconfidence, before and after inducing emotions.

3. Experimental design

For the data collection, a survey was designed in the following way:

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┌─────────────────────────────────────┐
│      Introduction and consent        │
└─────────────────────────────────────┘
                 ↓
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│        Demographic questions         │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│   #1 set of financial literacy       │
│            questions                 │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│  Accuracy assessment from the        │
│           participant                │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│     Randomly assigned treatment      │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│   #2 set of financial literacy       │
│            questions                 │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│  Accuracy assessment from the        │
│           participant                │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│          End of the survey           │
└─────────────────────────────────────┘
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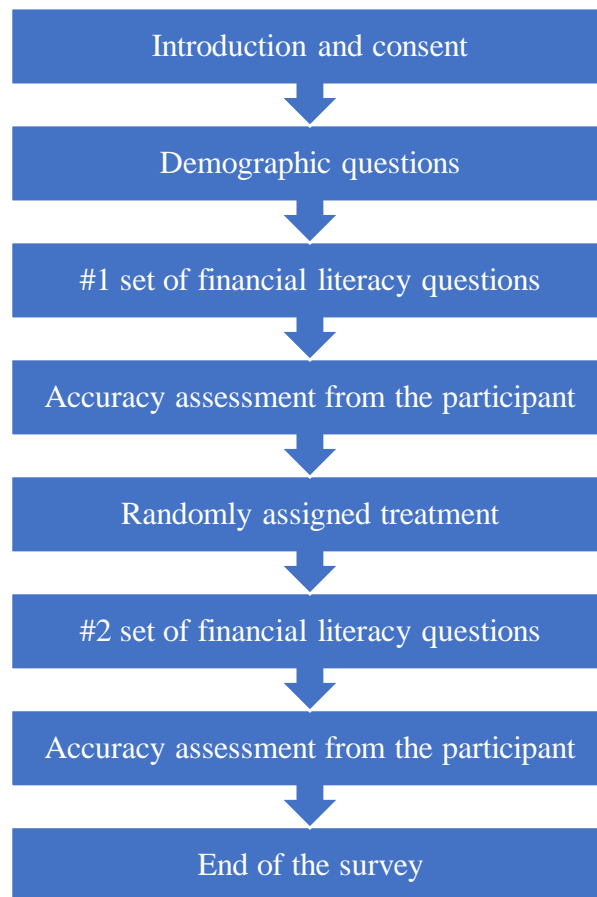
Figure 3.1 - Flowchart of the survey

For the target sample of this study, there was not any kind of limitation. Each person, over 18 years of age, could have participated in the study.

200 subjects answered the survey. Out of these 200 individuals, 101 subjects were assigned to the positive emotions treatment, while 99 were to the negative one. After selecting only the observations of individuals that successfully responded to the treatments, 141 observations remained. 81 individuals got assigned to the positive emotions treatment and 60 to the negative emotions treatment.

In the first part of the survey, there was an introduction and a question asking for the consent to participate in the survey. In this part, it was briefly explained to the participants what the study is about, and it was asked to the participants if they were over 18 years old. If not, the survey would have automatically ended.

Following the introduction, there were demographic questions. In this part, the participants were asked to give some information, including, *age*, *gender*, *nationality*, *level of educational attainment* and *field of studies*.

Proceeding on, it was found the first set of financial literacy questions. In this section of the survey three questions about financial literacy were asked (they are found in the Appendix A.). All the questions in the survey (except for the last one, formulated in the same style) are taken from the surveys of Annamaria Lusardi (Lusardi A. & Mitchell O. S. 2011). These questions, to effectively measure financial literacy, have to fulfil 4 main characteristics:

1. **Simplicity**: the point of these questions is to measure basic financial concepts.
2. **Relevance**: the questions have to be relatable to the daily life of the respondents.
3. **Brevity**: to make sure that these questions can be widely adopted by other studies (this thesis is an example of this concept).
4. **Capacity to differentiate**: these questions must be able to differentiate different financial knowledge levels.

After the questions about financial literacy, there was the first accuracy assessment from the participants. The participants were asked to assess how many answers they think they got correct out of the 3 questions about financial literacy. They also had to assess with which level of confidence they were assessing the number of correct answers, on a scale from 1 (*Not at all confident*) to 5 (*Completely sure*).

After the first self-assessment, there was the randomly assigned treatment. Based on the study from Kurdi B. et al. (2017), the OASIS (Open Affective Standardized Image Set) pictures database, was selected for the treatment due to two specific characteristics.
First of all, there is a large number of images in four categories. The images are also easy to explore and select, based on their rating of arousal and valence given by individuals when asked for feedback in the original study of the author.

Then, the pictures are collected in 2015, so this database is more recent compared to other ones, such as the IAPS (International Affective Picture System, one of the most used and recognized sets of images used to elicit emotions), and easy and free to access (this dataset is not protected by copyrights).

The respondents were evenly and randomly distributed to one of the two treatments, which could have either been about positive or negative emotions (it works in the same way across the two treatments). Firstly, a set of 5 pictures was shown to the participants for a minimum of 5 seconds (they cannot move on to the next picture/question before 5 seconds). The pictures for the positive and negative emotions treatments can be found in the Appendix A.

Regarding the pictures present in the survey, they were selected by using a tool found on the website of the creator of the dataset (the link to the website can be found in the Appendix A.). This tool regresses the different pictures present in the dataset based on the emotional valence and arousal ratings given by the respondents of the original study on the OASIS database. The pictures are divided into four categories, *animal*, *object*, *person,* and *scenery*.

Since the category "Object" has the lowest rating in valence and arousal, and since the most relevant pictures in the "Person" category were either pictures with explicit nudity or with visualized traumatic and violent scenes, this study decided to focus on the 3 most relevant images in the category "Animal" and on the 2 most relevant images in the category "Scenery" for ethical reasons.

After the pictures were shown, a PANAS (Positive and Negative Affect Schedule) survey was required to complete before moving on with the survey. Participants had to assess how they felt regarding different emotions (*interested*, *distressed*, *excited*, *upset*, *attentive*, *guilty*, *enthusiastic*, *hostile*, *inspired*, *ashamed*) on a scale from 1 (*Very slightly or not at all*) to 5 (*Extremely*).

After the treatment, there was the second set of financial literacy questions. In this section of the survey three more questions about financial literacy were asked (they can be found in the Appendix A. section as well).

After the second set of financial literacy questions, there was the second accuracy assessment from the participants, which works exactly as the first one.

Finally, there was the end of the survey, where the participants received feedback on their results on the financial literacy questions and a message was shown informing them that the survey was over.

Approximatively, it took 5 minutes for participants to end the survey.

The study introduced several variables to assess various aspects relevant to the study (all the sample data were analysed by using STATA; the variable name used in STATA can be found in the parenthesis).

The dependent variable of this study is the overall level of overconfidence of the participants after the treatment (*overall_overc_2*). This study is analysing how this overall level of overconfidence is behaving considering the independent variables, through an OLS regression. Other independent variables control for age (*age*), gender (*gender*), nationality (*country*), the level of educational attainment (*education_level*) and the field of studies (*field_studies*). More information about the categories included in these variables can be found in the Appendix B.

The overall level of accuracy of the financial literacy questions (*score_0*) is a score obtained by the participant by answering the financial literacy questions. There is a minimum of 0 points and a maximum of 6 points (1 point per correct answer). This score is shown at the respondent at the end of the survey.

The level of accuracy in the first set of questions (*results_1*) is a score obtained by answering the first 3 questions about financial literacy. There is a minimum of 0 points and a maximum of 3 points.

The level of accuracy in the second set of questions (*results_2*) is a score obtained by answering the last 3 questions about financial literacy. There is a minimum of 0 points and a maximum of 3 points.

The level of overconfidence before the treatment (*overall_overc_1*) is a score obtained conjunctively by summing both the questions in the first accuracy assessment by the participant and the level of accuracy in the first set of financial literacy questions. The participants are asked to give feedback on their answers to the financial literacy questions and then have to assess with which level of confidence they are assessing the number of correct answers (*not at all, slightly confident, confident, really confident, completely sure*). They obtain points depending on what they answer; if the respondents think they got 0 correct answers, they get 0 points, if the respondents think they got 1 correct answer, they get -1 point, if the respondents think they got 2 correct answers, they get -2 points and if the respondents think they got 3 correct answers, they get -3 points.

When asked with which level of confidence, if they answer "*Not at all*", the respondents get 2 points, if they answer "*Slightly confident*", the respondents get 1 point, if they answer "*Confident*" they get 0 points, if they answer "*Really confident*" they get -1 point and if they answer "*Completely sure*", they get -2 points.

