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Munich Discussion Paper No. 2012-16

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Volkswirtschaftliche Fakultät
Ludwig-Maximilians-Universität München

Online at http://epub.ub.uni-muenchen.de/13035/

Complexity and Narrow Bracketing in Credit Choice*

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May 25, 2012

Abstract

We examine experimentally the effect of complexity on individual decision making. We focus on credit choices, as they have been widely criticized for their complexity in recent years. In a first study, we find that complexity in benefits leads to random mistakes, while complexity in costs leads to a specific mistake: choosing a high-benefit loan, with very costly repayment schemes. In a second study, we show that individuals still (mistakenly) choose the high-benefit loan, even if cheaper and simple loans are available. This suggests that, when costs are complex, individuals bracket narrowly, focus on benefits and ignore costs, while they do not when benefits are complex. Hence, our results show that complexity and narrow bracketing may be deeply intertwined: complexity that makes narrow bracketing cognitively easier is likely to lead to myopic choices, such as choosing complex and expensive loans, despite the presence of simple and cheaper loans.

JEL codes: C91, D03, D14, G02

Keywords: Complexity, Credit, Mistakes, Narrow Bracketing

*We would like to thank David Cooper, Enrique Fatas, Paul Frijters, Changxia Ke, Nikos Nikiforakis, Wieland Müller, Jan Potters and Philipp Wichardt for their comments, as well as the audiences at the 6th Annual Australia New Zealand Workshop on Experimental Economics at Monash University, the European Workshop on Behavioral and Experimental Economics at the University of Munich, the 2011 North-American ESA Meeting and the Brown Bag seminar at the University of Munich for their comments and suggestions.

1 Introduction

Complexity is present in many decision processes, yet we know very little about *how* it affects choices. While it has been long recognized that individuals have limited cognitive resources that may lead to mistakes in decision making (Simon, 1957), the question remains: what kind of mistakes does complexity cause? What guides individuals' choices in complex environments?

One of many complex environments is financial decision making. Consumer financial choices are often overwhelmingly complex (Campbell, 2006). Even small financial transactions, such as consumer loans, can be complicated and are usually characterized by several types of fees and bonuses that differ across providers. Not surprisingly, the complexity of products in financial markets has generated substantial concern among policy makers (e.g., OECD, 2005). Such concerns about complexity are especially warranted for credit products, as mistakes can lead individuals into harmful debt spirals (Lusardi and Tufano, 2009). Despite the concern of policy makers, mainstream research in financial decision making has not taken complexity into account. Recent behavioral models of decision making, however, suggest two different effects of complexity. On the one hand, Carlin (2009) suggests that complexity in financial markets leads to more random choices. In contrast, Gabaix and Laibson (2006), among others, suggest that when products have immediate benefits but future and complex costs, complexity may lead to more myopic choices, i.e. based solely on benefits. While these models have different policy implications, e.g. in terms of the role of competition among credit providers, there is little empirical evidence showing which one may be more prevalent in credit decisions.

Our results suggest that the effect of complexity on choices strongly depends on how complexity is introduced. When costs are complex, individuals are more likely to make myopic choices, even if only one credit product presents complex costs, in line with Gabaix and Laibson (2006). In general, myopic choices may be driven by a present bias in time preferences (Heidhues and Köszegi, 2010, Meier and Sprenger, 2010) or narrow bracketing (Read et al., 1999). Our study provides evidence in support for narrow bracketing: within a short time interval, individuals disregard choices among different costs schemes, when these are complex, and focus only on benefits. Instead, when benefits are complex, individuals often make random mistakes, as suggested by Carlin (2009). Hence, our findings suggest that complexity leads to narrow bracketing, when it makes narrow bracketing cognitively easier. If it does not, as in the case where immediate benefits are complex, it is less likely to occur.

While narrow bracketing has been widely studied, to the best of our knowledge, our paper is the first to show how it depends on the complexity of the decision environment. This finding complements previous studies showing that narrow bracketing depends on framing (Tversky and Kahneman, 1981 and Rabin and Weizsäcker, 2009) and feedback (Gneezy and Potters, 1997). Such findings are important due to the power of narrow bracketing in explaining many financial phenomena, such as the equity premium puzzle (Benartzi and Thaler, 1995), the popularity of state lotteries (Haisley et. al, 2008), the stock market participation puzzle (Barberis et al., 2006) and the disposition effect (e.g., Kumar and Lim, 2008).

