

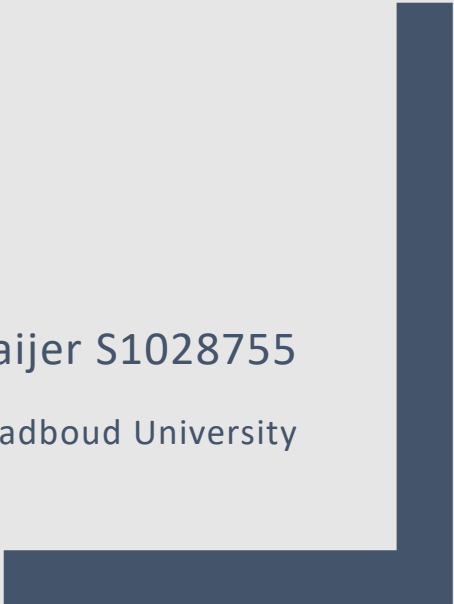


Masterthesis Economics, Behaviour and Policy

PREVENTING OVERCONFIDENCE IN THE ONLINE CONSUMER CREDIT MARKET

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Abstract

Overconfident consumers tend to borrow more money on the online consumer credit market. This behaviour can bring them in financial trouble later in life and should be prevented to protect consumers. This research looks into the preventive relation that choice architecture techniques in the loan calculator have on the overborrowing of overconfident consumers. The focus is on the Dutch online consumer credit market, where two types of loan calculators can be distinguished. A simplified calculator tries to make information easily understandable for consumers, while the extensive calculator gives feedback of the actual income and expenses that the consumer has concerning the loan amount they want to take out. Feedback is seen as an effective prevention against overconfidence.

The research uses an online experiment to test the described relations. Respondents were treated with overconfidence through hard-easy knowledge questions, after which they had to fill in either a simplified or extensive calculator. There are no significant results with regards to the effect of overconfidence on the online credit market, the effect of loan calculator techniques on the online credit market and with regards to the interaction of both on the online credit market. Future research that further looks into the preventive opportunities of loan calculator types are needed.

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1. Introduction

Protecting consumers from their own biases when borrowing money has become even more relevant given the current Covid-19 crisis. The crisis has led to countries taking measures, such as temporarily shutting down businesses, to contain the virus which will negatively impact the economy (OECD Economics Department 2020). This will bring many consumers in financial trouble, with research regarding the Covid-19 crisis showing that consumers expect to raise their household debts (Hanspal, Weber, and Wohlfart 2020). So, finding ways to protect these consumers against their bias in the credit decisions process is needed. This research aims to understand how an overconfidence bias on the online credit decision process can be prevented and will also empirically test this through an online experiment.

People borrow money to fulfil the need for a smooth lifetime consumption. Meeting the expectations of their lifestyle or, even more so, finding ways in which the lifestyle can be improved is of great significance for consumers. (Kamleitner, Hoelzl, and Kirchler 2012; Kamleitner and Kirchler 2007). When there is an inability to keep up this lifestyle, which leads to consuming less compared to others, consumers fall back on financing this gap through credit to increase their consumption patterns (Duesenberry 1949). The need for consumption will lead to the decision to borrow money on the consumer credit market.

The online consumer credit market enables the consumers to take up a credit in the form of, for example, a personal loan. Ideally, the consumers themselves put great care and consideration into making a credit decision on this online consumer credit market. Unfortunately, credit decisions are often made suboptimal due to the human biases in decision making (Gathergood 2012; Grohmann et al. 2019; Zinman 2015). The human biases lead to an inaccurate judgement of the decisions-process, which prevents consumers from making a rational decision (Bashir et al. 2013). One of these biases that affect borrowing behaviour is overconfidence.

Overconfident consumers make overestimations about the knowledge, cognitive abilities and precision of the information that they possess (Bhandari and Deaves 2006). For borrowing behaviour, this means that these consumers expect that their income in the future will be higher and will borrow according to this higher future income. Even more so, they also overestimate their ability to repay the loan because consumers estimate that they have better control of their future spending (Grohmann et al. 2019). Overconfident consumers will borrow more money than they should which can lead to future financial problems.

There is a need to protect consumers from overborrowing due to overconfidence. Preventing overconfidence can be achieved by giving consumers feedback about their behaviour (Clark and Friesen 2009; Proeger and Meub 2014). The feedback can be added in the credit decision process of consumers by looking at the choice architecture. A good choice architecture will create an optimal

decision context for the consumer using choice architecture techniques such as feedback or connecting the decision to its costs/benefits (Münscher, Vetter, and Scheuerle 2016).

Hence, the choice architecture decisions could offer the appropriate context for preventing overconfidence. For the online consumer credit market, a great place where choice architecture techniques can be applied are the loan calculators. These loan calculators are used by most consumers before they take up a loan (Timmons, McGowan, and Lunn 2019).

Looking at the loan calculators in the consumer credit market of the Netherlands, two types of loan calculators can be found. The first type is a simplified calculator where the credit providers focus on only showing the minimum options to come to a preferred loan specification. The focus of this calculator is the simplification of all the information, which should help consumers not to get overwhelmed. The second type of calculator is the extensive calculator. In this calculator, the consumers are also asked to fill in their income and expenses before the calculation of the loan is made. These calculators connect the consequences of the credit-decision to the income and expenses that the consumer makes. This connection of consequences can be seen as giving direct feedback to the consumer. It should, therefore, be possible that this extensive calculator can prevent overconfidence.

To see if the type of loan calculator can affect the borrowing decision of overconfident consumers in the Dutch online consumer credit market, the following research question has been made:

- ❖ How can borrowing decisions affected by overconfidence in the online consumer credit market be prevented by choice architecture in the loan calculator?

The thesis will start by giving the literature review in chapter 2. The review describes the consumer credit market, the problem of overconfidence and its prevention with more in-depth detail. The literature review is followed by a market review in chapter 3, which will give insights into the Dutch consumer credit market and connects this to the literature. After this, chapter 4 focusses on the methodology including the experimental design, measuring the data, analysing the design and the advantages and disadvantages of an experiment. In chapter 5 the results will be given, which is followed by a discussion of these results in chapter 6. Finally, the conclusion to this research is given in chapter 7.

2. Literature review

The literature review starts by introducing the online consumer credit market. The problem of overconfidence on this online consumer credit market will be explained afterwards, followed by the choice architecture that could help prevent the overconfidence on the online consumer credit market.

2.1. Online consumer credit market

The online consumer credit market allows people to borrow money to meet the consumption needs that they cannot fulfil with their current income (Tooth 2012). With the borrowed money, the consumer credit, a consumer can finance any purchase other than a property purchase. The consumer credit market is made up of specific purpose and general use credit. Specific purchase credits are loans that have a contractual obligation that ensures the purchase of only a specific product or service, such as a car. General use credits, on the other hand, are agreements where the consumer receives a loan that does not commit them to the financing a specific product or service (Guardia 2002).

Taking out a general loan, or more specifically a personal loan, means that consumers have more freedom when deciding how much they want to borrow, as they are not bound to a price of a specific product. This freedom could lead to consumers borrowing more than they can financially handle. Therefore, understanding how credit decisions can be affected when taking out a personal loan can help with protecting consumers.

2.1.1 The problem of an online market for credit decisions

Besides the freedom of personal loans, the characteristics of an online environment also affect the credit decision process. The digitalisation in the online market means that a loan can be taken out faster, making a shorter decision process more typical (Pousttchi and Dehnert 2018). This shorter decision process, however, could be against an ideal consumer decision process. This path should ensure that the credit decision is well-evaluated. The shortened process in an online market can mean that a wrong cognitive process is used for selecting an optimal action (Bashir et al. 2013).

The cognitive processes of the consumers can be structured by looking at System I and System II thinking, the dual-system theory. The theory shows that two systems are responsible for people's thought processes. System I thinking happens fast and automatic, while System II thinking is slower with more effort and consciousness. One of the systems dominates at different points in the decision process (Kahneman 2011). For credit decisions, taking the time to ensure that the consumer can meet future commitments is crucial. The decision to take out a personal loan should, thus, be supported by an extensive process to evaluate the way of financing (Dhar and Nowlis 2004; Kamleitner and Kirchler 2007). To assure that consumers use enough time to make this well-evaluated credit decision, the domination of System II thinking is important.

The online environment of the consumer credit market can negatively affect an adequate consumer decision path. The reduced time in the shorter online decision process can result in less use of a well-evaluated System II decision. The faster process makes System I more dominant than it should be, making consumers deviate from well-evaluating credit decisions. The involvement of System II is crucial to prevent irresponsible lending.

2.2. Overconfidence in credit decisions

In a rational world, consumers themselves are willing to put effort and consideration, by using more System II, to make a well-evaluated decision. It is, however, the case that consumers are not fully rational. They are influenced by human biases that affect their decision-making process, which leads to a suboptimal credit decision (Capuano and Ramsay 2011; Gathergood 2012; Zinman 2015). Since personal loans give consumers more freedom about the amount they want to borrow, human biases can lead to the consumer taking on a bigger loan than they can financially handle.

A bias that could be problematic for this borrowing behaviour of consumers is the overconfidence bias. The overconfidence bias leads to an overestimation of knowledge, cognitive abilities and precision of information (Bhandari and Deaves 2006; Johnson et al. 2012). Additionally, overconfidence makes consumers believe that they have an exaggerated ability to control the events in the future (Malmendier, Tate, and Yan 2011). This bias is relevant for credit decisions because taking out a loan involves making a decision in the present that affects the future.

There are two broad ways to consider somebody as overconfident. The first way is through miscalibration. Miscalibration overconfidence means that someone overestimates the probability that they will do well (Acker and Duck 2008). Their own judgements have a high probability of coming true, which is why this overconfidence type can also be recognised as judgemental overconfidence (Hilton et al. 2011).

The second type of overconfidence is the better-than-average effect (Acker and Duck 2008). This indicates an overestimation of the probability in comparison to others, preferably to social information that is favourable for themselves (Larrick, Burson, and Soll 2007).

Although someone can be considered overconfident in both the miscalibration and better-than-average context, this does not indicate that correlation between the two can be assumed. Several studies (e.g.: Acker and Duck 2008; Glaser, Langer, and Weber 2005; Hilton et al. 2011) found no correlation between miscalibration and better-than-average effect. Therefore, one cannot use the evidence of one form of overconfidence to justify the existence of the other form (Glaser and Weber 2007).

2.2.1. The problem of overconfidence in the consumer credit market

The overconfidence bias leads consumers to assume that they have more money to spend in the future compared to the present (Johnson et al. 2012). For the consumer credit market, this means that consumers will have high-income expectations, which will result in borrowing money as if they already have this high future income in the present. Not only do they estimate to have a high future income, but consumers also overestimate their abilities to pay back debts because they assume to have better control of their spending (Grohmann et al. 2019). These overestimations of income and spending mean that overconfidence has a positive relation with higher debt levels (Rihab and Lotfi 2016).

Besides overestimating income and spending, it is also possible that overconfidence makes the consumers too optimistic. This tendency to overestimate a favourable outcome, which according to Griffin and Brenner (2004) is related to both the miscalibration and better-than-average effect, is called optimistic overconfidence. Research has shown that optimistic consumers tend to borrow significantly more in comparison to pessimistic consumers (Brown et al. 2005; Kamleitner and Kirchler 2007).

In sum, being overconfident on the consumer credit market is problematic for the consumers as it will most likely lead to them borrowing more money than an average consumer. This effect can be translated into hypothesis 1.

Hypothesis 1: Overconfident consumers borrow more money compared to an average consumer

2.2.2. The character of an overconfident consumer

Although generally, overconfidence can result in overborrowing on the consumer credit market, not every consumer will be overconfident. Certain characteristics differentiate consumers and increase the chance of them being overconfident. The most notable are gender and education (Bhandari and Deaves 2006).