These scores (which represent the variable overconfidence_1) are then added to the score obtained with the level of accuracy in the first set of questions about financial literacy. Therefore, the level of overconfidence has a minimum value of -5 and a maximum value of 5. If a respondent gets a value of 0, he is considered neither overconfident nor underconfident, while <u>he is considered overconfident if he gets a negative value and underconfident if he gets a positive value.</u>

The level of overconfidence after the treatment (*overall_overc_2*) score is obtained in the same way as the level of overconfidence before the treatment, by using the values of the variables *results_2* (the level of accuracy in the second set of financial literacy questions) and *overconfidence_2* (the level of overconfidence regarding the accuracy of the answers in the second set of questions).

The level of positive and negative emotional involvement (*panas_positive* & *panas_negative*): in the PANAS survey, respondents have to state how they feel about particular emotional states (*interested*, *distressed*, *excited*, *upset*, *attentive*, *guilty*, *enthusiastic*, *hostile*, *inspired*, *ashamed*) on a scale (*very slightly or not at all*, *a little*, *moderately*, *quite a bit*, *extremely*). For the positive (negative) emotions intervention, during the PANAS survey, respondents get a positive score based on whether they feel positive (negative) emotions and a negative score if they feel negative (positive) emotions. There is a maximum of 20 points and a minimum of -20. A positive number indicates that a person is feeling positive (negative) emotions.

The scores are assigned, for emotions that the study wants to elicit, depending on which treatment the respondent gets, when answering with "*Very slightly or not at all*", individuals get 0 points, with "*A little*", 1 point, with "*Moderately*", 2 points, with "*Quite a bit*", 3 points and with "*Extremely*", 4 points.

This means that, for example, if a respondent gets the positive (negative) emotions treatment the study then is focused on eliciting positive (negative) emotions. So, whenever the respondent may express positive (negative) emotions trough the PANAS survey, points are added, and vice-versa, for the emotions that the opposite treatment wanted to elicit, points are deducted.

Participants are deducted by 0 points if answering "*Very slightly or not at all*", 1 point for "*A little*", 2 points for "*Moderately*", 3 points for "*Quite a bit*", 4 points for "*Extremely*".

The variables *time_pos* and *time_neg* were created as an average measure of the time that the participants spent on each image in their respective treatments.

These measures were then rounded to the first 3 decimals numbers with the creation of the variables *time_pos_round* and *time_neg_round*.

These variables were used in two regressions (one between a *panas_positive* and *time_pos_round* and one between *panas_negative* and *time_neg_round*) to see whether spending more time on the pictures drove the PANAS surveys' scores (these regressions can be found in the Appendix D.).

The variable *time_pos_round* was used to create a variable (*positive*) that assumes value 1 is *time_pos_round* is higher than 0 and 0 otherwise. This variable is meant to distinguish the group that received the positive treatment from the group that received the negative treatment. This was relevant for computing two-sample Wilcoxon rank-sum test.

4. Results

When analysing the effectiveness of the treatments, out of 101 observations belonging to the positive emotions treatment, 81 individuals experienced positive emotions, or, in other words, their scores of the PANAS survey were higher than 0. It means that 80.2% of individuals in the group experienced positive emotions.

Out of 99 observations for the negative emotions treatment, 60 individuals got scores higher than 0, so only 60.6% of respondents experienced negative emotions.

Based on these statistics alone, it seems that the positive emotions treatment was more effective in eliciting positive emotions, while the negative was less effective.

The scores obtained by individuals in the different groups can be visualized in figure 4.1.
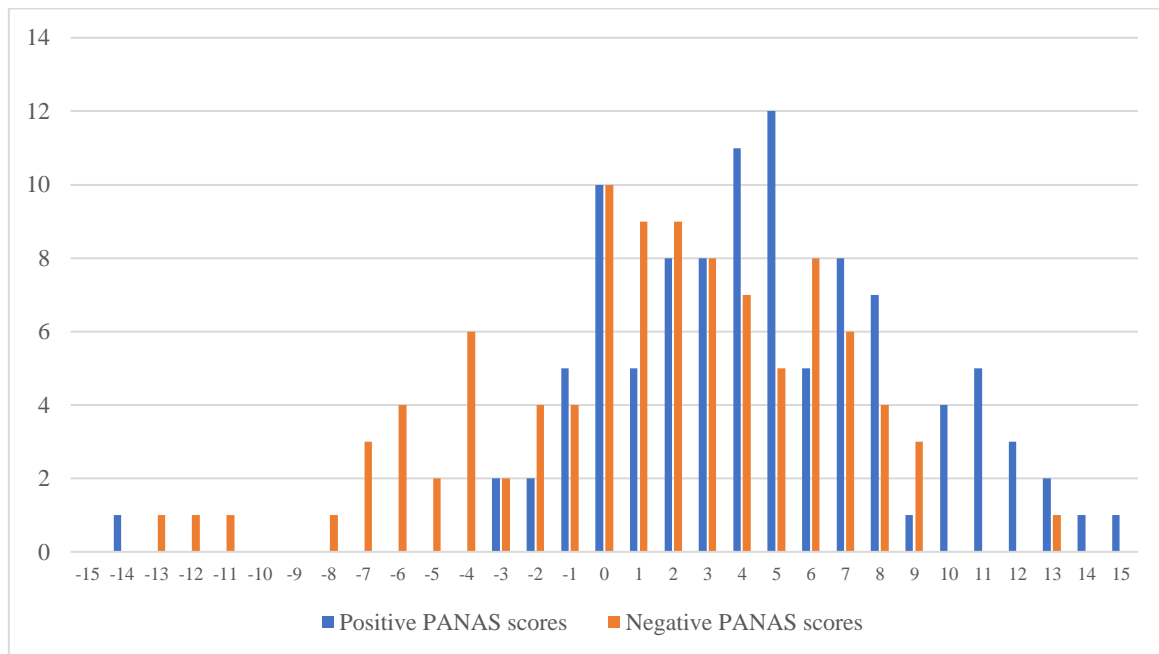
Figure 4.1 – PANAS scores values for positive and negative emotions treatment groups
(Expressed in number of individuals on the y axe and PANAS scores units on the x axe)

A two-sample Wilcoxon rank-sum test was performed to measure the distribution of the overall level of overconfidence after the treatment between the positive and negative groups. It is not possible to reject the null hypothesis that there is a significant difference between the two groups due to a p-value of 0.216. Therefore, the two treatments do not have a statistically different effect across treatments, even if the mean values of overconfidence levels are different across the two groups. Therefore, the different mean values across groups (shown in figure 4.2) could be attributable to chance.
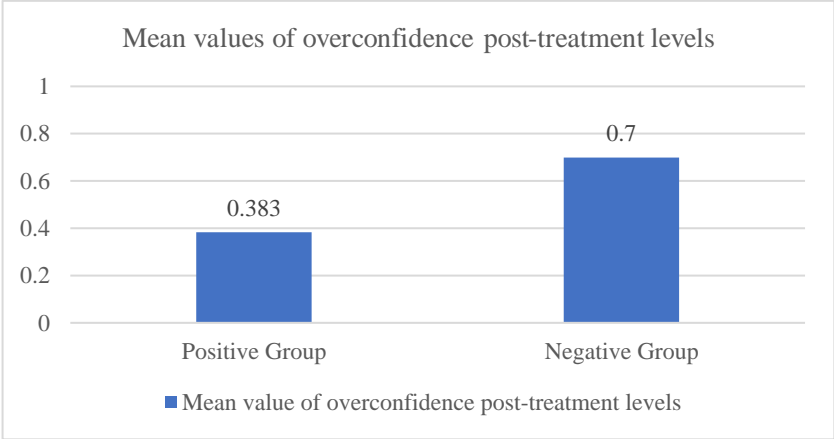
Figure 4.2 – Comparison of the mean values of overconfidence post-treatment
across positive and negative groups, on a scale from -5 to 5
(A higher score implies lower overconfidence levels)

Regarding the composition and the demographic statistics of the entire sample (without corrections), as mentioned in the chapter "Experimental Design", there are several demographic variables considered in the experiment and in the data analysis.

The variable age had a minimum value of 18 years old and a maximum value of 86 years old. The mean value was 24.82 years old.

For the variable gender, in the entire sample there were 85 females, accounting for 42.5% of all observations, 113 males (56.50% of the sample) and 2 individuals preferred not to answer about their gender (1% of the sample).

The most represented country in the sample was Italy, with 162 observations out of 200, accounting for 81% of all observations. Albania was the second most represented country, with 11 individuals accounting for 5.5% of all observations.