Our paper uses two experimental studies to examine the effects of complexity. In our first study we vary the complexity of the loans available and ask, what kinds of mistakes arise with complexity? In our second study, we examine the role of heterogeneity in the presence of complex loans and ask, do mistakes remain if some loans are simple while others are complex? As in many credit situations, e.g. credit lines or credit cards, subjects in the experiments are asked to choose first among different credit options (loans), knowing each loan's repayment options, and then they are asked to choose one of the repayment options of the chosen loan. Since in the field such decisions are taken over a long period of time, distinguishing the effect of complexity on mistakes from its potential effect on time preferences, e.g. increasing present bias, is difficult. Our lab setting, with decisions made in a short period of time and paid immediately, allows us to focus on the effect of complexity on mistakes.

In our first study, all loans have either complex benefits (values) or costs (repayment schemes), or are simple in both dimensions. When repayment schemes are complex, the fees of a product are presented as the sum of a standard fee, a percentage fee on loan value and a bonus. When they are simple, they are presented as a single number. Three loans are available: a high-valued loan, with expensive repayment options; a medium-valued loan, with cheaper repayment options and the highest net payoff; and a low-valued loan, again with cheap repayment options, but lower net value than the medium-valued loan. When complexity is in loan values, we show that mistakes increase, but these are directed both towards the high-valued and the low-valued loans. In contrast, when repayment costs are complex the effect of complexity is different: it leads to the choice of the high-valued loan with large advantages, despite its costlier repayment schemes. Additionally, mistakes are more frequent, making this kind of complexity especially worrisome.

In our second study we examine whether the effect of complexity depends on the number of complex loans available. In particular, if all other loans are presented in simple terms, is the

high-valued loan, with complex and expensive repayment schemes, still chosen? We observe that individuals still choose the high-valued loan in 25% of the cases. If the low-valued loan also presents complex repayment schemes, the frequency with which the high-valued loan is chosen does not significantly change. Thus, the presence of a single complex loan appears to suffice for mistakes to occur.

Our results complement recent findings by Bertrand and Morse (2011), who conduct a field experiment on pay-day borrowing. They find that simplifying the presentation of fees decreases borrowing, and that this may be driven by the fact that simplification reduces narrow bracketing. Controlling for the preferences, information and time horizon of individuals, our experimental evidence shows that indeed simplification of repayment reduces mistakes, and that choices under complexity seem to be driven by narrow bracketing when complexity makes it cognitively easier than broad bracketing.

Interestingly, when loan values are complex and repayment schemes simple, individuals do not choose the loan with the cheapest repayment more frequently. Hence, choices in our experiment do not appear to always be driven by salience, as modeled by Bordalo et al. (2011), Köszegi and Szeidl (2011) and Gabaix (2011). This may be driven by our focus on a decision process by which individuals' first choice, among loans, determines the subsets of choices they will face next. This is common among credit products, i.e. after a credit card has been chosen and debt has accumulated, the individual can only choose how to repay.

Our experimental findings contribute to a growing literature on bounded rationality and industrial organization (Spiegler, 2011). Especially, our second study provides important insights into consumer choices when credit products exhibit different levels of complexity. We show that if a product with highly attractive present attributes exhibits complex future surcharges, it may still be chosen even if other products are simple and have higher total payoffs (Spiegler, 2006). This suggests that complex products may remain in competitive environments. While our study examines only one-sided changes in complexity, abstracting from the (confounding) effect of competition among credit suppliers, recent studies suggest that producers may indeed strategically use complexity in product markets (Kalaycı and Potters, 2011, Kalaycı, 2011).

In two related experimental studies, Beshears et al. (2010) and Choi et al (2009) explore the effect of simplified disclosure and "cheat sheets" in mutual fund choices. Their findings suggest that offering clear information about fees of different mutual funds may only be of limited help to consumers. One potential explanation for their result compared to ours is that mutual fund

investments are still somewhat complex, due to their uncertain future returns. In our experiment, in the absence of risk, when all products are simple, subjects almost always make the correct choices.