One of the most prominent studies that look into gender and overconfidence finds that men are more likely to be overconfident compared to women (Barber and Odean 2001). Although this result has been duplicated in other studies (e.g. Bengtsson, Persson, and Willenhag 2005; Huang and Kisgen 2013), there is also evidence that shows that there is no significant difference between men and women (e.g.: Acker and Duck 2008; Bashir et al. 2013). The opposing results could be a result of the environment from which the information is taken, which is why gender will be seen as having an ambiguous relationship with overconfidence.

Even though the effects of gender are inconclusive, consumers with a higher education level have an unambiguous higher chance of being overconfident (Bhandari and Deaves 2006). Having learned more knowledge through education helps people feel more confident. The overconfidence felt

through knowledge is emphasised when the consumer also has financial educational knowledge instead of only general educational knowledge. People that received an education with finance-related subjects do not necessarily know more about this financial information, they just think that they do. They are, therefore, more overconfident than a consumer without financial knowledge (Bhandari and Deaves 2006). So, financial literacy of a (higher) educated consumer is an important determinant that gives them a higher chance of overconfidence (Kramer 2014; McCannon, Asaad, and Wilson 2016).

2.3. Choice architecture in the online consumer credit market

The way the choice of getting a loan is presented will significantly influence how the consumer will decide. The presentation of choices can easily be changed. Choice architecture refers to influencing and changing the context in which people make decisions (Johnson et al. 2012). Understanding the choice architecture and choice architecture techniques is necessary to provide the consumers with the right context to make an optimal decision about taking up a loan.

Consumers want to make their loan choices by interacting with credit providers on their online channels (Footitt et al. 2019). Information technology, such as the website layout, is a common way to influence the choices in the online consumer credit market (Murray, Liang, and Häubl 2010). If the website's layout and characteristics are matched to the consumers' cognitive styles, the consumers are more likely to stay on that website (Hauser et al. 2009). Content should be comprehensible and informative; the consumer should find it easy to navigate through the website; the layout should match the aesthetic appearance by leaving a visual impression on the consumer (Kincl and Štrach 2012). Thus, the website layout is a key component for influencing in the choice architecture of the online consumer credit market.

2.3.1. Preventing overconfidence with choice architecture techniques

Influencing a website layout with choice architecture techniques could make it possible to prevent the overborrowing of the overconfident consumer. Choice architecture techniques can be used to tackle several points in the decision-making process. Münscher, Vetter and Scheuerle (2016) made a framework, see table 1, that divides choice architecture techniques into three categories. The first category is the decision information, which refers to techniques about how information is presented to consumers. The second category is decision structure, where techniques modify and rearrange the structure of options given to consumers. Lastly, the third process decision assistance regards techniques that make consumer follow through with their intentions, for example, consumers feel more committed to a loan when they need send an initial offer to the credit provider.

Because the overconfidence problem in the online consumer credit market should be prevented before consumers have decided on an initial offer of the loan, only choice architecture techniques that are used in the categories decision information and decision structure are of relevance.

For each of these processes there is one choice architecture technique that is effective in preventing overconfidence, namely make information visible and change option consequences. These two techniques are further explained.

Category	Technique
A Decision information	A1 Translate information
	A2 Make information visible <i>Includes: make own behaviour visible (feedback)</i>
	A3 Provide a social reference point
B Decision structure	B1 Change choice defaults
	B2 Change option-related effort
	B3 Change range or composition of options
	B4 Change option consequences <i>Includes: connect decision to benefit/cost</i>
C Decision assistance	C1 Provide reminders
	C2 Facilitate commitment

Table 1 Overview of choice architecture techniques (based on Münscher et al. (2016))

A2 Make information visible

A choice architecture technique that makes consumers aware of their behaviour is direct or indirect feedback. The information that a consumer needs to process a decision is constraint by the attention and processing abilities of that consumer. By providing feedback, these constraints are removed and the information is made accessible for the consumers to use in the decision process (Münscher et al. 2016).

The fact that feedback has a powerful influence on human behaviour, is also true for overconfidence (Hattie and Timperley 2007). Giving feedback is the most efficient way to tackle overconfidence (Arkes et al. 1987; Clark and Friesen 2009; Proeger and Meub 2014). Hence, it is appropriate for prevention.

B4 Change option consequences

Another choice architecture technique is the modification of consequences of the decision by, for example, showing the cost/benefit effects of the decision. From a rational perspective, showing income and the expenses of a consumer should not change their decision. However, consumers are often not completely rational and disclosing consequences is likely to affect the decision behaviour (Münscher et al. 2016). More specifically for the credit market, disclosing more information about costs has been found to reduce the amount of borrowing (Bertrand and Morse 2011).

For tackling overconfidence, displaying how the loan of a consumer will relate to their income and expenses on the website of the credit provider, is a form of direct feedback. Therefore, this choice architecture technique could help as prevention.

3. Market review

Choice architecture techniques that use feedback are the best way to prevent overconfidence. In this chapter, a market analysis is performed to see where this choice architecture technique is used in the Dutch consumer credit market. After this analysis, the findings from the literature and market review will be combined.

3.1 Market analysis of loan calculators

The choice architecture of the websites of the Dutch credit providers is essential for the decisions of the consumers. The techniques used can prevent the overconfidence bias from affecting the decision-process (Bertrand et al. 2005). As stated before, the online channel and the website's layout are important for every consumer that wants to take out a loan (Footit et al. 2019; Hauser et al. 2009). The loan calculator on the website of the credit providers is the component on the website that consumer use most often when they want to apply for a personal loan (Timmons et al. 2019). Therefore, the layout of these loan calculators is important to evaluate.

With the loan calculators, consumers are made aware of the monthly payment and interest rate of their preferred loan amount. The use of the loan calculator is easy, especially because of the application of choice architecture techniques (Tooth 2012). Since these calculators are a crucial source of information during the decision process, the effects of using different choice architecture techniques can help protect the consumers (Timmons et al. 2019).

For the market analysis, the design of the loan calculators of five Dutch credit providers¹ is compared. In Appendix I, all five of the loan calculators can be found. The analysis showed that the credit providers design the loan calculator by one of two types, the simplified or extensive calculator.

3.1.1. Simplified calculator

With the simplified calculator, the credit providers keep the options simple and easy to understand while still giving the necessary information. An example of this simplified calculator is visible in figure 1. The consumer has to fill in (or slide to) the amount of money they want to borrow and the amount of money they want to pay every month. This method keeps the decision options basic and quick to fill in for the consumers.

The simplified calculator is a clear example of using the choice architecture technique simplification. By simplifying the

Figure 1 Simplified calculator example (Nationale-Nederlanden 2020)

¹ Nationale-Nederlanden, ABN AMRO, Rabobank, Freo and ING

information, the cognitive effort that is needed to process information is reduced. Information needed for the decision process is translated into plain language and the numerical calculations of borrowing are made understandable for all consumers (Münscher et al. 2016).

3.1.2. Extensive calculator

The extensive calculator, as seen in figure 2, takes more effort from the consumer. Not only do they need to fill in their loan amount, but the consumers are also asked to fill in other information regarding income and other expenses such as rent. Interestingly, these calculators are left completely blank. This means that the consumer has to think about what number to fill in, without having an amount they can slide to, which is used in the simplified calculator.

With the extensive calculators, credit providers use, among other things, the choice architecture technique of connecting the cost/benefit. The decision to borrow is connected to the income and expenses of a consumer. As this choice architecture technique is a form of giving feedback to the consumers, the more general feedback technique of showing the own behaviour is also used in this calculator.

3.1.3. Effect of calculators on the credit decisions

Although more choice architecture techniques can be seen in the two different calculators, the focus on simplification or connecting decisions to cost/benefit creates the biggest difference between the two types. These different choice architecture techniques do not only trigger different biases, but they also activate different cognitive processes during the credit decision process.

The simplified calculator is easy and understandable for the consumer to fill in, which means a quick decision process. When looking at System I and System II, a domination of the fast and automatic processes of System I seems more likely for the simplified calculator. The extensive calculator, on the contrary, has a more effortful task for consumers to fill in. They need to go through broader steps, which will take longer and cannot be done completely automatically. For this calculator, the domination of the conscious and effortful brain processes, System II, seems more likely.

During a shorter decision circuit, that of the simplified calculator, the consumer does not fall back on evaluating the information (Pousttchi and Dehnert 2018). This will result in the consumers borrowing more compared to the longer decision circuit of an extensive calculator, where they take time to evaluate the disclosed information (Bertrand and Morse 2011). This trade-off leads to hypothesis 2.

Bereken uw lening

Hoeveel wilt u lenen? ⓘ

 €

Waarvoor wilt u geld lenen? ⓘ

- ☐ Auto
- ☐ Bestaande lening(en) oversluiten
- ☐ Verbouwing
- ☐ Restschuld hypotheek
- ☐ Grote aankoop
- ☐ Studie

Wat is uw leeftijd? ⓘ

Wat is uw inkomenbron? ⓘ

 Maak uw keuze

Wat is uw bruto maandinkomen? ⓘ

 €

Wat is uw gezinssituatie?

 Maak uw keuze

Wat is uw woonsituatie? ⓘ

 Maak uw keuze

Wat zijn de maandlasten van eventuele andere leningen? ⓘ

 € 0

Hoeveel alimentatie betaalt u per maand? ⓘ

 € 0

Bereken

Figure 2 Extensive calculator example (ABN AMRO 2020)

Hypothesis 2: A consumer using a simplified calculator will borrow more money compared to a consumer using an extensive calculator

3.2. Preventing overconfidence with the loan calculator

An overconfident consumer is more likely to borrow more money than they need since they believe they will be able to pay this back. When the date of repayment of commitments arises and the consumer realises that they were too overconfident when making the initial decision, the consumer can end up in financial trouble (Zinman 2015). Finding ways in which this overconfidence can be prevented in the early stages, before the consumer makes the offer to the credit provider, is in the best interest of both the credit provider and the consumers. Because consumers consider the loan amount and monthly payments while filling in the loan calculator, this is a good place where overconfidence should be prevented to protect the consumers.

The two types of calculators, the simplified and the extensive, use different choice architecture techniques to support the consumer when making a credit decision. However, only the extensive calculator makes use of the choice architecture technique that could prevent overconfidence. Having to fill in one's actual income and expenses can result in a direct feedback mechanism, which is the most effective in preventing overconfidence (Arkes et al. 1987; Clark and Friesen 2009; Proeger and Meub 2014). Using the extensive calculator means that the consumer will put more effort and conscious considerations into the credit decision. The extra information that they have to include, makes consumers think more broadly about the consequences of their decisions (Bertrand and Morse 2011). Therefore, the extensive calculator can lead to lowering the overconfidence of consumer which should make them borrow less money.

With the simplified calculator, there is no confrontation with the income and expenses nor is there more information than the absolute minimum. For the average consumer, this simplification will mean that the information is easier to process (Münscher et al. 2016). However, for an overconfident consumer, there is a bigger benefit from prevention measures to ensure that they will not overborrow. The simplified calculator does not provide this, so the overconfident consumer will borrow more. The preference for using the extensive calculator to prevent overconfidence is expressed in hypothesis 3.

Hypothesis 3: An overconfident consumer using the extensive calculator will borrow less money in comparison to the overconfident consumer that uses the simplified calculator.

4. Methodology

The research question “*How can borrowing decisions affected by overconfidence in the online consumer credit market be prevented by choice architecture in the loan calculator?*” will be answered through means of an online experiment. The literature suggests that either an overconfident consumer or a consumer using a simplified calculator will borrow more compared to an average consumer. This overborrowing could be prevented by letting an overconfident consumer use an extensive calculator. To answer the research question, the online experiment should measure the effect on the borrowing decision when an overconfident consumer uses a simplified calculator versus and extensive calculator.