In the entire sample, 75 individuals completed high school (accounting for 37.5% of all observations), 102 individuals completed a bachelor's degree (accounting for 51% of all observations), 20 individuals completed a master's degree (accounting for 10% of all observations), and 3 individuals completed a PhD (accounting for 1.5% of all observations).

Most individuals completed or are attending Human Studies degrees (21.11% of all observations), while individuals coming from a background in Business and Economics account for 20.6% of all observations and individuals coming from Financial Studies for 3.52% of all observations.

In Appendix C. can be found more graphs showing the demographic data before and after correcting the sample for the PANAS scores, for both groups.

Table 4.1 Results of the general regression of overconfidence level post-treatment with all the control variables

Variable	Coefficients
Overall Overconfidence pre-treatment	0.453***
	(0.095)
Age	- 0.011
	(0.012)
Gender (male is the baseline category)	
Female	- 0.912***
	(0.276)
Prefer not to Answer	0.937
	(1.575)
Field of Studies (Social Sciences is the baseline category)	
Human Studies	2.680***
	(0.600)
Natural Sciences	2.277***
	(0.594)
Engineering and Technology	1.487**
	(0.669)
Medical and Health Sciences	1.322
	(0.810)
Economics and Business	2.337***
	(0.617)
Financial Studies	0.967
	(0.798)
Art and Design	2.425***
	(0.771)
Education Level (High School degree is the baseline category)	
Bachelor's degree	0.102
	(0.316)
Master's degree	- 0.184
	(0.437)
PhD	- 0.753**
	(0.346)
Nationality (Albania is the baseline category)	
Belgium	- 0.184
	(0.623)
Chile	1.487
	(0.958)
Croatia	0.573
	(0.748)
Finland	1.223
	(0.786)
France	0.159
	(0.847)
Germany	0.326
	(0.582)
Greece	0.747
	(0.490)
Hungary	0.717
	(1.03)
India	- 0.461
	(0.0.661)
Italy	1.437**
	(0.553)
The Netherlands	0.929
	(0.840)
Poland	3.485***
	(0.830)
PANAS survey's score for positive emotions	- 0.079*
	(0.043)
PANAS survey's score for negative emotions	- 0.008
	(0.061)
Constant	- 1.710**
	(0.729)
Observations	141
R^2	0.427

Note. Standard errors are in parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

This regression only considered the observations relative to individuals with positive PANAS scores.

The variables *time_pos_round*, *time_neg_round* and *positive* were excluded from the regression due to endogeneity concerns. As mentioned before, in the Appendix D. it is possible to find two regressions between the average time spent by the participants on the pictures of the treatments and the PANAS surveys' scores.

All the results in the regressions of the thesis are robust to heteroskedasticity.

The main driver of the overall overconfidence level after the treatment is the overall overconfidence level before the treatment. One additional point in the pre-treatment overconfidence score increases the post-treatment overconfidence score by 0.453 points, ceteris paribus. This effect is statistically significant at a 1% level. This variable was designed in such a way that increasing its points means that individuals are less overconfident. This means that, the more the participants went into the study, the less overconfident they became. As this was identified as a learning effect, this finding does not confirm what was hypothesized by *H2*, that individuals do not have any kind of learning effect when experiencing positive and/or negative emotions.

There is a statistically significant (at the 10% significance level) effect on the overall overconfidence level post-treatment by having a positive score on the PANAS survey, ceteris paribus. For every point more in the positive PANAS survey score, the overconfidence level score decreases by 0.079 points (therefore it slightly increases the level of overconfidence). Although it is not a strong effect, this result is confirming the hypothesis that positive emotional states increase the level of overconfidence. This confirms what was hypothesized by *H1a*, or that positive emotions increase overall overconfidence levels in individuals.

Considering the emotional influence derived from the scores of the negative PANAS survey, there is not a statistically significant effect on the score of the overconfidence level. This contradicts *H1b*.

5. Discussion

Before proceeding with the discussion, it seems appropriate to remind the readers that higher scores in the overconfidence score post-treatment equal to lower levels of overconfidence, due to the way this variable was designed.

The overall level of overconfidence pre-treatment drives the overall level of overconfidence post-treatment. Scoring a point more in the overall level of overconfidence post-treatment increases the score of overconfidence post-treatment by 0.453 points, ceteris paribus. This effect is statistically significant at the 1% significance level. This means that in the second set of financial questions, participants were less overconfident. It is suggestive to interpret this result as an improving learning effect, which is contrary to what Filiz. I. (2020) found in his study. He did not find any statistically significant results for learning effects regarding individuals who were the subjects of negative and positive emotions elicitation, while he found statistically significant results for individuals with neutral emotions. It has to be noted though, that this study did not elicit neutral emotions and did not find any statistically significant results for the negative emotions group either.

Confirming partly the first hypothesis of this study (that positive emotional states can increase the individuals' level of overconfidence), having a positive PANAS survey score (which implicates that positive emotions were successfully elicited in the respondents) lowers the score of the level of overconfidence post-treatment, meaning that individuals are more overconfident when assessing the percentage of correct answers. In particular, every point that a participant scores more in the positive PANAS survey, decreases the score of the overall level of overconfidence post-treatment by -0.079 points, ceteris paribus. This effect is statistically significant at the 10% significance level. Although this effect does not have a high magnitude, it has to be considered that the experimental settings were not optimal to properly elicit emotions. This will be analysed more in detail when discussing the limitations of this experiment in this paragraph.

To analyse whether there are other drivers, other than the average time spent on the pictures of the treatment (it is possible to find additional regressions in Appendix D.), to the emotional engagement of the participants, such as the picture quality for inducing an emotional response, a more in-depth analysis should be made. This aspect will also be discussed in the limitations analysis of this paragraph.

This study finds this result promising, although this effect has a small magnitude and a relatively large statistical significance value. Analysing more in-depth how positive emotional states can influence overconfidence levels in financial literacy could be relevant in self-regulation for individuals, if possible (as mentioned in the "Introduction" chapter, defining self-regulation strategies is beyond the scope of this thesis). For example, if it was found, one day, that positive emotional states can influentially alter overconfidence levels in the context of financial literacy, individuals could self-regulate themselves in this regard. Being overconfident in financial literacy, as discussed in the literature review, has several impacts on our daily life, as seen in the "Introduction" and "Literature Review" chapters. Therefore, mitigating our overconfidence levels through positive emotions self-regulation could remarkably improve our financial decisions.

Analysing this result in the more general context of the research question of this study (*Does eliciting positive or negative emotions on individuals, have an impact on their overconfidence levels in the assessment of their capabilities of financial literacy?*), it is possible to conclude that it is partly true that eliciting positive or negative emotions on individuals, has an impact on their overconfidence levels in the assessment of their capabilities of financial literacy. It is true, as stated before, that positive emotions can alter, more precisely increase, overconfidence levels in individuals when assessing their capabilities in a financial literacy context.

Another interesting result of this experiment, although not related to the main hypotheses and research question, is regarding different overconfidence levels across men and women. In the general regression, it was found, with a confidence level of 99%, that being a female led to a lower overconfidence post-treatment score (by -0.912 points, ceteris paribus), meaning that being a female, implies a higher overconfidence level compared to male participants. This result is relevant, as it is an opposite finding to what Barber, B.M. & Odean, T. (2001) concluded in their study "Boys will be boys: gender, overconfidence, and common stock investment", where they stated that men are more overconfident than women.

This study has several limitations. First, a survey was not the optimal choice to assess all the relevant variables excluding the demographic ones. A laboratory setting would be the optimal choice to induce emotions and to properly assess the level of emotional engagement: measuring physiological values (such as heart rate, for example) and facial expressions, is a more efficient way to assess whether a person is successfully engaging emotionally than a PANAS survey.

The choice of using pictures to elicit emotions was also dictated by the need of using a survey to complete the study. There are other and more effective ways to induce emotions in subjects. For example, Filiz, I. (2020) successfully induced emotions in the participants of his study by showing them movie clips. This has been proven to be an effective method of eliciting emotions in individuals also by Schaefer et al. (2010). This option was considered for this study's survey, but it was abandoned because not always individuals can complete a survey in a quiet environment and it would have been too time-consuming, leading to a high abandon rate.

The emotions elicitation could also have been altered by pre-existing emotional states. Individuals already feeling positive emotions for factors external to the survey, could, for example, have been less affected by the negative emotions treatment, and vice versa for the positive emotions treatment. Moreover, pre-existing emotional states could ultimately have influenced the entire survey, as, if emotional states effectively influence overconfidence levels, it would have been impossible to measure a difference from before and after the treatment. This is because positive PANAS scores could be due only to the pre-existing emotional states and not because of the treatment. Again, without measuring physiological values, it is difficult to tell whether emotional states were induced by the treatments or not.