Additionally, our paper also contributes to the existing literature on the biases displayed by consumers in making (financial) choices. Ausubel (1999) finds that recipients of credit card solicitations overrespond to the introductory interest rate relative to the duration of the introductory offer and to the post introductory interest rate, while Brown et al. (2010) show that increasing hidden shipping charges increases seller revenues on eBay. Stango and Zinman (2009) show that consumers may also have difficulties in understanding interest compounding, while Caplin and Martin (2012) show that "benevolent" defaults may improve decisions in complex environments but may also lead to more inattention. Our experiment shows that complexity in repayment schemes may lead to choices of loans with attractive advantages, but very costly repayment schemes.

2 Study 1

2.1 Experiment

The experiment is an individual choice task, where subjects make choices among different loans. Subjects make decisions in two stages. In the first stage, subjects choose between three loans. In the second stage, subjects choose among the available repayment schemes for the loan they chose in the first stage. Each loan has three possible repayment schemes, which are observable to the subject in the first stage. The payoff of each subject is the loan value minus the repayment she chooses.

$$\text{Payoff} = \text{Value of the Loan - Repayment Amount}$$

The parameters, shown in Table 1, were chosen such that the first loan, called the "High" loan, offers the highest value but expensive repayment schemes. Taking this loan's value and subtracting the lowest repayment, yields a maximum payoff of 30. In contrast, the second loan, called the "Medium" loan, has the second highest value but less expensive repayment schemes. It thus yields the highest maximum payoff, 33. The third loan, called "Low", has the lowest value and the lowest possible repayment. However, the lower value implies that the maximum payoff that can be obtained by choosing the Low loan is 30, the same as the High loan. We will describe a subject's choice as a mistake if she does not choose the Medium loan. This is justified by the fact that loans

are otherwise equal and, if choices are simple, an ample majority of the subjects choose indeed the Medium loan.[1]

Loan	Loan value	Repayment options	Maximum payoff
High	73	49 45 43	30
Medium	67	45 43 34	33
Low	61	43 34 31	30

Table 1: Base numbers

In the experiment the loans are labeled as Loan A, Loan B and Loan C, and repayment schemes as Repayment X, Repayment Y and Repayment Z for each loan. The assignment of the High, Medium and Low loans to Loans A, B, C and the repayment schemes to Repayments X, Y, Z are randomized by the computer and the same for all subjects. The exact numbers shown to participants are derived from the base numbers in Table 1, using a scaling factor. More precisely, in each period the base numbers shown in Table 1 are multiplied by a scale factor, which is randomly drawn from uniform distribution [100, 200]. This prevents subjects from learning the base numbers.

In Study 1, there are three treatments: SIMPLE, COMPLEX REPAYMENT and COMPLEX VALUE. In SIMPLE both the value and the repayment for each loan consists of a single number. Figure 1 displays a sample screen for the loan choice in SIMPLE.[2]

In COMPLEX REPAYMENT the value of the loan is a single number as in SIMPLE, while the repayment for every scheme consists of three items: A standard fee, a percentage amount and a bonus. Figure 2 gives an example of the way in which complex repayment schemes are presented to subjects. For example, the repayment of scheme X in Figure 2 is equal to 4600+0.07*7300-1627=3484.

COMPLEX VALUE differs from SIMPLE in how the loan values are displayed. Each loan value consists of three items: A standard amount, a percentage amount, and a tax. For example, the loan value for choosing Loan A in Figure 3 equals $11928 + 0.07 * 13440 - 605 = 12264$. The repayment in COMPLEX VALUE is a single number as in SIMPLE. A summary of the treatment conditions

[1]This does not mean that choices in the field for high-valued loans, but with expensive repayments, are necessarily a mistake. However, controlling for payoffs and choice sets, they are in our experiment.

[2]See the Appendix for instructions and an example screen-shot for the repayment choice in SIMPLE.

Loan	Value
Loan A	7300
Loan B	6700
Loan C	6100

Please make a choice among the above 3 Loans. In the 2nd stage you will have to make a choice between 3 repayment options. The repayment options you will get depends on the Loan you choose now. Below you can find the details of all the repayment options for each Loan.