This chapter will go into further detail about this online experiment by first describing the experimental design, followed by the ways of measuring the variables in the experiment and how the results of the design can be analysed. The chapter will conclude by evaluating the choice of using an online experiment by explaining its advantages and disadvantages.

4.1. Experimental design

The experimental design is visible in figure 3. The online experiment has a between-subject design and is inspired by the study of Grohmann et al. (2019) where they compared overconfident income expectations to borrowing behaviour on the consumer credit market. An overview of the experiment, including the questions, can be found in appendix II. Ideally, this experiment would have been run with a monetary incentive. However, this was not possible due to financial constraints.

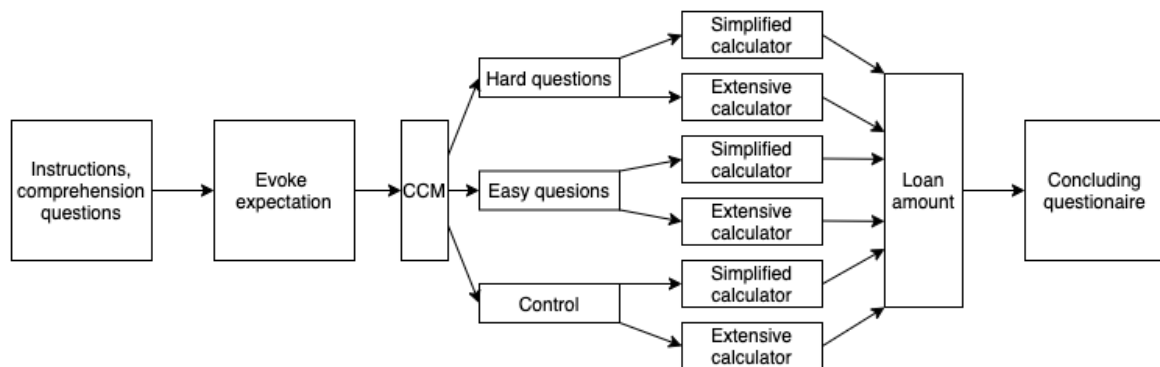


Figure 3 Experimental design

The experiment starts with instructions and comprehension checks. These comprehension checks are about the functions of the online program in which the experiment is made, to ensure that the participants understand how to fill their answers.

After the instructions, the participants are randomly assigned to one of three groups. Two groups will get treated with overconfidence; the other group will be the control group where there will be no priming of overconfidence. One treatment group gets hard knowledge questions, the other treatment group gets easy knowledge question. The questions are the treatment of priming participants

into overconfidence. To ensure that an overconfident feeling is reached, the knowledge questions are followed by questions about the participants' expectations of the number of knowledge questions they answered correctly, and their expectation of correct answers compared to others.

The control group will not receive any questions. Even though there will be a difference in the duration for the control group compared to the treatment groups, the control is still necessary for the experiment as this control group will show what an average consumer will do. Furthermore, this group is not affected by overconfidence treatment, which makes it possible to study the effect of the treatment (Pithon 2013).

The experiment continues by letting all the participants enter the consumer credit market. On this consumer credit market, the participant is given a scenario. In the scenario, the participant just signed the lease of a new rental home. To be able to furnish the home, the participant needs to get a personal loan, while keeping a set of financial information in mind. Because the online experiment will mostly be distributed under young adults, the scenario is purposefully described for a starter in the housing market. The financial information is based on Dutch data about the average rent, savings, starting salaries and their indexations (CBS 2019b, 2019a, 2020; Centraal Planbureau 2020; Heuvel 2019; Rijksoverheid 2019). A complete description of the scenario can be found in appendix II.

The overconfidence treatment randomly assigned the participants to one of three groups; hard questions, easy questions or control. Each overconfidence group is again randomly split into half for the calculator treatment. Using the information received in the scenario, which is the same for everybody, the participants fill in either a simplified or an extensive calculator to decide on the amount of the loan amount.

The last part of the experiment is a concluding questionnaire. The participants are reminded that they have completed the scenario and that this concluding questionnaire should be based on their own life and knowledge. This questionnaire is divided into two parts. The first part, questions about the demographic information of the participants; gender, age, education, occupation, and income (Grohmann et al. 2019). The second part of the questionnaire will test the financial literacy of the participants.

4.2. Data

The research design explained in which way the experiment will use treatments of overconfidence and calculator types to get participants to make a borrowing decision. Ergo, the dependent variable of the experiment is the borrowing decision, represented by the amount of credit the participants decide to take up. The independent variables are the levels of overconfidence and the use of a simplified or extensive calculator. The loan amount and type of calculator can simply be translated to quantitative data. The overconfidence and certain control variables, on the other hand, need to be measured and/or generated before they can be translated to quantitative data.

4.2.1. Generating and measuring overconfidence

The overconfidence needs to be generated before it can be measured. To generate the feeling of overconfidence for the participants, the reverse hard-easy effect will be used as a priming treatment. To ensure that overconfidence is properly generated, two types of overconfidence will be measured, namely the miscalibration and the better-than-average effect.

Reverse hard-easy effect

Overconfidence will be generated by priming participants through the reverse hard-easy effect, which will give a group of participants either easy or hard questions. Getting faced with a certain set of question will make the participant feel either over- or underconfident.

The normal hard-easy effect shows that people are overconfident when a task is perceived as difficult and underconfident when a task is perceived as easy (Bordley, LiCalzi, and Tibiletti 2014). Yet, this assumption is not applicable in all situations. When people are faced with a set of general knowledge questions, instead of a task, the reverse happens. The reverse hard-easy effect indicates that people are overconfident about easy general knowledge questions and underconfident about hard questions (Gigerenzer, Hoffrage, and Kleinbölting 1991).

Research about both the normal and reverse effect has shown that the reverse hard-easy effect is more likely to be true (Moore and Small 2007). In addition, previous research that looked into the relation between overconfidence and debt on the consumer credit market also worked with the reverse hard-easy effect, instead of the normal hard-easy effect, to make their participants feel overconfident (Grohmann et al. 2019). Hence, the reverse hard-easy effect is the best way to prime the participants into overconfidence and will be used during the experiment.

Although the reverse hard-easy effect is likely to work with general knowledge questions and only easy questions are needed to get overconfidence, hard questions will still be asked as a treatment. This will mean that groups that receive a set of easy questions will be assumed to be overconfident, while the group that gets hard questions will be assumed to be underconfident. Both the hard and easy questions will be used because it is not a given that the participants will feel overconfident. It is, therefore, needed to include a measure to indicate how the participants are feeling. With this measure, it is possible to check if the assumed reverse hard-easy effect is effective in generating overconfidence.

Types of overconfidence

To be able to measure if the respondents feel overconfident, it is necessary to look at the different types of overconfidence. There is not just one way in which people can feel overconfident.

Overconfidence can be miscalibration or the better-than-average effect, as previously mentioned (Acker and Duck 2008). The reverse hard-easy effect is an effective way to prime participants into overconfidence, which allows both forms of overconfidence to be enabled (Bordley et al. 2014).

To check which way of overconfident the consumer is feeling, two questions will be asked. One will ask the participants to rate how much of the questions they think they got right, the miscalibration, and one question will ask if the amount of questions they got right is below or above average in comparison to the other participants, the better-than-average effect (Acker and Duck 2008).

4.2.2. Control variables and measuring financial literacy

Several control variables will be taken into account and will be measured through a concluding questionnaire. The first set of control variables will be the demographics of the participants; gender, age, education, occupation, and income (Grohmann et al. 2019). As literature has shown that general educational level alone is not enough to increase the change of being overconfident, the second type of control variable will be the financial literacy of the participants (Bhandari and Deaves 2006).

A higher financial literacy of an educated participant increases their chance of being overconfident (Kramer 2014; McCannon et al. 2016). Financial literacy means that somebody can use their knowledge and skills to manage their financial resources. Measuring the financial literacy of participants can be done by asking them the “Big Five” questions. These questions are focused on testing the participant’s understanding of core financial concepts, such as compound interest, and are a standard to measure financial literacy (Hastings, Madrian, and Skimmyhorn 2013). The complete “Big Five” questions can be found in appendix II.

4.3. Analysing factorial experimental design

The experimental design can be viewed in a 2x3 factorial design matrix as visible in table 2. This design is factorial because the interaction of two independent variables, overconfidence and calculator, leads to the dependent variable, loan amount (Crump, Navarro, and Suzuki 2019:9).

	IV: Simplified calculator	IV: Extensive calculator
IV: Easy questions Overconfidence	Group 1 DV: Loan amount	Group 4 DV: Loan amount
IV: Hard questions Underconfidence	Group 2 DV: Loan amount	Group 5 DV: Loan amount
IV: Control	Group 3 DV: Loan amount	Group 6 DV: Loan amount

Table 2 2x3 factorial design

Analysing a factorial experimental design means looking at significant differences between groups of either the blue or green cells. The green cells show the main effects of the factorial design. The main effects give the differences in the mean of a single independent variable (Crump et al. 2019:9). For example, the total of the simplified calculator has to be tested for significant differences against the total of the extensive calculator. As there are two independent variables and thus two main

effects, there should also be two hypotheses stated to test these effects. Hypothesis 1 and 2, previously mentioned, are about the main effects of the experimental design.

- ❖ *Hypothesis 1:* Overconfident consumers borrow more money compared to an average consumer.
- ❖ *Hypothesis 2:* A consumer using a simplified calculator will borrow more money compared to a consumer using an extensive calculator

The blue cells show the interaction of the factorial design. The combination of both treatments leads to the determination of the loan amount. These two independent treatment variables lead to one interaction in the factorial experimental design. With the interaction, it can be tested if the effect of one independent variable changes at the different levels of the other independent variable (Crump et al. 2019:9). This interaction has also been stated in hypothesis 3.

- ❖ *Hypothesis 3:* An overconfident consumer using the extensive calculator will borrow less money in comparison to the overconfident consumer that uses the simplified calculator.

To be able to analyse results, it is important to find a method that can test both the main effects and the interaction. Most analytic methods are parametric, meaning that there are underlying assumptions with regards to the distribution of the dependent variable. Generally, the dependent variable needs to have a normal distribution to be able to use a parametric model. As the dependent variable of the experiment is a loan amount, it can be more common that the respondent will borrow a maximum amount. This could result in a non-normal distribution of the dependent variable. Non-parametric methods are not bound to normal distribution assumptions (Conover and Iman 1981). Both parametric and non-parametric models are described. Testing the dependent variable on its distribution will determine if parametric or non-parametric methods need to be used. The statistical tests will be performed with Stata.

4.3.1. Parametric methods

The two-way Analysis Of Variance (ANOVA) is the best parametric method to analyse both the main effects and the interaction. An ANOVA is more suited than a 1- or 2-sample t-test because it is possible to test over two groups with ANOVA, which is necessary to be able to test the design (Crump et al. 2019:7). The two-way ANOVA can compare the mean differences of groups with two independent variables and their interaction. This statistical method can, therefore, show all the needed results in one overview.

Six assumptions need to be met before an ANOVA analysis can be used. The first three assumptions are related to how the data is collected and distributed. These assumptions are met without further statistical testing. The other three assumptions need to be tested (Lund Research Ltd 2018b).