Inducing emotions could also have led the participants to some collateral effects. More than one person approached the author of this study asking what the meaning of the survey was. Curiosity, and distraction, could have altered the results when answering the financial literacy questions and the self-assessing percentage of correct answers. It is possible that respondents could also have put extra effort into answering the financial literacy question to have a better final score. Some individuals could also have experienced extreme behaviour in response to the pictures. For example, a participant reacted to the third picture of the negative treatment by thinking of her departed dog. Emotional distress, which the thesis' author finds different from emotional engagement, could have altered the mental states of individuals and therefore the survey results.

Moreover, the pictures used in the survey came from a lesser-known picture database, OASIS. The most famous and effective picture database (usually used in a laboratory setting) is the IAPS. The fact that its material is protected by copyright and since its usage is requestable only by researchers and not students, dictated the need of using the OASIS database. Although the

author of the latter database found a statically significant level of emotional engagement as a response to viewing the pictures, the consolidated reliability of the IAPS would have been preferred.

Some criticisms of the way the OASIS database was used must be made. The most engaging pictures in the database could not be included in the survey due to ethical reasons, as they contain explicit nudity or are graphic and explicit representations of traumatic and/or violent content. It did not seem appropriate, to the author of this thesis, to include them in the survey.

Regarding the entire sample, without corrections, there are several considerations to be made. First, this survey was distributed by word of mouth, mainly to a young audience (the mean value was 24.82 years of age) that is attending university. There was a greater percentage of females compared to males (113 against 85) and a greater percentage of individuals attending Business and Economics or Financial Economics studies (24.12% of all individuals, combining the two groups). Lastly, most of the participants was coming from Italy (162 individuals out of 200).

Therefore, suffering from selection bias is a real possibility for this sample, as random distribution to individuals was not feasible for the author of this study, due to its restricted resources. This is true especially if considering the amount of individuals coming from economics and financial studies, as, theoretically speaking, they should be more prepared in financial literacy. This means that the results found in this study cannot be generalized to the rest of the population outside the selected sample.

6. Conclusion

This thesis aimed at measuring the effects of emotions on overconfidence levels after eliciting positive or negative emotions in the participants of the survey, in the context of financial literacy.

This was done through a survey, where participants were first asked to answer 3 questions about financial literacy and then to assess the number of correct answers. After this first part, they were evenly and randomly distributed to a treatment, the goal of which was to elicit emotions in the participants. After the treatment, the respondents were asked to answer 3 more questions about financial literacy and then assess again the number of correct answers.

The regression made during the analysis considered only the observations relative to individuals where the emotions elicitation was successful.

This was made to test two main hypotheses, the first one being that emotional states influence overconfidence levels (*H1*), and the second one being that individuals affected by emotional states do not experience any learning effect, intended as a decrease in overconfidence levels due to progression in the survey (*H2*). The first hypothesis was divided based on which kind of emotional states the individuals were feeling. In particular, it was hypothesized that positive emotional states increase overconfidence levels (*H1a*) and that negative emotional states decrease overconfidence (*H2a*).

When analysing the data, it was found that positive emotional states increase overconfidence, confirming *H1a*, and partly *H1*. It was not possible to discover any statistically significant result linking negative emotional states and a decrease in overconfidence levels; it was not possible then to confirm *H1b*. It was also found that the participants were experiencing learning effects as they progressed in the survey, contradicting *H2*.

This study has several weaknesses. Mainly, selection bias could have altered the results of the entire analysis, as well as pre-existing emotional states. Also, a relatively less efficient method, compared to others, was used to elicit emotions.

Acknowledging these weaknesses, the analysis found some relevant results, which are promising for future research in this context, especially if considering the possibility to design an experiment more controlled and with more potential if designed in a laboratory setting.

Overconfidence has several adverse consequences, also in the financial literacy context. Therefore, understanding more how this bias works, can help improve the living quality of individuals, who could be more effective in the decision-making process involving their personal finances, by self-regulating their emotional levels.

7. References

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8. Appendix

A.   Additional information about the survey

The first set of questions about financial literacy included the following questions:

- *"Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?"*

  The possible answers are the following:

  - *More than $102* (Correct answer)
  - *Exactly $102*
  - *Less than $102*

- *"Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, with the money in this account, would you be able to buy..."*

  The possible answers are the following:

  - *More than today*
  - *Exactly the same as today*
  - *Less than today* (Correct answer)

- *"Do you think the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund."*

  The possible answers are the following:

  - *True*
  - *False* (Correct answer)

Positive emotions treatment pictures:

Figure A.1

Figure A.2

Figure A.3

Figure A.4

Figure A.5

Negative emotions treatment pictures:

Figure A.6

Figure A.7

Figure A.8

Figure A.9

Figure A.10

The following is the website of the creator of the OASIS database, with the tool to analyse the different values of valence and arousal for each picture in the database:

https://www.benedekkurdi.com/%23oasis

The second set of questions about financial literacy included the following questions:

- "*If interest rates rise, what will typically happen to bond prices?*"

  The possible answers are the following:

    - *They will rise*
    - *They will fall* (Correct answer)
    - *They will stay the same*

- "*A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.*"

  The possible answers are the following:

    - *True* (Correct answer)
    - *False*

- "*Suppose you owe $1,000 on a loan and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?*" (This question was not formulated by Annamaria Lusardi but it is inspired by her original questions)

  The possible answers are the following:

    - *Less than 2 years*
    - *At least 2 years but less than 5 years* (Correct answer)
    - *At least 5 years but less than 10 years*
    - *At least 10 years*

B. Additional information about categorical variables

Age (age), is a numerical variable, with a minimum of 18 years of age and a maximum of 86, with a mean of 24.82 years of age. *Gender* (gender) includes the categories *Male* (male), *Female* (female), *Non-binary / third gender* (even though no observations were collected in the sample for this category), and *Prefer not to answer* (pnta).

Nationality (country) has the following categories, *Albania*, *Belgium*, *Chile*, *Croatia*, *Finland*, *France*, *Germany*, *Greece*, *Hungary*, *India*, *Italy*, *The Netherlands*, *Poland*, *Russia*, *Spain*, *United Kingdom*, *and the United States*.

The *Level of educational attainment* (education_level) comprehends the categories *High school* (high_school), *Bachelor's degree* (bachelor), *Master's degree* (master) and *PhD* (phd).

The variable *Field of studies* (field_studies) includes *Social sciences* (social_sciences), *Human studies* (human_sciences), *Natural sciences* (natural_sciences), *Engineering and Technology* (engineering_technology), *Medical and Health sciences* (medical_health_sciences), *Business and Management sciences* (business_management), *Financial studies* (financial_studies), *Art and Design* (art_design).

C.   Additional demographic results

Table C.1 Demographic results for the positive and negative treatment groups, considering only observations relative to PANAS scores higher than 0.

	Number of observations	
Variable name	**Positive group**	**Negative Group**
Age	81	60
Gender		
Male	48	33
Female	32	26
Third gender/other	0	0
Prefer not to answer	1	1
Nationality		
Albania	6	3
Finland	1	0
France	2	0
Germany	1	0
Greece	3	1
Hungary	1	0
India	0	1
Italy	63	51
The Netherlands	1	1
Russia	0	1
Spain	2	1
United States	1	0
United Kingdom	0	1
Level of education		
High School degree	9	6
Bachelor's degree	30	20
Master's degree	40	34
PhD	2	0
Field of education		
Art and Design	0	2
Business and Economics	16	10
Engineering and Technology	17	12
Financial Studies	10	8
Human Studies	5	6
Medical and Health Studies	18	14
Natural Sciences	3	2
Social Sciences	12	6
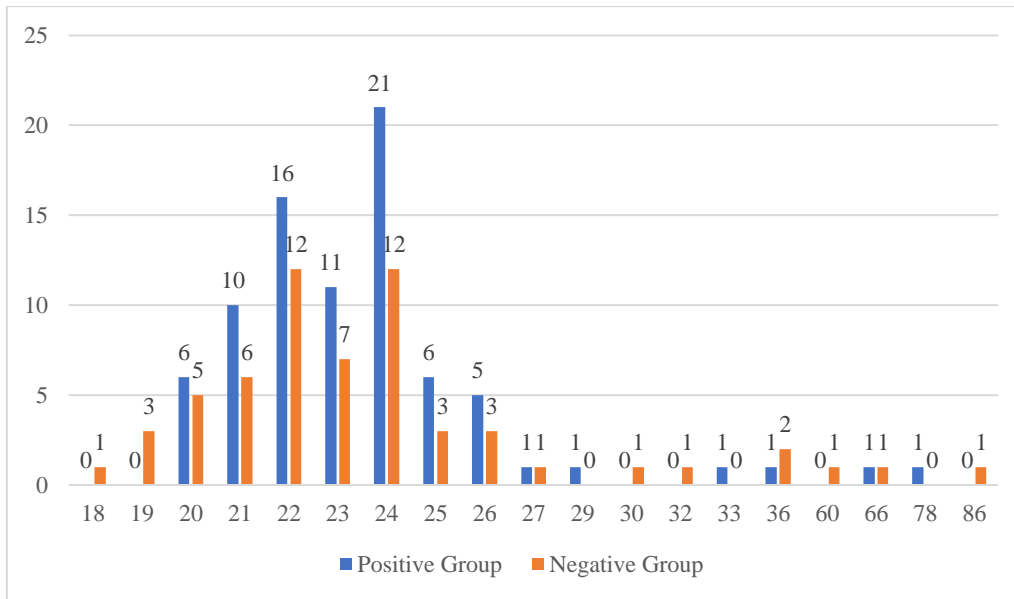
Figure C.1 Age - Positive and Negative Treatment Group