Repayment options for Loan A	Payment amount
Repayment X	4900
Repayment Y	4500
Repayment Z	4300
Repayment options for Loan B	**Payment amount**
Repayment X	4500
Repayment Y	4300
Repayment Z	3400
Repayment options for Loan C	**Payment amount**
Repayment X	4300
Repayment Y	3400
Repayment Z	3100

Figure 1: Loan choice in SIMPLE

Repayment	Payment Details
Repayment X	A standard Fee of 4600, a percentage fee of %7 of the value of the Loan you have chosen minus a bonus of 1627 .
Repayment Y	A standard Fee of 4800, a percentage fee of %5 of the value of the Loan you have chosen minus a bonus of 2005 .
Repayment Z	A standard Fee of 4700, a percentage fee of %3 of the value of the Loan you have chosen minus a bonus of 583 .

Figure 2: Loan choice in COMPLEX REPAYMENT

is presented in Table 2.

Loan	Details for the Value of the Loan
Loan A	A standard amount of 11928, plus a percentage amount of %7 of 13440 minus a tax of 605 .
Loan B	A standard amount of 11760, plus a percentage amount of %5 of 12432 minus a tax of 1126 .
Loan C	A standard amount of 12096, plus a percentage amount of %3 of 9408 minus a tax of 2130 .

Figure 3: Loan choice in COMPLEX VALUE

Treatment	Loan value	Repayment alternatives
SIMPLE	Simple	Simple
COMPLEX REPAYMENT	Simple	Complex
COMPLEX VALUE	Complex	Simple

Table 2: Treatments

The experiment employs a within subject design. Subjects play each treatment condition 4 times (or periods) in a randomized order, which is the same for all subjects. Subjects have 120 seconds in the first stage, to choose among loans, and 60 seconds in the second stage, to choose among the repayment schemes of the chosen loan. Both of these time limits are binding. If subjects fail to make a decision at any stage, they receive 0 points for that period. We chose to implement time limits in order to provide subjects with an implicit cost of decision time, mirroring actual financial decision making of individuals who often have limited time to make their choices. An alternative option would have been to include a price to be paid the longer the subject took to make her decisions. This however introduced an additional level of complexity in the experiment, optimal decision times, which we want to avoid. Also, subjects were not allowed to proceed to the next stage before the time ends. This prevents subjects from trying to finish the experiment sooner.

The experiment was run at Tilburg University's CentERLab in June 2010. The experiment was programmed and conducted with the software zTree (Fischbacher 2007). 35 subjects in two sessions (18+17) participated in the study. The subjects were students at Tilburg University who were recruited through e-mail lists of students interested in participating in experiments. Upon arrival participants were randomly seated behind computers. Subjects had a calculator, pencil and paper available. The instructions were displayed on their computer screen and read aloud by the experimenter. The experiment started when all subjects indicated that they had read and understood the instructions. Earnings were denoted in points and transferred to cash at a rate of 7000 points = 1 EUR.[3] The experimental sessions lasted about 75 minutes and subjects on average earned about 15 Euros. At the end of the experiment a short questionnaire was run.

2.2 Hypotheses

As null hypothesis we assume that consumers make random mistakes when evaluating the payoff of each option, and that these may become more frequent with increased complexity, in line with Carlin (2009). For this reason, we use the random utility model of Luce (1959). According to

[3]In terms of the base parameters, on average 47 points are equal to 1 EUR.

this model, an individual's utility is the sum of a deterministic component, the net payoff of the loan in this case, plus a random utility component. Hence, the utility of choosing loan j, where $j = L, M, H$ and the letters L, M and H refer to the Low, Medium and High loan respectively, is $u_j = v_j + \epsilon_j$.

In our decision problem we define v_j as the net payoff of the loan, its value minus the minimum repayment of this loan. If the error term, ϵ_j, is distributed according to an extreme value distribution with scale factor μ, McFadden (1973) showed that the probability of choosing loan j is,

$$Pr[y = j] = \frac{e^{\mu v_j}}{e^{\mu v_L} + e^{\mu v_M} + e^{\mu v_H}} \tag{1}$$

As μ increases, the probability of choosing the option with the highest net payoff increases. Hence, mistakes may occur, especially for small μ values.[4,5]

We hypothesize that complexity may lead to more mistakes, i.e. decrease the value of μ. This follows from the fact that complexity makes comparing loans harder and thus probably makes errors play a larger role. In COMPLEX VALUE one item per loan is complex, the loan value. In contrast, in COMPLE REPAYMENT three items per loan, the repayment schemes, are complex. Hence, we hypothesize that COMPLEX REPAYMENT is more complex than COMPLEX VALUE and this leads to more mistakes. This is summarized in Hypothesis 1.