1. A continuous dependent variable
2. The two independent variables need to consist of at least two categorical variables from independent groups
3. There should be independence of observations
4. There should be no significant outliers
5. The dependent variable should have a normal distribution for each group of the independent variables
6. Each combination of groups should have homogeneity of variances

4.3.2. Non-parametric methods

There are no clear non-parametric alternative methods for the ANOVA that can analyse the main effects and the interaction of the design in one method. This means non-parametrically, ways to test the main effects and the interaction have to be analysed separately.

Main effects

The Kruskal-Wallis test is a non-parametric test that is suitable for the main effects of the design. This rank-based test is preferred over the other non-parametric tests, such as the Mann-Whitney U test because it can be used to determine significant differences for two or more groups (Lund Research Ltd 2018a). This is relevant considering that the independent variable overconfidence consists of three levels.

Just like the ANOVA, this Kruskal-Wallis test comes with assumptions. However, unlike the ANOVA these assumptions do not require a normal distribution. There are a total of four assumptions, of which the first three are related to data collection and distribution (Lund Research Ltd 2018a).

1. A continuous dependent variable
2. The two independent variables need to consist of at least two categorical variables from independent groups
3. There should be independence of observations
4. The distributions of each group in the independent variable should have the same shape

Interaction

Testing an interaction in a non-parametric way is rather difficult. Non-parametric methods that test interaction often suffer from complexity or lack of power (Leys and Schumann 2010). The best method available starts with the adjusted rank transform test (ART). The data is transformed into aligned ranks. To be able to show the interaction with aligning, the main effects are removed before the data is ranked (Johnson 2017). After transformation, the data can be used to perform a parametric test, such as the ANOVA mentioned previously (Conover and Iman 1981; Leys and Schumann 2010).

For one-way ANOVA the ART procedure can be used to show adequate results (Mansouri, Paige, and Surles 2004). However, the experimental design calls for a two-way ANOVA, so that main effects and interaction can be tested. For the two-way ANOVA, the ART procedure is less appropriate. This ANOVA on ranks has an increased Type I error, which means that there is a higher chance that the null hypothesis is rejected even though the null hypothesis is true (Luepsen 2017). This increase in Type I error, sometimes even reaching a 100% probability, has been found in several studies. There is a big probability that results from a two-way ANOVA on ranks give a false positive.

4.4. Online experiments

The experimental design is put into a Qualtrics survey. Using the functions of Qualtrics the experiment is distributed with QR-code, social media and anonymous links. The distribution for both the QR-code and social media, and partly for the anonymous link, has been through a personal network.

To also reach participants outside of the personal network, most participants are selected through SurveySwap. This website is made to distribute surveys among students and researchers, which will mean that there is more variation among the participants. Still, most of the participants will be students. This has been taken into account when making the scenario of the research design.

4.4.1 Advantages and disadvantages of online experiments

Choosing to work with an online experiment comes with several advantages and disadvantages. An advantage of online experiments is that they are cheap (Finley and Penningroth 2015). It is also easy to get access to a large samples size. The ability for easy distribution reduces the data collection time and experimenter effects, which are the subconscious ways in which researchers let their cognitive bias affect the experiment (Reips 2002).

On the other hand, several disadvantages come with testing through an online experiment. The biggest is regarding the quality of data. Participants could be distracted by their surroundings and pay less attention to the instructions given. This can result in misunderstanding the experiment which means that the participants will not give answers as intended (Finley and Penningroth 2015). In addition to distractions, the problems of high dropout rates and repeated participation are also unique for the online experiment environment (Birnbaum 2004; Finley and Penningroth 2015; Reips 2002). Another disadvantage is that online experiments work best with a restricted duration. Participants are more likely to lose interest and focus when filling in online experiments, which leads to them either quitting the experiment or rushing through it. The online experiment, therefore, has a limited time frame and should not exceed 10 minutes (Revilla and Ochoa 2017).

The disadvantages mentioned have been taken into account when designing and distribution the experiment. To persevere the data quality of the experiment, comprehension checks are added.

These checks have to be passed before proceeding and will ensure that the participants have read and/or have understood the instructions (Crump, McDonnell, and Gureckis 2013). All answers in the experiment need to be filled in before the online program continues to the next part of the experiment.

Date loss due to problems with comprehending the experiment also needs to be taken into account. The experiment that will be conducted for this thesis can be seen as a relatively complex decision environment. Taking into account a 20% data loss rate can be seen as adequate anticipation (Finley and Penningroth 2015).

The high dropout rates are reduced by distributing the experiment on websites such as SurveySwap. These websites use a credit system to let people fill in each other's surveys. Credits are earned by taking other surveys and reduced by having participants fill in the survey. This ensures that one can only get participants when they actively partake in surveys. Furthermore, these websites have quality control to guarantee that real people are filling in the surveys (SurveySwap 2020).

To decrease the likelihood of having a participant repeat the experiment, the Internet protocol addresses of the participants are tracked (Birnbaum 2004).

5. Results

This chapter discusses the results of the online experiment and starts by giving an overview of the data collected. This is followed by an analysis of the main effects and interaction. Finally, the chapter shows the robustness of the overconfidence treatment.

5.1. Overview of results

The experiment was answered by 146 respondents. However, some exclusion of the respondents was needed, which resulted in 126 respondents being taken into account during the analysis. The respondents that were excluded were mostly related to those who filled in the extensive calculator. For this calculator, the respondents had to fill in the income source, monthly income, living situation and monthly housing cost before determining the loan amount. These four factors were given in the scenario. Respondents who wrongly filled in two or more of these factors often borrowed small amounts or even 0 euros. This indicates that they did not properly read and take into account the information given in the scenario but based the answer on their own life. Therefore, the respondents were excluded.

In Appendix III, an overview of the data and descriptive graphics of the demographics of the respondents are shown. Figure 4, 5 and 6 show graphics of the three main variables needed for the analysis, the loan amount, overconfidence and calculator type. The loan amount varies between the €5,000 and €15,000, with most respondents answering either €10,000 or €15,000. The histogram of the loan amount already shows that the data is skewed to the right.

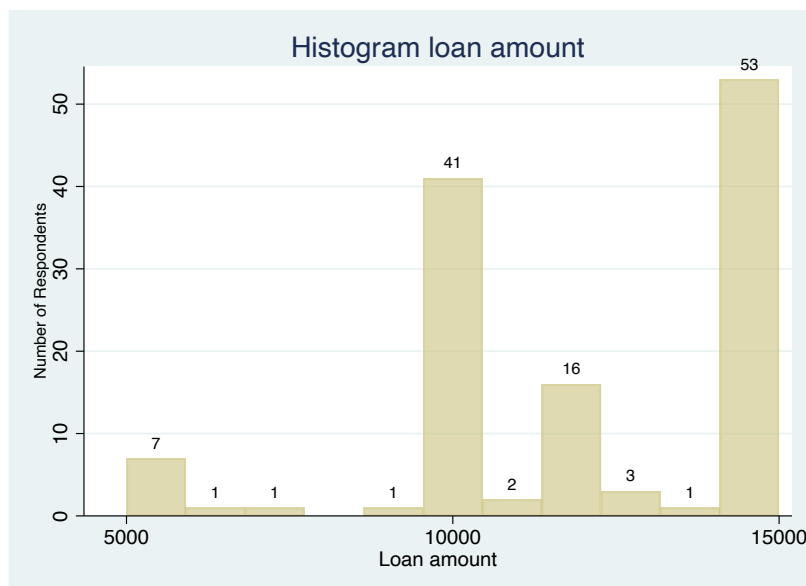


Figure 4 Histogram Loan Amount

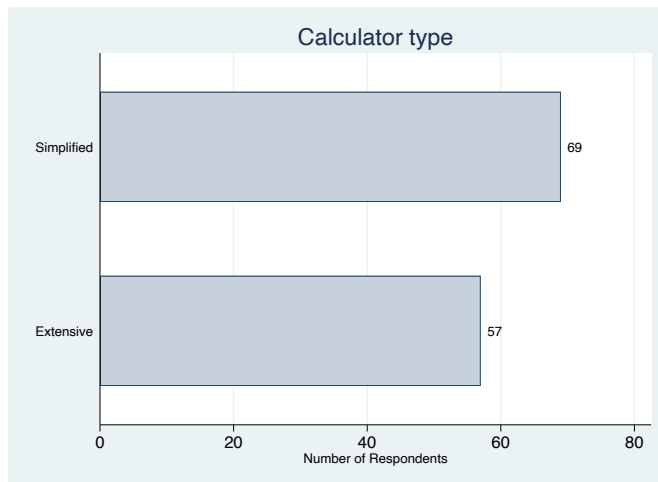


Figure 6 Distribution of calculator

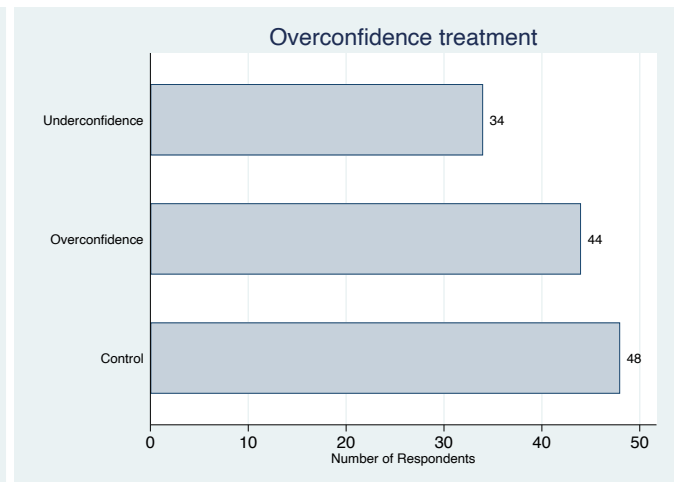


Figure 5 Distribution of overconfidence

The design of this experiment divided the respondents into one of six groups. This division is visible in table 3. The tabulation shows the number of observations, the mean regarding loan amount and the standard deviation of each of these groups. Observing the tabulation gives a first glance at possible results.

It seems that on average the loan amount is higher for the simplified calculator. Both the underconfident and overconfident respondents borrow more under this simplified calculator. Only under the control groups is this not the case. Interestingly, the groups that are underconfident, meaning that they received the treatment with the hard questions, borrow the most overall for both the simplified and extensive calculator.

Treatment overconfidence		Treatment calculator	
		Simplified	Extensive
Underconfidence	Obs	19	15
	Mean	13,236.84	12,466.67
	Std. Dev.	2,238.355	2,503.331
Overconfidence	Obs	22	22
	Mean	11,500	11,286.36
	Std. Dev.	2,939.874	3,173.858
Control	Obs	28	20
	Mean	12,160.71	12,400
	Std. Dev.	3,159.505	2,945.112

Table 3 Tabulation of group division

5.1.1. Distribution of loan amount

To determine whether the results should be analysed using parametric or non-parametric methods, it is necessary to look at the distribution of the dependent variable loan amount. When this variable is normally distributed, parametric methods can be used. Otherwise, the data has to be analysed with non-parametric methods. The distribution of the dependent variable can be determined visually, by looking at the histogram of figure 4, but it can also be statistically tested.

To statistically test for a normal distribution of the loan amount, the Shapiro-Wilk test of normality is used. The Shapiro-Wilk test has been proven to be the most powerful normality test, even for smaller sample sizes (Ghasemi and Zahediasl 2012; Mohd Razali and Yap 2011). According to the null hypothesis, if the probability from the test is greater than the alpha 0,05, the variable has a normal distribution.

H_0 = loan amount is normally distributed

H_A = loan amount is not normally distributed

Variable	Obs	W	V	z	Prob>z
Loan amount	126	0.95909	4.103	3.171	0.00076

Table 4 Shapiro-Wilk W test for normal data

The results from the Shapiro-Wilk test of normality are visible in table 4. The probability of 0,0075 is smaller than the alpha of 0,05, therefore, the H_0 is rejected. H_A is accepted, which means that the loan amount, the dependent variable, is not normally distributed.