(Expressed in number of individuals on the y axe and years on the x axe)

When not accounting for observations where the treatment was not effective, in the positive treatment group, there were 48 males, 32 females, and 1 person who preferred not to answer, while in the negative treatment group, there were 33 males, 26 females and 1 person who preferred not to answer.
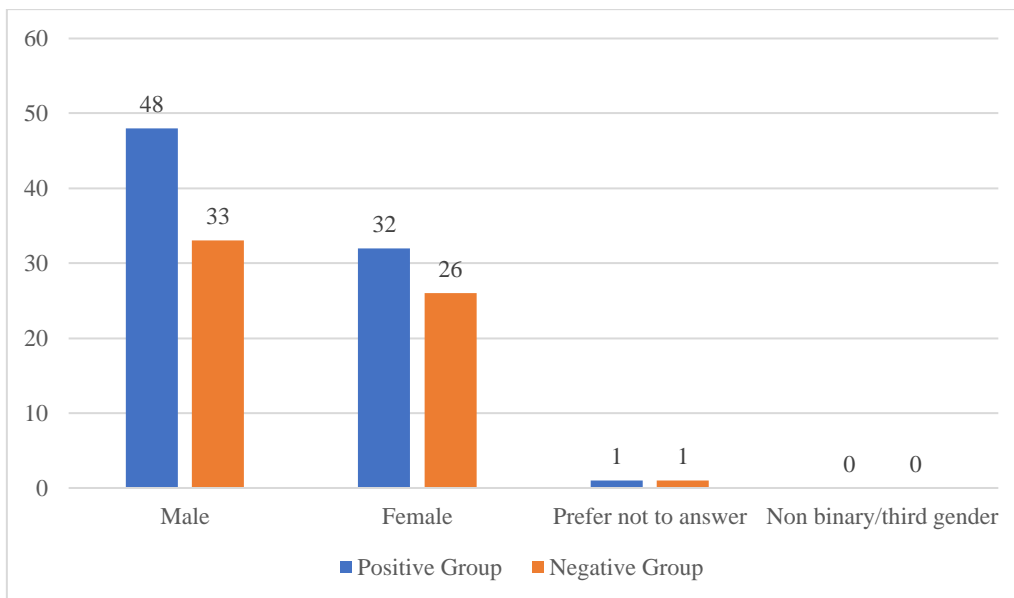
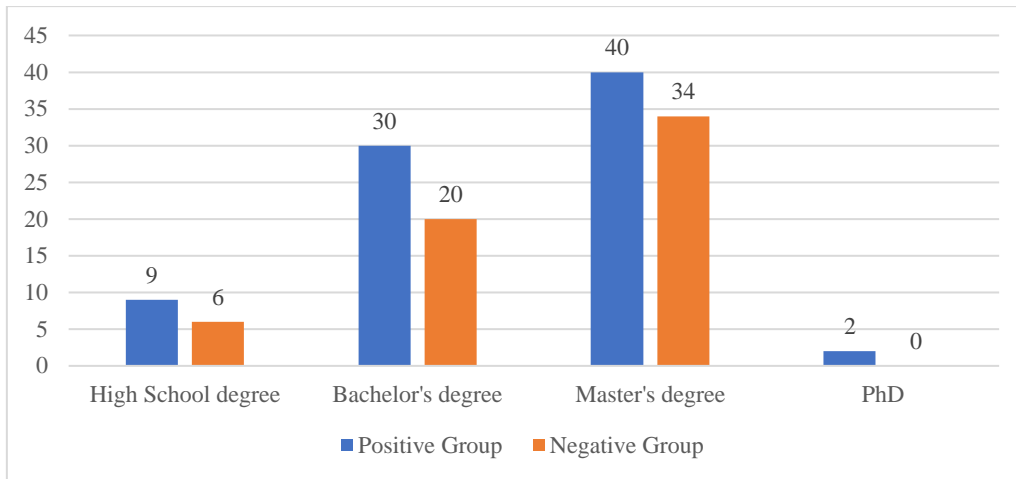*Figure C.2 - Gender - Positive and Negative Treatment Group*

(Expressed in number of individuals on the y axe)

When not accounting for observations where the treatment was not effective, in the positive treatment group, 6 people were from Albania, 1 person was from Finland, 2 people were from France, 1 person was from Germany, 3 people were from Greece, 1 person was from Hungary, 63 people were from Italy, 1 person was from The Netherlands, 2 people were from Spain and 1 person was from the United States.

In the negative treatment group: 3 people were from Albania, 1 person was from Greece, 1 person was from India, 51 people were from Italy, 1 person was from The Netherlands, 1 person was from Russia, 1 person was from Spain, 1 person was from the United Kingdom.
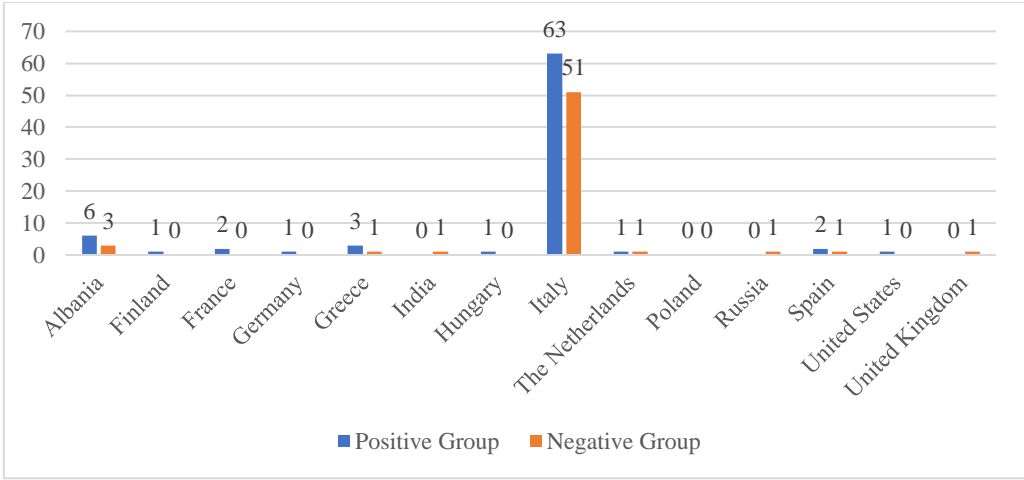
Figure C.3 - Nationality - Positive and Negative Treatment Group
(Expressed in number of individuals on the y axe)

When not accounting for observations where the treatment was not effective, in the positive treatment group, 30 individuals completed a bachelor's degree, 40 individuals completed a master's degree, 9 individuals completed high school, and 2 individuals completed a PhD degree. In the negative treatment group, 20 individuals completed a bachelor's degree, 34 individuals completed a master's degree, 6 individuals completed high school, and no individuals completed a PhD degree.

Figure C.4 - Education level - Positive and Negative Treatment Group
(Expressed in number of individuals on the y axe)

When not accounting for observations where the treatment was not effective, in the positive treatment group, 16 people were studying Business and Economics, 17 people were studying Engineering and Technology, 10 people were studying Financial Studies, 5 people were studying Human Studies, 18 people were studying Medical and Health Sciences, 3 people were studying Natural Sciences, and 12 people were studying Social Sciences.