***Hypothesis 1**: Mistakes are more frequent in COMPLEX REPAYMENT than in COMPLEX VALUE and, in both treatments, more frequent than in SIMPLE.*

Interestingly, since the net payoff of the Low and the High loan are the same, the random utility model predicts that mistakes will be 'symmetric': If the frequency of mistakes increases, it should increase equally for the High and Low loan. This yields to Hypothesis 2.

***Hypothesis 2**: If mistakes increase in COMPLEX REPAYMENT and COMPLEX VALUE, the increase will be equally directed towards the High and Low loan.*

Note that Hypothesis 2 makes the strong assumption that mistakes are proportional to the net payoff of each loan. However, it may be that complexity in later choices makes subjects ignore

[4]Note that this is equivalent to assuming that, if μ is large, all subjects are experienced consumers, as in Carlin (2009), while this share may decrease (and some subjects may become uninformed consumers) as μ decreases.

[5]Our approach is related to the concept of Quantal Response Equilibrium (McKelvey and Palfrey, 1995). We consider an individual decision problem, while they consider a game theoretic setting. A comprehensive overview of the econometric estimation of different error models for individual decision problems can be found in Blavatskyy and Pogrebna (2010).

these choices and focus on 'present' dimensions, as in narrow bracketing (Read et al., 1999). We will come back to this other potential driver of mistakes below.

If complexity makes comparing loans harder, its effect could also be observed in decision times (Wilcox, 1993). In line with Hypothesis 1, we hypothesize that complexity will lead to the longest decision times in COMPLEX REPAYMENT, and will also make decision times longer in COMPLEX VALUE than in SIMPLE. This leads to Hypothesis 3.

Hypothesis 3*: Decision times for choosing among loans will be longer in COMPLEX REPAYMENT than in COMPLEX VALUE and, in both treatments, longer than in SIMPLE.*

Of course, whether a difference between decision times in COMPLEX REPAYMENT and COMPLEX VALUE is observed, depends on whether the time limit of 120 seconds is enough for subjects in the COMPLEX VALUE treatment.

2.3 Results

In this section we present the results from the experiment. Observations where the subjects fail to make a decision on time are dropped from the analysis. These are very few cases, as reported below. Treatment effects are examined with a Wilcoxon matched-pairs signed-rank test using each subject's average score over all repetitions as the unit of observation. Reported p-values in parenthesis are based on two sided tests, unless otherwise noted.

2.3.1 Choices

Figure 4 shows the average choice frequency of each loan choice, High, Medium and Low, in each treatment. The first block is for SIMPLE, the second block is for COMPLEX REPAYMENT and the third block is for the COMPLEX VALUE treatment.

In SIMPLE subjects make the optimal choice in a majority of the cases. As shown in the first block of Figure 4, the Medium loan is chosen 84 % of the time. High is chosen 13 % of the time, while Low is chosen about 4 % of the time.

Decisions change significantly in COMPLEX REPAYMENT. Mistakes increase and the choice frequency of the Medium loan drops from 84% to 43%, as shown in the second block in Figure 4. Compared to SIMPLE, the choice frequencies of both the High and the Low loan increase in COMPLEX REPAYMENT. The increase in High, from 13 % to 41 %, is however significantly stronger than the increase in Low, from 4% to 15 % of the time (p-value=0.03). Such a differential