5.2. Non-parametric test results

The Shapiro-Wilk test showed that there is a non-normal distribution of the dependent variable. Thus, the parametric ANOVA analysis cannot be used to test the data, as the assumption for a normal distribution is violated. For that reason, data is analysed using non-parametric methods.

5.2.1. Main effects

To test the two main effects of the design, the Kruskal-Wallis test will be used. Four assumptions need to be met before the Kruskal-Wallis test can be applied (Lund Research Ltd 2018a). The first three assumptions are already satisfied. The fourth assumption is not yet satisfied and has to be tested before the Kruskal-Wallis test is performed.

1. The dependent variable loan amount is a continuous variable
2. The two independent variables, calculator and overconfidence consist of at least two categorical variables from independent groups
3. There is independence of observations
4. The distributions of each group in the independent variable should have the same shape

Analysing whether distributions of each group has the same shape, can be done visually by looking at histograms of all the levels of the independent variable in question. If the groups/levels are generally similar and have the same skewness, the distribution is assumed to have the same shape. The fourth assumption is met accordingly.

When the Kruskal-Wallis test is performed, it orders the data into a rank sum to look at the differences in the means of the groups for the independent calculator and overconfidence variables. The null hypothesis states that the mean ranks of the groups are equal to each other. This is rejected when there is a significant difference between the means of alpha 0,05.

H_0 = mean ranks of the groups are equal

H_A = mean ranks of the groups are not equal

Calculator

To test if the calculator treatment groups have a similar shape, the histogram of both the calculator groups simplified and extensive are combined in figure 7. The distribution of both groups is generally similar and have the same skewness to the right. It can be stated that the distribution of each group has the same shape, which means that the fourth assumption of the Kruskal-Wallis test is met.

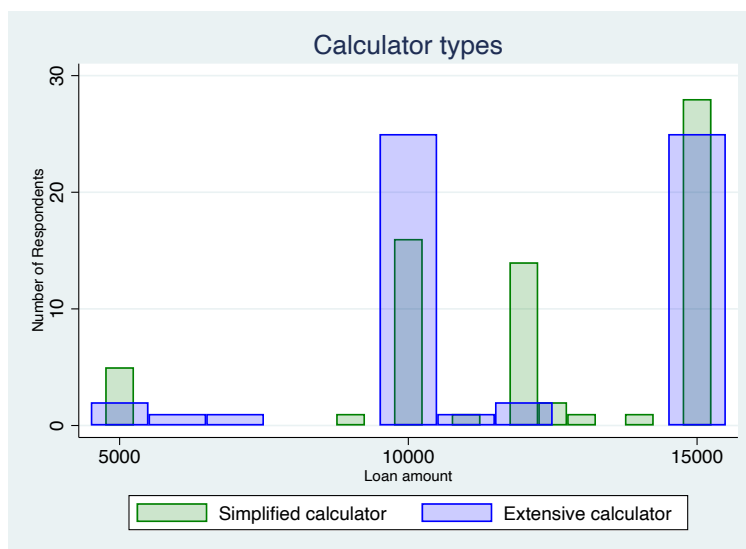


Figure 7 Histogram calculator treatment

The Kruskal-Wallis test looks at the rank sum of the groups to determine the chi-square and the probability. Because a group has multiple respondents that answered, for example, €10,000, these data points are tied. Tied values cannot be ranked without adjustment. It is, therefore, necessary to look at chi-squared with ties of the Kruskal-Wallis, as this corrects for the tied values (Lund Research Ltd 2018a). The results of the test are shown in figure 8.

Kruskal-Wallis equality-of-population rank test

Treatment calculator	Obs	Rank Sum
Simplified	69	4525.50
Extensive	57	3475.50

Chi-squared 0.498 with 1 d.f.
Probability 0.4803

Chi-squared with ties 0.560 with 1 d.f.
Probability 0.451

Figure 8 Kruskal-Wallis calculator treatment

The probability of the Kruskal-Wallis test of 0.451 is above the alpha of 0.05, which means that H_0 is accepted. The test shows no significant difference between the simplified and extensive calculator.

Overconfidence

To test the similarity of distribution for the overconfidence treatment groups, the histogram of all three the levels are combined in figure 9. The histogram shows that the shapes are not similar. Both the overconfidence and control group have a minimum value of €5,000, while the underconfident group has a minimum value of €10,000. To be able to run a Kruskal-Wallis test, the minimum value of the loan amount has to be increased.

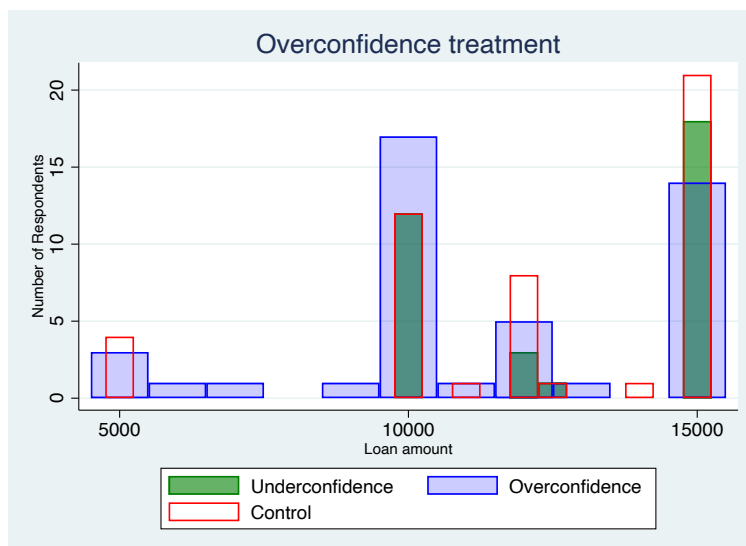


Figure 9 Histogram overconfidence treatment

Correcting the minimum value of loan amount to be at €10,000, gives the histogram visible in figure 10. This leads to ten values being removed. Adapting this correction will give the groups a similar distribution. It can then be stated that the distribution of each group has the same shape, which means that the fourth assumption of the Kruskal-Wallis test is met. The test is performed with the loan amounts above €10,000.

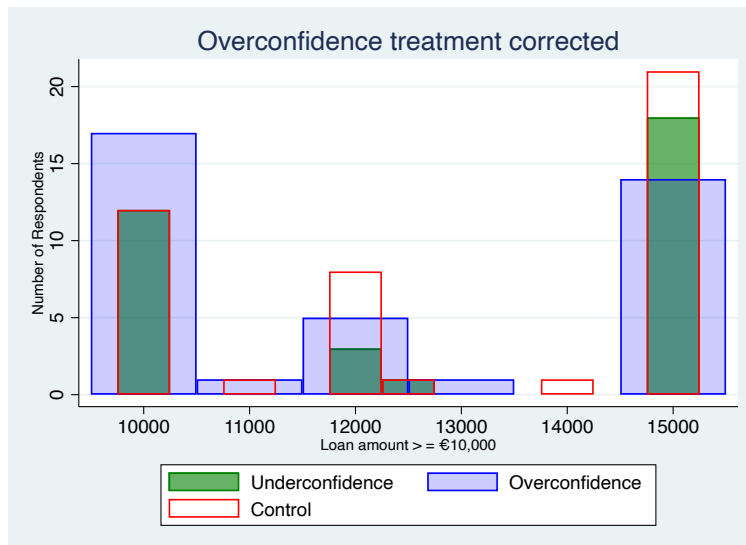


Figure 10 Histogram overconfidence groups adjusted to loan amount >10.000

The Kruskal-Wallis test has to take tied values into account again, which means looking at chi-squared with ties. The results of the Kruskal-Wallis test are shown in figure 11.

Kruskal-Wallis equality-of-population rank test

Treatment overconfidence	Obs	Rank Sum
Underconfidence	34	2087.00
Overconfidence	38	1979.00
Control	44	2720.00

Chi-squared	2.063	with 2 d.f.
Probability	0.3564	

Chi-squared with ties	2.405	with 2 d.f.
Probability	0.3004	

Figure 11 Kruskal-Wallis overconfidence treatment

The probability of the Kruskal-Wallis test of 0.3004 is above the alpha of 0.05, which means that H_0 is accepted. The test shows no significant difference between underconfident, overconfident and control.

5.2.2. Interaction

Besides the main effects of the calculator and overconfidence, there is also an interaction between the calculator and overconfidence on the loan amount that should be tested on significant differences between groups. A graph can help with visualizing how the interaction looks. The means per group of table 3 of this chapter are filled into the factorial design of table 2 from chapter 4. This complete factorial design of table 5 is used in figure 12, where the groups means of the blue cells are graphically plotted to see what the interaction looks like.

	IV: Simplified calculator	IV: Extensive calculator	
IV: Easy questions Overconfidence	Group 1 €11,500.00	Group 4 €11,286.36	€12,851.76
IV: Hard questions Underconfidence	Group 2 €13,236.84	Group 5 €12,466.67	€11,393.18
IV: Control	Group 3 €12,160.71	Group 6 €12,400.00	€12,280.36
	€12,299.18	€12,051.01	

Table 5 Factorial design with means

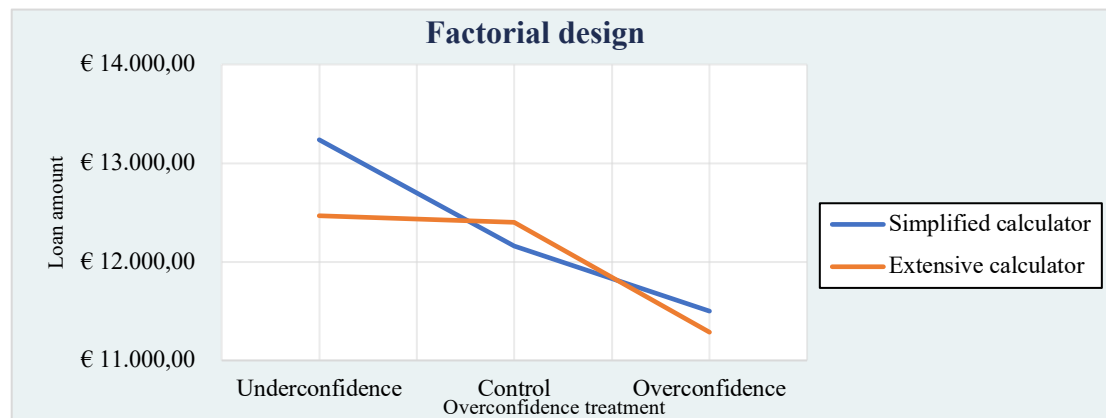


Figure 12 Graph factorial design with means

The visualisation in figure 12 shows an interaction between choice architecture in loan calculator and overconfidence. The simplified and extensive calculator lines cross and are also not completely linear to each other. To statically test the interaction, the non-normally distributed data should be aligned rank transformed to fit a parametric method. However as described in chapter 4, using the aligned rank transformation for a two-way ANOVA has been proven to not be a completely effective option, as it increases the Type I error (Luepsen 2017). This transformation should be applied with caution and is for that reason only suitable when there is a great reason to believe that the interaction could be significant. This is not the case. The differences seen in figure 12 seem relatively small, which can increase the risk of a Type I error. It is, therefore, not sufficient to align rank transform the data and statistically test this through an aligned rank two-way ANOVA.

As the aligned rank two-way ANOVA is not deemed appropriate, another possibility is to test for differences between the groups with the Kruskal-Wallis test. The combination of groups that are tested is in correspondence with the points on the graph of figure 12. This means that a Kruskal-Wallis is performed on the following combination; groups 1 & 4, groups 2 & 5, and groups 3 & 6. The fourth assumption with regards to a similar distribution is tested in Appendix IV. All combinations meet this assumption. The test can be performed. For the Kruskal-Wallis test of figure 13, the chi-squared with ties is relevant, as there are again tied values in the data.