In the negative treatment group, 2 individuals were studying Art and Design, 10 individuals were studying Business and Management, 12 individuals were studying Engineering and Technology, 8 individuals were studying Financial Studies, 6 individuals were studying Human Studies, 14 individuals were studying Medical and Health Sciences, 2 individuals were studying Natural Sciences, and 6 individuals were studying Social Sciences.
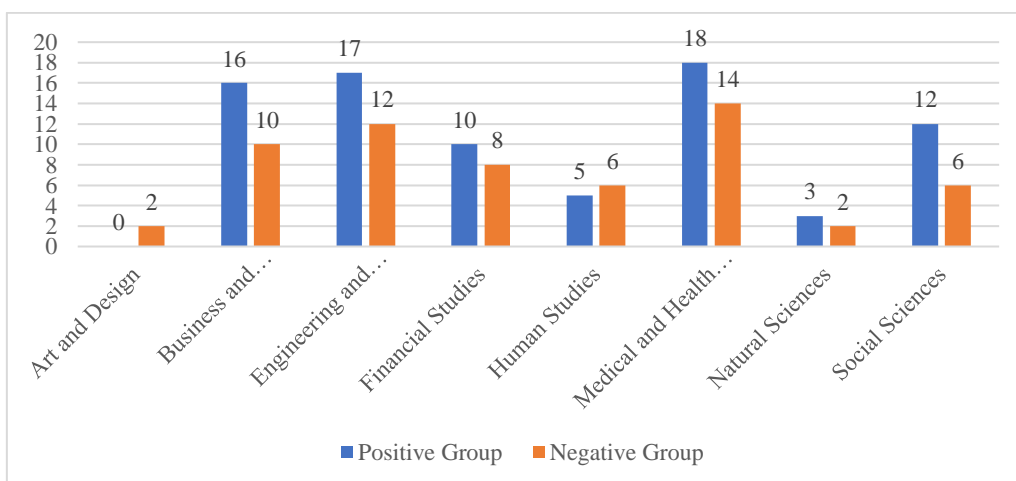
Figure C.5 - Field of studies - Positive Treatment Group
(Expressed in number of individuals on the y axe)

The age was distributed as follows, distinguishing between the positive and negative treatment groups and before and after correcting for PANAS scores:
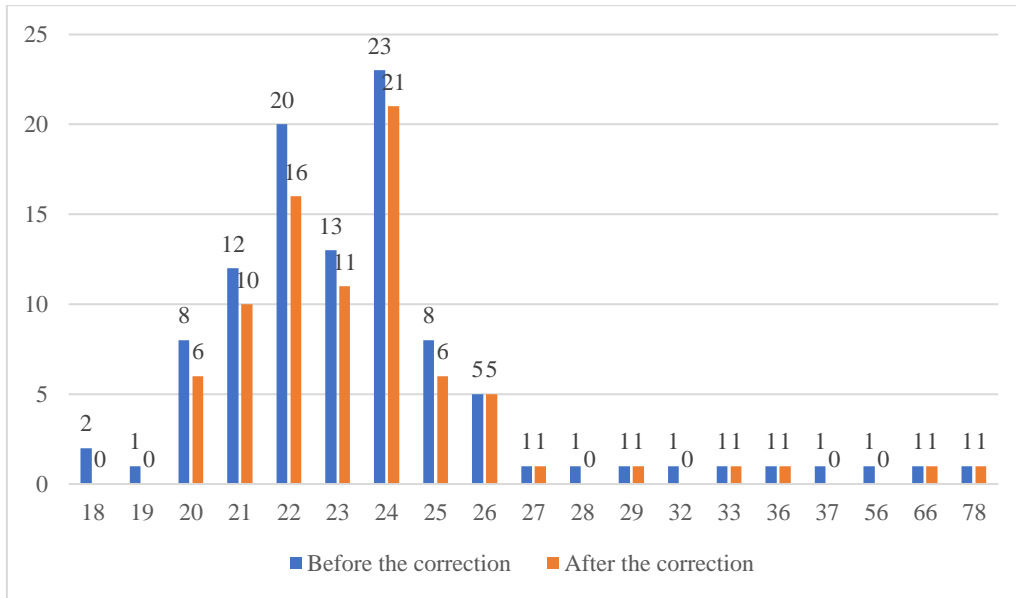
Figure C.6 Age - Positive Treatment Group

(Expressed in number of individuals on the y axe and years on the x axe)
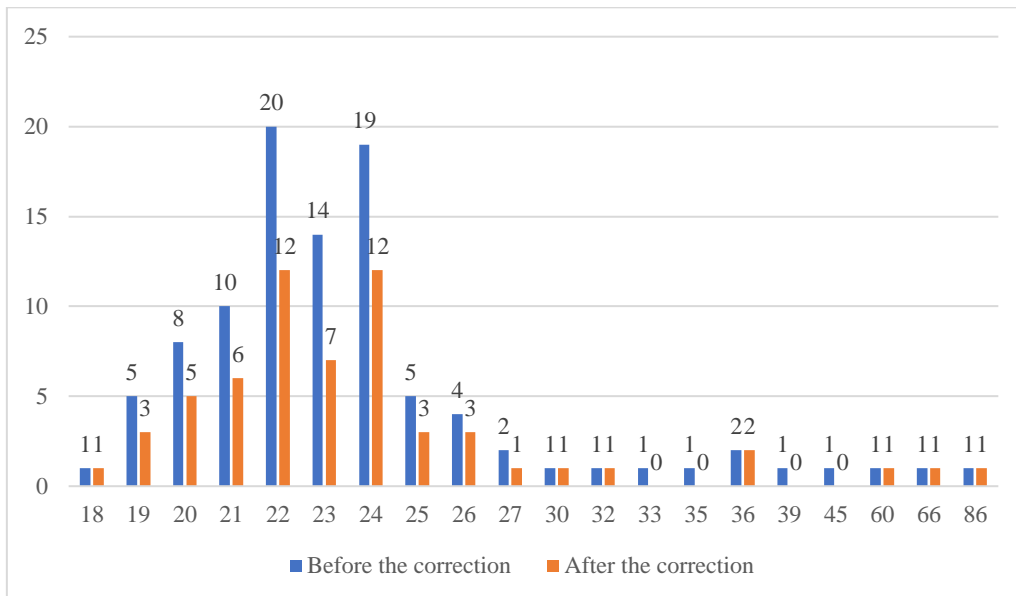
Figure C.7 Age - Negative Treatment Group

(Expressed in number of individuals on the y axe and years on the x axe)

Before the correction for PANAS scores, in the positive treatment group there were 60 males, 40 females, and 1 person preferred not to answer, while in the negative treatment group: there were 53 males, 45 females and 1 person preferred not to answer.
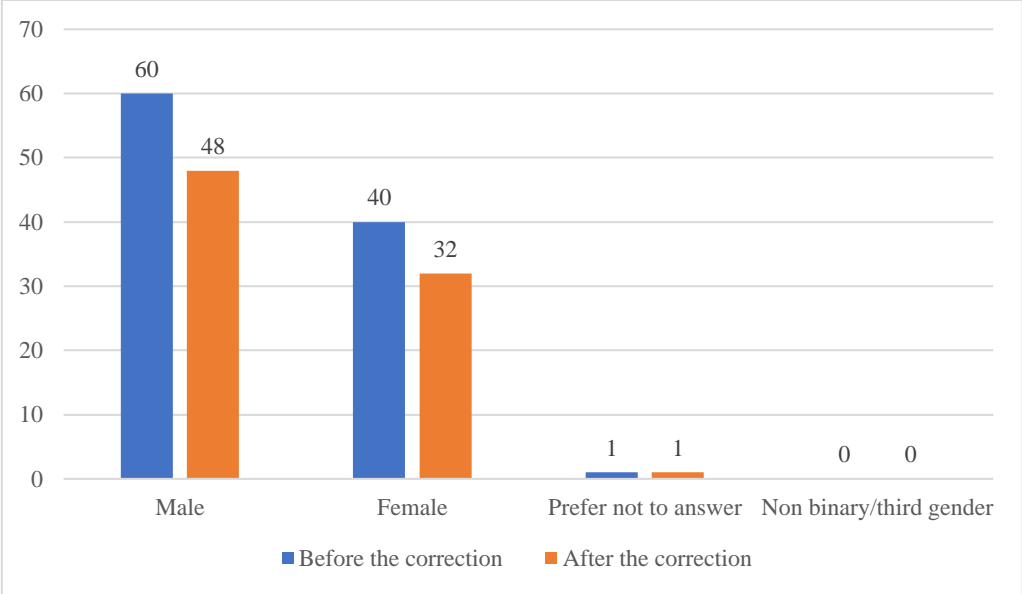
Figure C.8 Gender - Positive Treatment Group
(Expressed in number of individuals on the y axe)
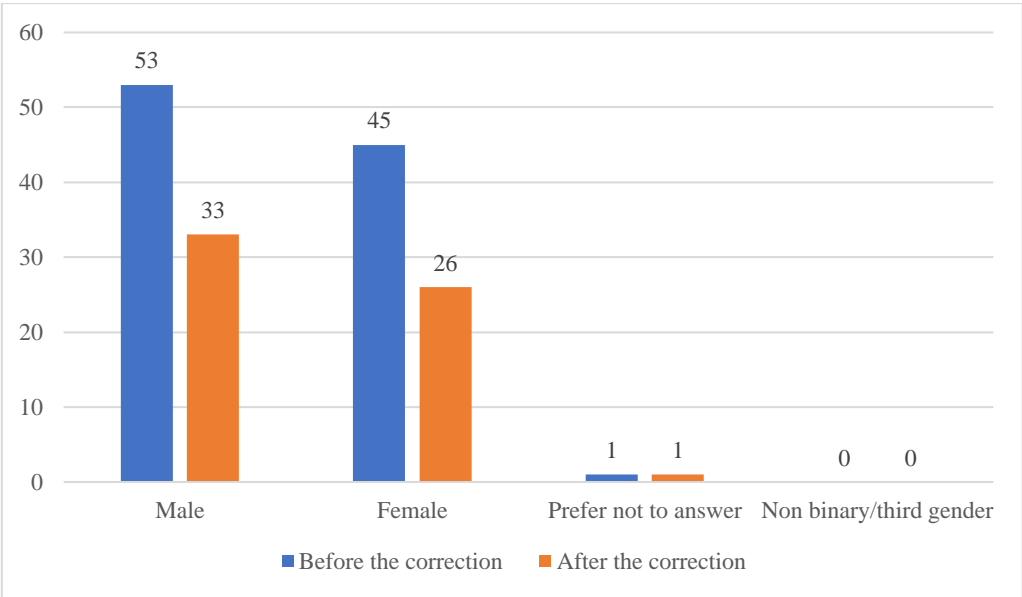
Figure C.9 Gender - Negative Treatment Group
(Expressed in number of individuals on the y axe)