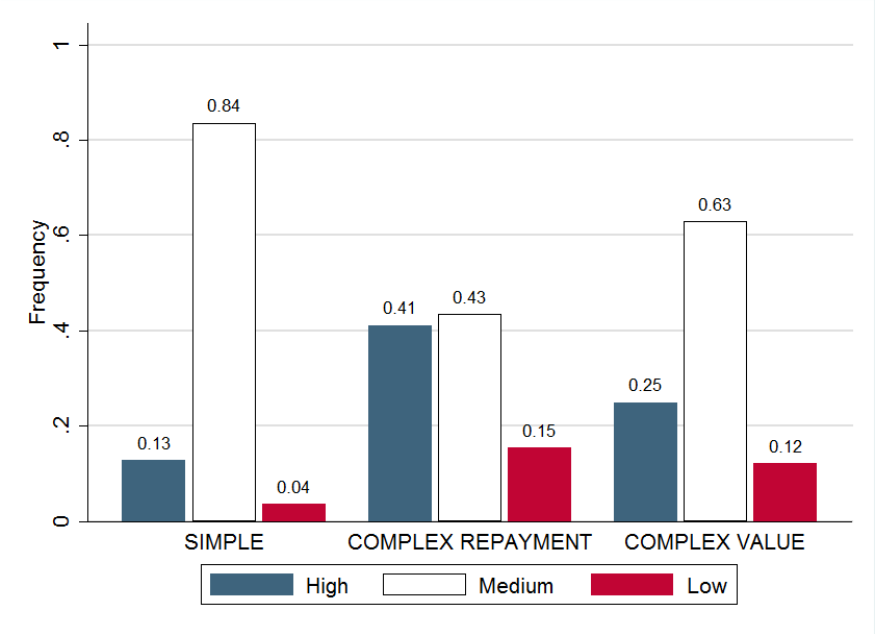

Figure 4: Loan choices by treatment

increase across High and Low loans suggests that mistakes are not symmetric, as hypothesized. Instead, subjects exhibit a stronger bias toward the High loan.[6]

In COMPLEX VALUE subjects choose the Medium loan more often, 63% of the time, as shown in the third block of Figure 4. Compared to SIMPLE, COMPLEX VALUE leads to an increase in the choice frequency of the High loan by 12%-points, from 13% to 25%, while it increases the choice frequency of the Low loan by 8%-points, from 4% to 12%. In this treatment, the difference in the increases (12% vs. 8%) is not statistically significant (p-value=0.72). Hence, mistakes do appear to increase 'symmetrically' in this case, as hypothesized.

We look for further patterns of choice within subjects' repayment choices. After having chosen a particular loan, they most frequently choose the cheapest repayment option, especially in SIMPLE (99% of the cases) and COMPLEX VALUE (98% of the cases). In contrast, in COMPLEX REPAYMENT they more often make mistakes. Subjects choose the cheapest repayment scheme in 70% of the cases. This frequency is significantly different to that in SIMPLE and COMPLEX VALUE (p-value<0.01 in both cases). Interestingly, an overwhelming majority of the mistakes

[6]The relative bias towards the High loan in the COMPLEX REPAYMENT treatment remains robust over the course of four repetitions. If we consider the first repetition, COMPLEX REPAYMENT increases the average choice frequency of the High option from 34% in SIMPLE to 66%, while it only slightly increases the choice frequency of the Low option, from 5.7% to 6.2%. Similarly, in the last repetition, the average choice frequency of the High option increases from 6% in SIMPLE to 29% in COMPLEX REPAYMENT, while the increase in the Low option is from 0% in SIMPLE to 14% in COMPLEX REPAYMENT.

made in the repayment choices is made by subjects who chose the High loan. Of 35 cases in which subjects do not choose the cheapest repayment scheme in COMPLEX REPAYMENT, 27 of them are cases where the loan chosen is High, 5 where it is Medium and 3 where it is Low.

To examine the fit of choices with the random utility model, we estimate μ for each level of complexity, i.e. by treatment. The results are reported in Table 3 below.[7] As expected, μ is largest in SIMPLE, 0.55. This implies a high weight on payoffs, in particular, the value of each option, and hence it yields a predicted probability of choosing Medium of 0.83. If we compare it with the actual probability in the experiment, 0.84, it is strikingly close to it. In fact, in all treatments, the predicted probability of choosing Medium is very close to the actual one. In COMPLEX REPAYMENT, where μ is 0.11, the predicted probability of choosing Medium, 0.44, which is very close to the actual probability 0.43. The same is true for COMPLEX VALUE, where the predicted and actual probabilities are 0.61 and 0.63, respectively.

	Treatment					
	SIMPLE		COMPLEX REPAYMENT		COMPLEX VALUE	
Estimated μ	0.55		0.11		0.26	
Probability of choosing	Predicted	Actual	Predicted	Actual	Predicted	Actual
High	0.08	0.13	0.28	0.41	0.20	0.25
Medium	0.83	0.84	0.44	0.43	0.61	0.63
Low	0.08	0.04	0.28	0.15	0.20	0.12

Note: This table reports maximum likelihood estimates for μ, the noise parameter in the random utility model, by treatment in Study 1. These estimates are then used to predict the average probability of choosing each loan option, given the loan value of each option in each period. They are then compared to actual choice probabilities by treatment, listed under Actual.