<i>Kruskal-Wallis equality-of-population rank test</i>								
Interaction Group 1 & 4			Interaction Group 2 & 5			Interaction Group 3 & 6		
Obs	Rank	Sum	Obs	Rank	Sum	Obs	Rank	Sum
Group 1	22	514.00	Group 2	19	357.00	Group 3	28	581.50
Group 4	22	476.00	Group 5	15	238.00	Group 6	20	494.50
Chi-squared	0.199	with 1 d.f.	Chi-squared	0.722	with 1 d.f.	Chi-squared	0.009	with 1 d.f.
Probability	0.6556		Probability	0.3955		Probability	0.9250	
Chi-squared with ties	0.291	with 1 d.f.	Chi-squared with ties	0.894	with 1 d.f.	Chi-squared with ties	0.010	with 1 d.f.
Probability	0.6399		Probability	0.3444		Probability	0.9208	

Figure 13 Kruskal-Wallis interaction

The probabilities of the Kruskal-Wallis tests of 0.6399, 0.3444 and 0.9208 are all above the alpha of 0.05, which means that H_0 is accepted. The test shows no significant differences between groups in the interactions. The interaction effect of the design is insignificant.

5.2.3. Conclusion of hypotheses

The findings from the literature are expressed in three hypotheses:

1. Overconfident consumers borrow more money compared to an average consumer
2. A consumer using a simplified calculator will borrow more money compared to a consumer using an extensive calculator
3. An overconfident consumer using the extensive calculator will borrow less money in comparison to the overconfident consumer that uses the simplified calculator

Hypothesis 1 and 2 refer to the main effects. Both of these are insignificant, meaning that hypothesis 1 and 2 are rejected. The interaction of hypothesis 3 is also rejected as the results are insignificant.

5.3. Robustness of overconfidence treatment

So far, the categorization of the overconfidence groups is based on the treatment the respondents have received through the reverse hard-easy effect. This means that the respondent treated with the easy questions are assumed to be overconfident and are categorized as such. To see if the overconfidence treatment had been effective, and to further prime the respondents, they were also asked two questions to measure their better-than-average or miscalibration overconfidence. Based on the answer to this question, two extra variables can be made, the actual overconfidence effects. In Appendix III, it is tested if the characteristics of overconfidence found in the literature have a significant effect on the respondents being overconfident. There are no significant characteristics, meaning that the overconfidence that the respondents felt is a result of the treatment.

The correlation matrix of table 6, looks at the strength of the relationship between actual better-than-average, actual miscalibration and overconfidence. The strong correlation of 0.992 between the miscalibration and overconfidence, shows that the overconfidence treatment is effective

in making the respondents feel miscalibration overconfidence. The correlation of 0.387 between better-than-average and overconfidence, on the other hand, is rather weak. This means that the treatment of reverse hard-easy effect did not necessarily make the respondent feel like they were better than the other respondents that participated in the experiment. The reverse hard-easy effect that was used in the experiment worked better at making the respondents feel miscalibration overconfidence than it did at making them feel better-than-average overconfidence.

Variables	(1)	(2)	(3)
(1) Overconfidence	1.000		
(2) Actual better-than-average	0.387	1.000	
(3) Actual miscalibration	0.922	0.427	1.000

Table 6 Correlation matrix overconfidence

Besides looking at the correlation between the actual overconfidence and the treatment overconfidence, the division of the categories under the actual overconfidence visible in table 7 can also show how effective the treatment was into making people feel overconfident.

Actual miscalibration overconfidence		Treatment calculator		Actual better-than-average overconfidence		Treatment calculator	
		Simplified	Extensive			Simplified	Extensive
Underconfidence	Obs	13	10	Underconfidence	Obs	7	4
	Mean	13,192.31	12,700		Mean	12,785.71	10,500
	Std. Dev.	2,175.033	2,496.665		Std. Dev.	1,776.165	1,000
Overconfidence	Obs	28	27	Overconfidence	Obs	5	7
	Mean	11,892.86	11,418.52		Mean	13,200	10,878.57
	Std. Dev.	2,922.952	3,061.019		Std. Dev.	2,683.281	3,146.937
Neither	Obs	28	20	Neither	Obs	57	46
	Mean	12,160.71	12,400		Mean	12,096.49	12,285.87
	Std. Dev.	3,159.505	2,945.112		Std. Dev.	3,037.619	2,973.077

Table 7 Tabulation of groups under actual miscalibration and actual better-than-average overconfidence

The tabulation shows that under the actual miscalibration effect there is a good division of respondents in every group. 55 respondents felt overconfident because of the treatment. This is not the case for the actual better-than-average overconfidence. Most respondents fall under the ‘neither’ category, only 12 respondents felt overconfident. It can be concluded that the overconfidence treatment worked for the miscalibration overconfidence but did not work for the better-than-average overconfidence. The reverse hard-easy treatment was effective in making people feel overconfident, as long as this overconfidence is defined as miscalibration overconfidence.

6. Discussion

The results of the research did not significantly support the overconfidence problem on the consumer credit market, nor did it significantly show that a different choice architecture technique in the loan calculator affects either the general borrowing behaviour or the borrowing behaviour of overconfident consumers. This chapter will discuss these findings in relation to literature, improvements that relate to the research design and future research.

The first main effect of the study is the relation between overconfidence and borrowing behaviour. The result shows an insignificant relation between overconfidence and borrowing. However, this is not in line with the literature. Several previous studies (e.g.: Brown et al. 2005; Kamleitner and Kirchler 2007; Rihab and Lotfi 2016)) have found a significant positive relation between overconfidence and debt level. Also, the more specific relation between overconfidence and borrowing behaviour on the consumer credit market has been proven to be significant (Grohmann et al. 2019). A difference between previous studies and this research is the size of the observations. The insignificant results may be due to the limited number of observations per group in comparison to other studies. Besides increasing group sizes, improving the way the loan amount is collected in the experimental design, can also affect the insignificant results. A better quality of this variable will increase the strength of the experiment.

The answers that the participants gave for the loan amount varied between €5.000 - €15.000. However, participants that answered below €8.850² could not have purchased the furniture that was needed. Therefore, these answers should not have been a possibility. There are two ways in which the experimental design could have improved upon this. The first way is by adding a minimum amount to the question. Anything that is answered below €8.850 cannot be accepted. A second way, which is less restricting, is to add another question to the design. In this question, participants are asked why they did not borrow enough money to purchase the furniture immediately. This can be followed by questioning if they are certain of this lower amount or if they would like to change it.

The second main effect, regarding the relationship between the choice architecture in the loan calculator and borrowing behaviour, is not one that has been researched in previous studies. Thus, the insignificant results of this main effect cannot be related to findings in the literature. A reason for the insignificant results can be the possible complexity of having to remember a scenario and having to imagine oneself in this scenario. The participants that were excluded from the data, where almost all participants that did not correctly remember the information from the scenario and, consequently, did not correctly fill in the extensive calculator. With the collection of respondents, a data loss of 20% was taken into account for miscomprehension of the experiment, which is equal to the number of participants that have been excluded.

² Furnishing €15,000 – savings €5,000 - €1,150 that is left of income after expenses = €8,850

Although the second main effect has been statistically proven to be insignificant, initial observation of the tabulation in table 3 did suggest a link between borrowing behaviour and choice architecture in the loan calculator. The borrowing behaviour when using an extensive calculator was lower for two out of the three groups. This could indicate that a weak link exists between the loan amount and the loan calculator type.

The group that did not have a lower loan amount when using the extensive calculator, were the control groups. These control groups did not get a task before starting the scenario and went through the experiment quicker. It was difficult to find a good task for the control group with the same duration as the hard-easy questions, that did not affect them in any other way and where a motivation with financial incentives was not necessary. Due to this, it was decided to not give the control groups a task. Even though options were limited, it would have been better to give them some task. The control group with the simplified calculator went through the experiment very quickly, sometimes in two minutes. It could very well be possible that some of the participants in this control group did not take the experiment seriously enough. Adding a task for the control group would improve the experimental design and can affect the findings of the second main effect.

Lastly, there is also an interaction in the research. Testing for differences between the groups in the interaction did not result in any significant findings. The interaction and both the main effects are insignificant.

The current experimental design did not have the opportunity to use financial incentives. It is, however, very possible to add these to the experiment and improve the strength of, for example, the overconfidence treatment. For the groups that get either hard or easy questions, adding financial incentives will mean that there is more weight added to the answers. The amount of questions the participants answered correctly is related to the monetary reward they will receive. This will add more importance to the questions, which increases the priming effect (Grohmann et al. 2019). Having access to financial incentives would also improve the control groups. When incentives are possible, adding a lottery would give them a task not related to knowledge, while still giving them a similar duration of the experiment. The monetary reward for a lottery is random and, hence not related to their performance (Grohmann et al. 2019).

Even though there are no significant results, there is still something striking in table 3. Against the expectations of the literature, the consumer that was treated with the hard questions, the underconfident consumer, borrows more money overall. Even though this difference is not significant, it is still interesting. Although it is only possible to speculate about this borrowing behaviour, perhaps the hard questions that these participants received mentally exhausted them in a way that it affected their ability to focus on the second task. Since there is only one other previous study that used the reverse hard-easy effect to generate overconfidence on the consumer credit market, it is not possible to confirm whether mental exhaustion played a role (Grohmann et al. 2019). Future research could look into the effect of hard and easy question on mental exhaustion.

Future research is also possible for running the experiment in a lab instead of online. A lab experiment is not as restricted by time as an online experiment. An online experiment should not exceed 10 minutes so that the interest of the participants is not lost (Revilla and Ochoa 2017). Increasing the time of the experiment gives room for a longer hard-easy questionnaire. The robustness of the overconfidence treatment showed that the better-than-average effect was not achieved. It may be possible to give the participants a better-than-average overconfidence feeling when the amount of questions is increased. Currently, there are only five hard-easy questions due to the time limit of online experiments while a similar study worked with at least twenty hard-easy questions (Grohmann et al. 2019).

7. Conclusion

Consumers should be protected when making credit decisions on the online consumer credit market. Protecting consumers means finding preventive measures to ensure that consumers make well-evaluated credit decisions. Without this protection, consumers can let biases affect their decisions process which increases the chance of borrowing more money than they can financially handle. This research aimed to study the prevention of a bias by answering the research question “*How can borrowing decisions affected by overconfidence in the online consumer credit market be prevented by choice architecture in the loan calculator?*” This chapter answers the research question by reflecting on the results, giving contributions of the study and making recommendations for future research.

The literature of the research identified two main effects for the online consumer credit market. Overconfident consumers borrow more money on the online consumer credit market and the extensive calculator choice architecture technique leads to more borrowing compared to a simplified calculator. Based on the quantitative results from the online experiment, both main effects are not proven to be significant.

The two identified main effects also interact with each other, as the extensive calculator provides feedback that can prevent a consumer from getting overconfident. The extensive calculator can then be seen as a prevention measure for the overborrowing behaviour of an overconfident consumer. The results established that this interaction is insignificant.

The lack of significant results in contrast to the expectation from literature could be explained by the limitations of the experiment. The online experiment had a rather small amount of observations per group and the strength of the experiment could have been improved if the control group had an additional task and if financial incentives could have been made available.

The research contributed a market analysis which showed that there are two types of loan calculators in the Dutch consumer credit market. The credit providers either will use a simplified calculator or use an extensive calculator. Little other research has been done into the effect of the different loan calculators. Although not proven to be significant, the initial descriptive statics did suggest that the extensive and simplified choice architectures in the loan calculators can affect the borrowing behaviour. It could be worthwhile for future research to further investigate the different types of loan calculators and the opportunities they give to protect consumers.