Before the correction for PANAS scores, in the positive treatment group 6 people were from Albania, 1 person was from Finland, 2 people were from France, 1 person was from Germany, 3 people were from Greece, 1 person was from Hungary, 82 people were from Italy, 1 person was from The Netherlands, 1 person was from Poland, 2 people were from Spain and 1 person was from the United States. In the negative treatment group, 5 people were from Albania, 1 person was from Belgium, 1 person was from Chile, 1 person was from Croatia, 2 people were from Greece, 1 person was from India, 81 people were from Italy, 4 people were from The Netherlands, 1 person was from Russia, 1 person was from Spain and 1 person was from the United Kingdom.
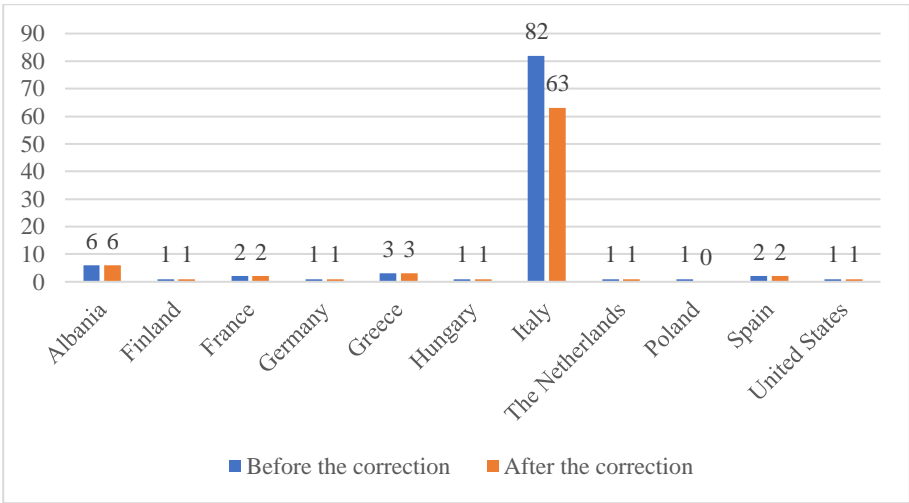

Figure C.10 Nationality - Positive Treatment Group

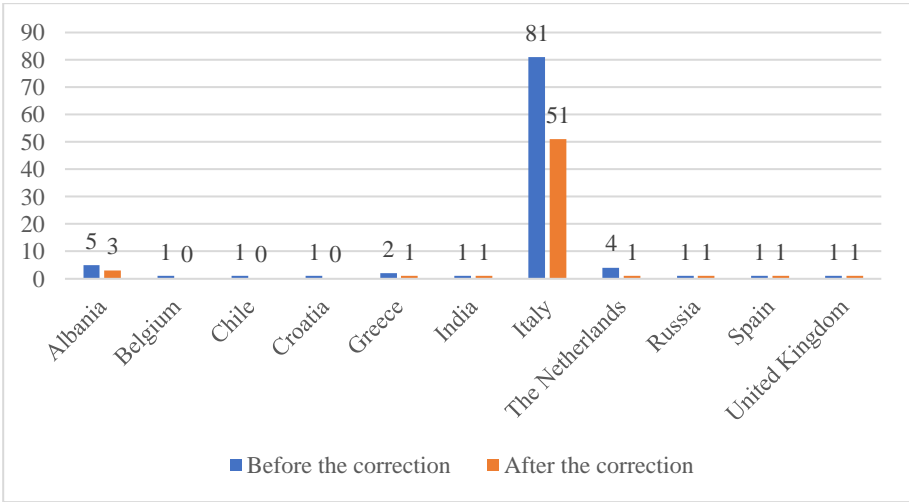*(Expressed in number of individuals on the y axe)*

Figure C.11 Nationality - Negative Treatment Group

(Expressed in number of individuals on the y axe)

Before the correction for PANAS scores, in the positive treatment group, 34 individuals completed a bachelor's degree, 54 individuals completed a master's degree, 11 individuals completed high school, and 2 individuals completed a PhD degree. In the negative treatment group, 41 individuals completed a bachelor's degree, 48 individuals completed a master's degree, 9 individuals completed high school, and 1 individual completed a PhD degree.
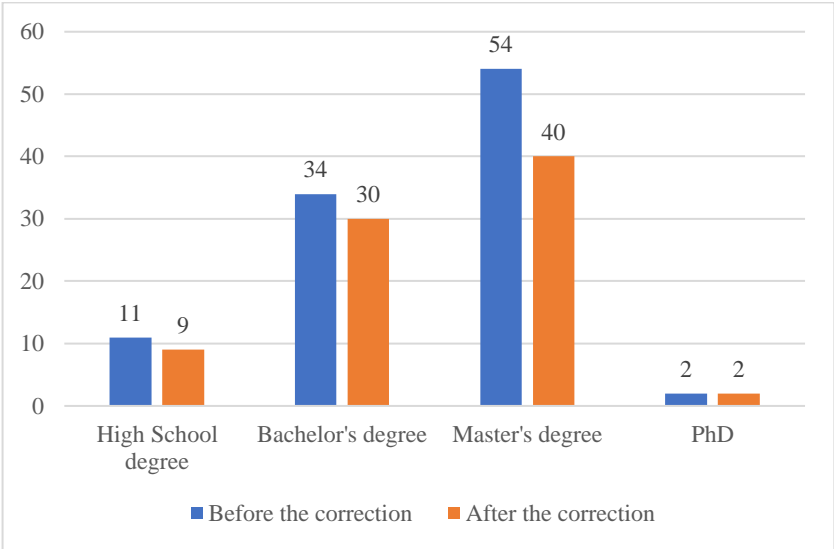