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Appendix I. Loan calculators on the Dutch credit market

The loan calculators of Nationale Nederlanden, Rabobank, ABN, FREO and ING have been compared for the market analysis. The loan calculators can be categorized into two different types; the simplified and the extensive calculator.

Simplified calculator

Two credit providers use clear example of a simplified calculator, where only the most basic relevant information is shown to the consumer.

Nationale Nederlanden

Figure 14 Nationale Nederlanden loan calculator (Nationale-Nederlanden 2020)

Figure 15 Nationale Nederlanden loan calculator extended (Nationale-Nederlanden 2020)

Freo

Figure 16 Freo loan calculator (Freo 2020)

Both the calculators of Nationale Nederlanden use default in the sliders, set at the start. Defaults in relation to borrowing behaviour has been researched extensively, not of interest for further investigation (AFM 2018).

Extensive calculator

Two credit providers have calculator where extensive information is needed.

ABN AMRO

Bereken uw lening

Hoeveel wilt u lenen? ⓘ

€

Waarvoor wilt u geld lenen? ⓘ

- Auto
- Bestaande lening(en) oversluiten
- Verbouwing
- Restschuld hypotheek
- Grote aankoop
- Studie

Wat is uw leeftijd? ⓘ

Wat is uw inkomstenbron? ⓘ

Maak uw keuze ✓

Wat is uw bruto maandinkomen? ⓘ

€

Wat is uw gezinssituatie?

Maak uw keuze ✓

Wat is uw woonsituatie? ⓘ

Maak uw keuze ✓

Wat zijn de maandlasten van eventuele andere leningen? ⓘ

€

Hoeveel alimentatie betaalt u per maand? ⓘ

€

Bereken

Figure 17 ABN AMRO loan calculator (ABN AMRO 2020)

Rabobank**Bereken je lening**

Hoeveel wil je lenen?

€

Wat is het doel van je lening?

Maak een keuze ✓

Wat is je inkomstenbron?

Maak een keuze ✓

Wat is je netto maandinkomen?

€ ⓘ

Wat is je woonsituatie?

Maak een keuze ✓

Wat zijn je woonlasten per maand?

€ ⓘ

Heb je elders nog andere consumptieve leningen?

☐ Ja ☐ Nee

Heb je kinderen onder de 21 jaar? ⓘ

☐ Ja ☐ Nee

Wat is je burgerlijke staat?

Maak een keuze ✓

Berekenen

Indicatie	
Kosten per maand	...
Rente	...
Totale kosten	...
Type lening	...
Leenbedrag	...
Looptijd	...
Totale rente	...

Lening aanvragen

Deze bedragen geven een indicatie.
[Uitgangspunten bij de berekening](#)

Figure 18 Rabobank loan calculator (Rabobank 2020)

The calculators are left blank meaning that there are no amounts filled in. Every step needs to be filled in before the calculator gives a result. Also, when specifying thing as living situation or marriage, other options will be given in relation to these answers.

*The odd one out***ING**

The loan calculator of ING is almost a combination of both principles. The consumer gets asked if they know how much they want to borrow. If they do, the consumer gets presented with a relatively simplified calculator.

Hoeveel wil je lenen?

Je leenbedrag

Weet je al hoeveel je wilt lenen?

☒ Ja, namelijk € 10.000

☐ Nee, hoeveel mag ik eigenlijk maximaal lenen?

Gebruik van je lening

Je lening

Waar wil je de lening voor gebruiken?

Auto Motor Caravan Boot

Financiële ruimte Verbouwing huis Woning inrichten Ander leendoel

Ben je huiseigenaar?

☐ Ja ☐ Nee

Je berekening

Je maakt een berekening voor de Persoonlijke Lening en je kunt hier zelf een looptijd kiezen.

Hoeveel wil je lenen? € 10.000

Looptijd Persoonlijke Lening Maak een keuze

Bereken

Figure 19 ING loan calculator (ING 2020)

If the consumers are not sure how much they want to borrow, ING gives a more extensive option menu with information that the consumer can fill in. The overtone of the ING calculator is a more extensive approach to also asking other relevant information of consumers.

Je situatie

Geboortedatum dd-mm-jjjj

Burgerlijke staat Maak een keuze

Werk situatie Maak een keuze

Financieel verantwoordelijk voor kinderen? ☐ Ja ☐ Nee

Betaal je kinder- of partneralimentatie? ☐ Ja ☐ Nee

Wat is je woonsituatie? Maak een keuze

Heb je nog andere leningen? ☐ Ja ☐ Nee

Bereken

Figure 20 ING loan calculator extended (ING 2020)

Appendix II. Experiment

Instructions

Thank you for participating in this research. This experiment is designed for my master behavioural economics. During the experiment, a scenario is shown with income, rental charges and future expectations. You will be asked to create an assignment based on this scenario.

Design

1. Instructions
2. Quiz
3. Scenario and assignment
4. Final questions

Voorbeelden van vragen die voorkomen in het experiment.

De quiz bestaat uit een aantal meerkeuze vragen. Hierbij kan je het juiste antwoord geven door erop te klikken.

Juiste antwoord
☐

Tijdens de opdracht wordt gebruik gemaakt van een tekst invoer balk zoals hieronder. Vul hierbij ronde bedragen in (geen gebruik maken van komma's).

Figure 21 Screenshot comprehension question of functions

The questions will be processed anonymously. The total experiment will take approximately 5-10 minutes.

Thanks in advance for filling in the experiment!

Quiz

Easy questions

1. In which century was World War II?
 - a. Eighteenth
 - b. Nineteenth
 - c. Twentieth
 - d. Twenty-first
2. Which organ ensures the blood circulation?
 - a. Lungs
 - b. Heart
 - c. Kidneys
 - d. Liver
3. Which party of the current coalition, Rutte III?
 - a. PvdA
 - b. SP
 - c. GroenLinks
 - d. VVD

4. What does the chemical abbreviation H₂O stand for?
 - a. Nitrogen
 - b. Oxygen
 - c. Water
 - d. Iron
5. What is the currency of the United Kingdom?
 - a. Pound
 - b. Euro
 - c. Dollar
 - d. Frank

Hard questions

1. In which century did the Eighty Years' War end?
 - a. Fourteenth
 - b. Fifteenth
 - c. Sixteenth
 - d. Seventeenth
2. Which part of the human eye is responsible for the colour observations?
 - a. Rods
 - b. Cones
 - c. Lens
 - d. Buttons
3. Which political party in the Netherlands has never been part of a coalition?
 - a. ChristenUnie
 - b. PvdA
 - c. D66
 - d. SP
4. What does the chemical abbreviation AG stand for?
 - a. Gold
 - b. Iron
 - c. Silver
 - d. Mercury
5. What is the currency of Serbia?
 - a. Dinar
 - b. Dirham
 - c. Peso
 - d. Rial

After either the easy or hard questions, two questions to measure overconfidence:

How many questions do you think you answered correctly?

- More than half
- Less than half

How well do you think you did in comparison to other participants?

- I did better than other participants
- I did worse than other participants
- I did not do better or worse than other participants

Scenario

Imagine that you have a new rental home and it is now time to furnish this rental home.

This is your current financial situation

- The rental price of the house is €850 per month
 - o The contract states that this price can be increased annually, on average between 3% and 5%
- You have a permanent job where you earn €2,000 net
 - o You expect the net wage to increase by at least 3% annually
- €1,150 euros is therefore left each month for other expenses and possibly for savings
 - o This may become less or more in the future
- There is €5,000 in savings in your account
 - o With this savings account you can ensure that there is enough money available for now and for in the future

The furnishing will cost €15,000. It is therefore necessary to borrow more money for this

Short view

- Rental price €850 (increase 3% - 5%)
 - Permanent contract €2,000 (increase at least 3%)
 - Savings €5,000
 - Furnishing: €15,000
-

With this information available, you visit the Bank ABC website to take out a loan

Below the scenario, the participants were asked if they had read the information. They could only continue if they pressed agreed.

- I have read the scenario (You cannot go back to this information)
 - o Agreed

Filling in the calculators*Extensive*

Opdracht: Lening op website Bank ABC



Op de website van bank ABC wordt om informatie (uit het scenario) gevraagd.
Doe hieronder de aanvraag voor een lening om uw nieuwe inrichting te kunnen betalen.

Website Bank ABC

Wat is uw inkomstenbron?

Vast contract	☐
Tijdelijk contract	☐
Zelfstandig ondernemer	☐
Pensioen	☐
Uitkering	☐
Studie	☐

Wat is uw netto maandinkomen?

Wat is uw woonsituatie?

Koophuis	☐
Huurhuis	☐
Inwonend	☐

Wat zijn uw woonlasten per maand?

Hoeveel wilt u lenen?

Als u de financiële informatie uit de situatieschets niet meer precies weet, is dit geen probleem. Vul in wat u denkt dat klopt.

Figure 23 Screenshot of extensive calculator in experiment

Simplified

Opdracht: Lening op website Bank ABC



Op de website van bank ABC wordt om informatie (uit het scenario) gevraagd.
Doe hieronder de aanvraag voor een lening om uw nieuwe inrichting te kunnen betalen.

Website Bank ABC

Hoeveel wilt u lenen?

Figure 22 Screenshot of simplified calculator in experiment

Concluding questionnaire

5 demographic questions about gender, age, education, employment and marital status.

Financial literacy question, the big five questions (Hastings et al. 2013; Lusardi and Mitchell 2011)

1. 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?
 - a. More than \$102
 - b. Exactly \$102
 - c. Less than \$102
 - d. Don't know
2. Imagine that the interest rate on your saving account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account?
 - a. More than today
 - b. Exactly the same as today
 - c. Less than today
 - d. Don't know
3. Do you think that the following statement is true or false: buying a single company stock usually provides a safer return than a stock mutual fund?
 - a. True
 - b. False
 - c. Don't know
4. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage but the total interest over the life of the loan will be less.
 - a. True
 - b. False
 - c. Don't know
5. If interest rates rise, what will typically happen to bond prices?
 - a. They will rise
 - b. They will fall
 - c. They will stay the same
 - d. There is no relationship
 - e. Don't know

Appendix III. Overview variables

Variable	Overconfidence	Calculator	Loan Amount	Actual better-than-average	Actual miscalibration
	Based on assigned group	Type of calculator	loan amount	Based on answer: How much correct compared to others	Based on answer: How much did you think you got correct
Values	1-3	1-2	€5.000-€15.000	1-3	1-3
Meaning	1. Underconfidence (G 2,5) 2. Overconfidence (G 1,4) 3. Control (G 3,6)	1. Simplified 2. Extensive		1. Underconfidence 2. Overconfidence 3. Neither	1. Underconfidence 2. Overconfidence 3. Neither

Variable	Gender	Age	Education	Employment status	Marital status
			Control variables		
Values	1-3	16-78	1-7	1-7	1-5
Meaning	1. Men 2. Women 3. Prefer not to answer		1. VMBO/HAVO/VWO 2. MBO 3. HBO 4. University bachelor 5. Master 6. PhD 7. Other	1. Working, 40 2. Working <40 3. Not working, looking 4. Not working, not looking 5. Student 6. Retired 7. Other	1. Single 2. Married 3. Living together 4. Divorced 5. Widow

Variable	Financial literacy	Group
	Control variable	
Values	1-5	1-6
Meaning	Score of financial literacy test (higher is more correct)	