Figure C.12 Education level - Positive Treatment Group
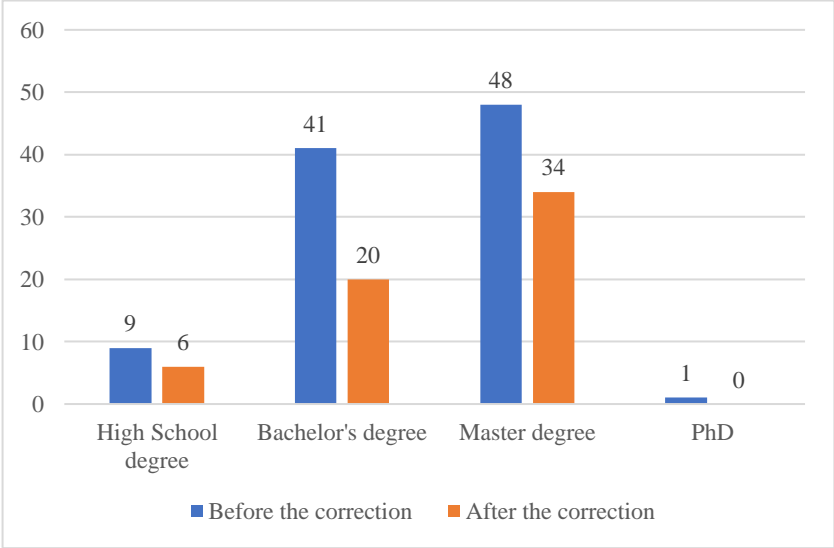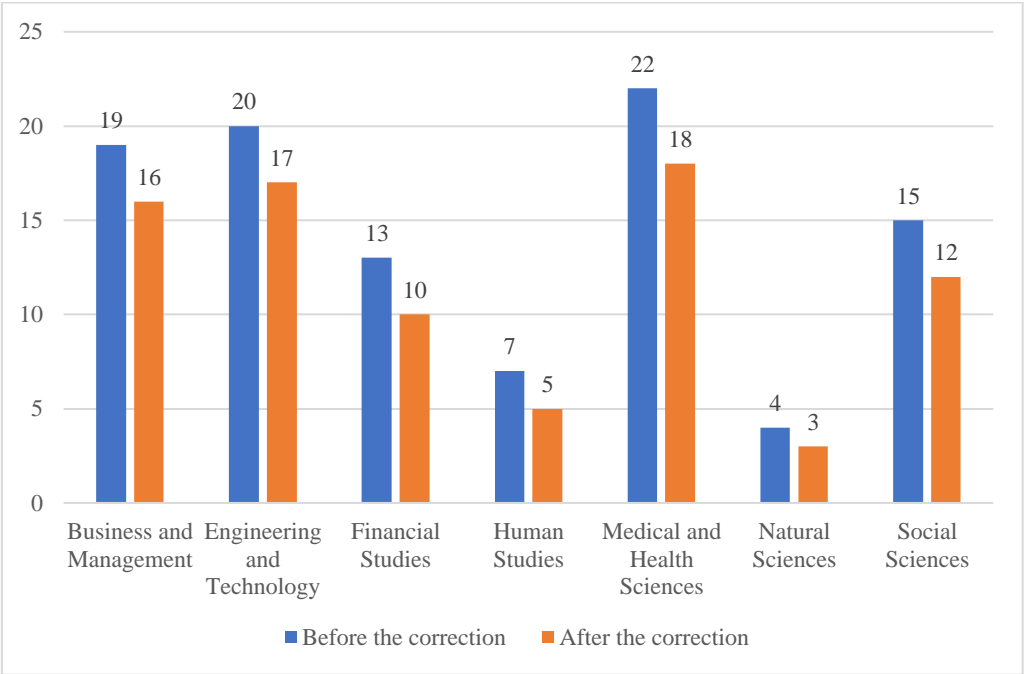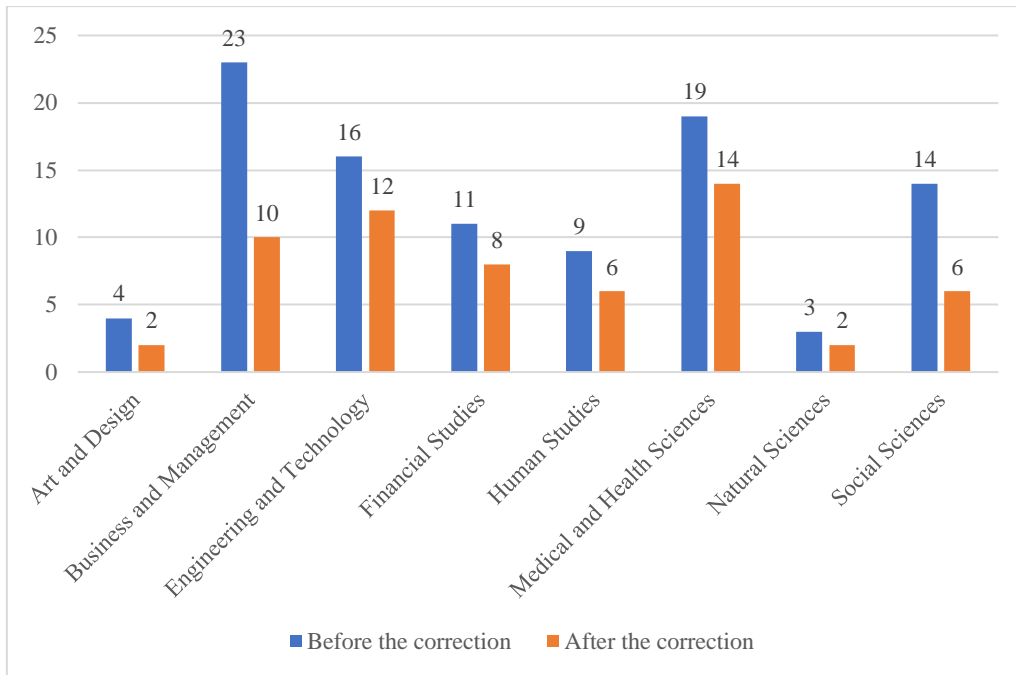*(Expressed in number of individuals on the y axe)*

Figure C.13 Education level - Negative Treatment Group
(Expressed in number of individuals on the y axe)

Before the correction for PANAS scores, in the positive treatment group, 19 individuals were studying Business and Management, 20 individuals were studying Engineering Technology, 13 individuals were studying Financial Studies, 7 individuals were studying Human Studies, 22 individuals were studying Medical and Health Sciences, 4 individuals were studying Natural Sciences, and 15 individuals were studying Social Sciences.

In the negative treatment group, 4 individuals were studying Art and Design, 23 individuals were studying Business and Management, 16 individuals were studying Engineering and Technology, 11 individuals were studying Financial Studies, 9 individuals were studying Human Studies, 19 individuals were studying Medical and Health Sciences, 3 individuals were studying Natural Sciences, and 14 individuals were studying Social Sciences.

Figure C.14 Field of Studies - Positive Treatment Group
(Expressed in number of individuals on the y axe)

Figure C.15 Field of studies - Negative Treatment Group

(Expressed in number of individuals on the y axe)

D.   Additional regressions

It is important, to the eyes of the author of this study, to understand if and how the PANAS surveys' scores are influenced by the average time spent by the participants on the pictures of the two treatments.

To do so, firstly it is relevant to include all the observations in the survey and not only consider the observations conditional to PANAS scores being higher than 0, to see whether there is a relationship between the two variables.

Table D.1 Results of the regression on PANAS scores and average time spent on positive treatment images on the entire sample

Variable	Coefficient
Average time spent on positive treatment images (rounded to the third decimal)	- 0.036
	(0.184)
Constant	4.778***
	(1.481)
Sample size	101
R^2	0.0002

Note. Standard errors are in parenthesis; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table D.2 Results of the regression on PANAS scores and average time spent on negative treatment images on the entire sample

Variable	Coefficient
Average time spent on negative treatment images (rounded to the third decimal)	0.050
	(0.108)
Constant	0.905
	(0.949)
Sample size	99
R^2	0.0011

Note. Standard errors are in parenthesis; * p < 0.1, ** p < 0.05, *** p < 0.01.

There is not a distinct relationship between the time spent on the images of the treatments and the PANAS surveys' scores, as there is not a statistically significant effect for both regressions.

If decided to consider only the observations used in the general regression of the experiment, so only the observations for which the PANAS surveys received a positive score:

Table D.3 Results of the regression on PANAS scores and average time spent on positive treatment images on the corrected sample

Variable	Coefficient
Average time spent on positive treatment images (rounded to the third decimal)	0.653***
	(0.086)
Constant	0.733***
	(0.228)
Sample size	141
R^2	0.413

Note. Standard errors are in parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table D.4 Results of the regression on PANAS scores and average time spent on negative treatment images on the corrected sample

Variable	Coefficient
Average time spent on negative treatment images (rounded to the third decimal)	0.403***
	(0.127)
Constant	0.655**
	(0.323)
Sample size	141
R^2	0.413

Note. Standard errors are in parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

It is worth noting that, by regressing the positive treatment PANAS survey for the average time spent on the pictures of this treatment, it is true that spending a second more on average on the images increases the PANAS survey score for positive emotions by 0.653 points. This effect is statistically significant at the 99% level of confidence.

As for the regression for the negative PANAS score, every second spent more on the images increased the general score by 0.403 points. This effect is statistically significant at the 99% level of confidence.

So, if considering only the case where the treatment successfully elicited emotions in the participants, it is possible to say that spending more time at looking the pictures in the positive treatment was more effective in eliciting emotions than in the negative treatment.