Table 8 Overview of variables in data

Descriptive graphics of demographics participants

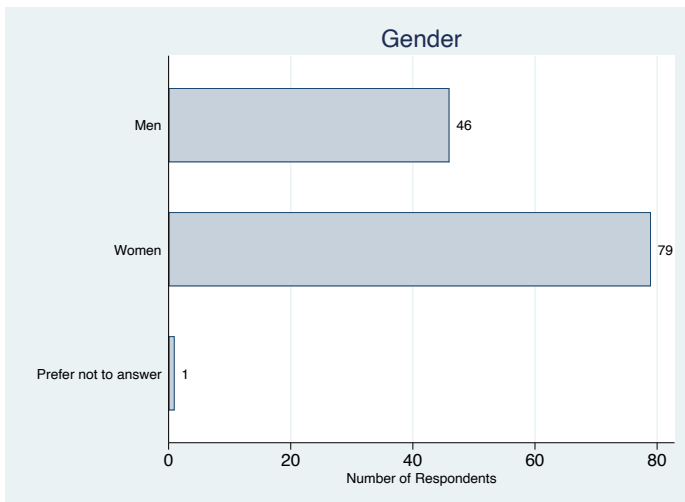


Figure 25 Gender of respondents

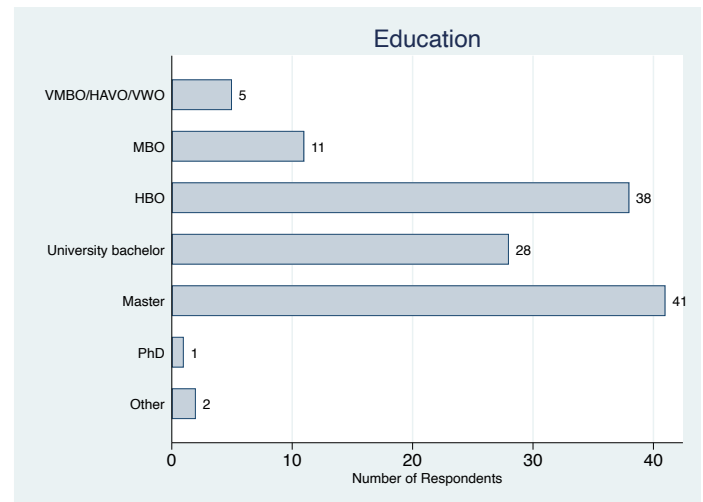


Figure 24 Education of respondents

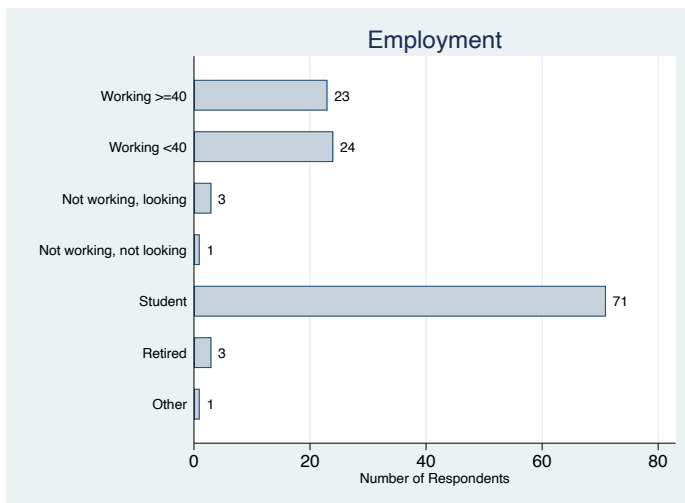


Figure 27 Employment status of respondents

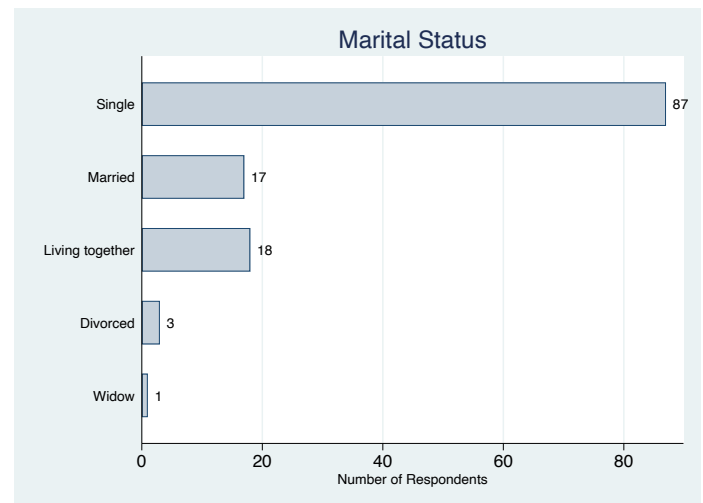


Figure 26 Marital status of respondents

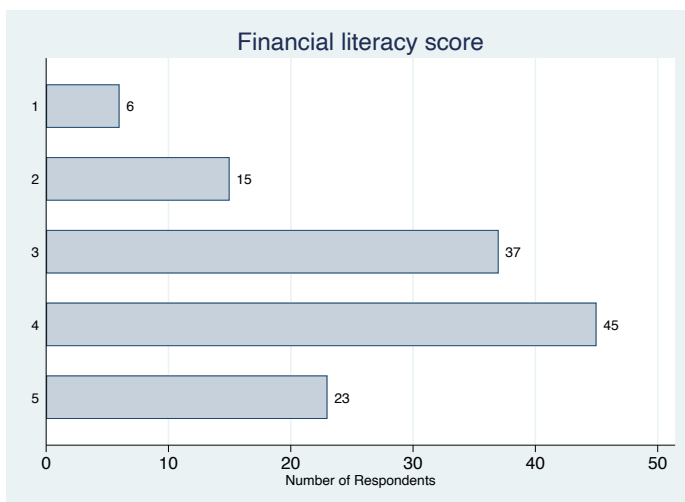


Figure 29 Financial literacy scores of respondents

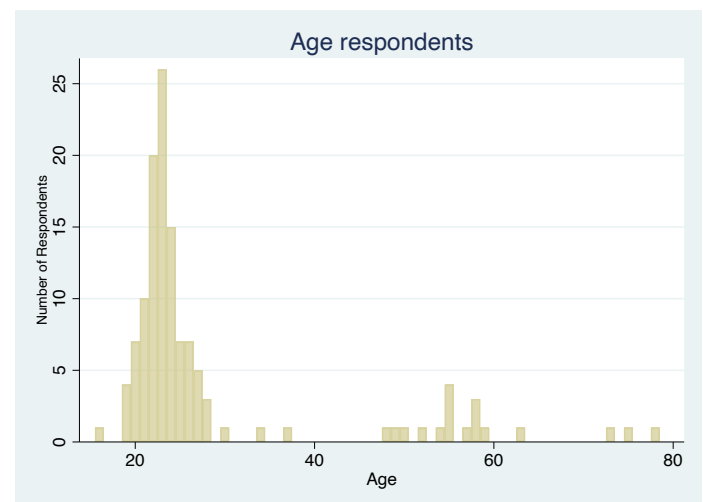


Figure 28 Age of respondents

Characteristics of overconfident consumers

In the literature review, overconfidence was characterised as a financial literate (higher) educated consumer, with an ambiguous effect of gender. To test if the characteristics are also visible in this research, a logit regression is run. For this logit regression, the data from the variable actual miscalibration overconfidence is transformed into a dummy variable, where 1 is equal to overconfidence. Regression 1 only uses gender, ‘Men’ is the reference category. In regression 2, is education added, ‘VMBO/HAVO/VWO’ is the reference category. Regression 3 adds the financial literacy score. The last regression includes all the demographics of the respondents. The logit regressions show that there are no significant results, no further analysis is needed. The characteristics of an overconfident consumer found in the literature have no significant effect in this research.

	(1) Dummy overconfidence	(2) Dummy overconfidence	(3) Dummy overconfidence	(4) Dummy overconfidence
Men	0 (.)	0 (.)	0 (.)	0 (.)
Women	-0.0179 (-0.05)	-0.137 (-0.35)	-0.269 (-0.62)	-0.176 (-0.39)
Prefer not to answer <i>Only 1 observation, dropped</i>	- (.)	- (.)	- (.)	- (.)
VMBO/HAVO/VWO		0 (.)	0 (.)	0 (.)
MBO		-1.016 (-0.90)	-1.133 (-0.99)	-0.577 (-0.36)
HBO		-0.460 (-0.47)	-0.491 (-0.49)	0.315 (0.24)
University bachelor		-0.525 (-0.52)	-0.517 (-0.50)	0.144 (0.11)
Master		-1.120 (-1.13)	-1.088 (-1.08)	-0.379 (-0.29)
PhD <i>Only 1 observation, dropped</i>		- (.)	- (.)	- (.)
Other		-0.405 (-0.24)	-0.506 (-0.30)	-0.329 (-0.20)
Financial literacy total			-0.140 (-0.68)	-0.115 (-0.54)
Age				0.0287 (1.13)
Marital status				-0.0891 (-0.34)
Employment status				0.183 (1.40)
Constant	-0.262 (-0.88)	0.543 (0.55)	1.127 (0.84)	-1.049 (-0.54)
Observations	125	124	124	124

Table 9 Logit regression of characteristics *t statistics in parentheses* * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix IV. Kruskal-Wallis interaction

Before the Kruskal-Wallis test can be performed on the groups in the interaction, the distributions of each of the groups need to be tested. They need to have the same shape to be able to meet all the assumptions of the Kruskal-Wallis test. As visible in the histograms below, the shape of all distributions is relatively equal. The Kruskal-Wallis test can be used.

Group 1 & 4

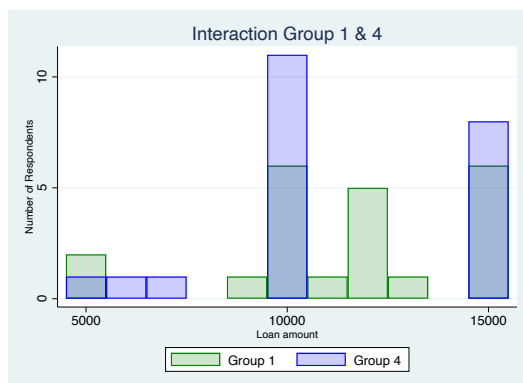


Figure 30 Histogram Group 1 & Group 4

Group 2 & 5

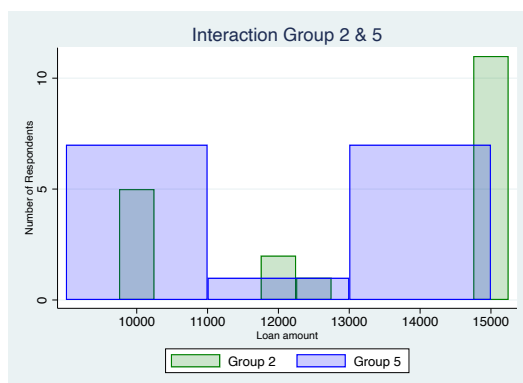


Figure 31 Histogram Group 2 & Group 5

Group 3 & 6

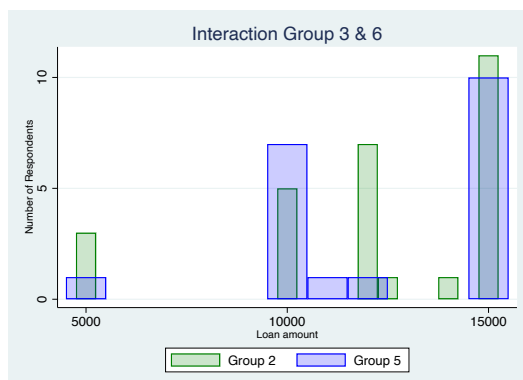


Figure 32 Histogram Group 3 & Group 6