Table 3: Estimated Noise Parameter and Predicted Choices

However, the predictions of the random utility model tend to be farther from actual choices for the High and Low loans. By construction, since the net payoff of both options is the same, the predicted probability of choosing each option is equal. This is close to actual behavior in SIMPLE and COMPLEX VALUE, where the difference between the predicted and actual probability is at most 0.08 (in COMPLE VALUE for the Low loan). But it is not the case in COMPLEX REPAYMENT, where the predicted probability of choosing High is 0.28, while the actual probability is 0.41. This

[7]The MATLAB code used to estimate μ is available from the authors. We have also conducted multinomial logit regressions estimating the likelihood that a loan is chosen depending on the treatment, decision time and individual characteristics. We find the same qualitative results as those shown in Figure 4: the likelihood that the High loan is chosen increases significantly more in COMPLEX REPAYMENT than in COMPLEX VALUE. With these regressions, however, μ cannot be identified separately from the coefficient estimates. Hence, results are not reported in the paper but are available upon request.

is a difference of .13. The same difference is obtained for Low, where the actual probability of choosing this option is 0.15. Hence, the estimated μ generates predicted choice frequencies, which are similar to actual behavior in two treatments, SIMPLE and COMPLEX VALUE. However, it cannot capture the more frequent choice of High, compared to Low, in COMPLEX REPAYMENT, suggesting that choices may be driven by factors that are ignored in the random utility model.

Our findings indicate that indeed complexity increases mistakes, and these are most frequent in COMPLEX REPAYMENT, in line with Hypothesis 1. However, individuals in this treatment do not display 'symmetric' mistakes, but a strong tendency to choose the High loan. This is different from the mistakes in COMPLEX VALUE, where the increase in choices towards the High and Low loan is not significantly different, and hence in line with Hypothesis 2. This leads to Results 1 and 2.

Result 1*: Mistakes increase when complexity is introduced, and these are most frequent in COMPLEX REPAYMENT, in line with Hypothesis 1.*

Result 2*: Mistakes toward the High and Low loan do not display a significantly different increase in COMPLEX VALUE, but they do in COMPLEX REPAYMENT. Hence, we reject Hypothesis 2.*

Support for the random utility model is hence only obtained in COMPLEX VALUE. Choices under COMPLEX REPAYMENT display a different pattern. Such pattern could be explained by narrow bracketing (Read et al., 1999), a tendency to focus separate decisions, such as that among loans and repayment schemes, instead of integrating them. If subjects bracket narrowly, they would choose the High loan for its high value, disregarding future repayment choices. Such a tendency could increase when repayment schemes are complex, leading to more High choices, as bracketing makes decisions easier. Instead, when values are complex, narrow bracketing is not easier and potentially less likely to occur. We discuss this in further detail in the Discussion below.

2.3.2 Decision time

Complexity not only leads to different choices, but also to longer decision times, as shown in Table 4. While most subjects in SIMPLE make their loan choice in 20 to 60 seconds, a majority of subjects need more than 100 seconds to make their choice in COMPLEX REPAYMENT. Similarly, a majority of subjects need more than 80 seconds in COMPLEX VALUE. Average decision time in SIMPLE (59.1 secs.) are significantly different from those in COMPLEX REPAYMENT (93.3

secs., p-value<0.01) and COMPLEX VALUE (89.4 secs., p-value<0.01), as predicted in Hypothesis 3. However, there is no significant difference in decision times between COMPLEX REPAYMENT and COMPLEX VALUE (p-value=0.14). This appears to stem from the fact that many subjects need most of the available time (38.6%) to choose among loans in COMPLEX VALUE, and hence also reach the time limit of 120 seconds.

	Treatment		
	SIMPLE	COMPLEX REPAYMENT	COMPLEX VALUE
Distribution of decision time (in seconds):			
Loan choice			
less than 20	3.6%	0.7%	0.7%
20-40	27.1%	5.0%	5.0%
40-60	33.6%	8.6%	10.0%
60-80	17.1%	12.9%	19.3%
80-100	12.1%	20.0%	26.4%
100-120	6.4%	52.9%	38.6%
Repayment choice			
less than 20	97.1%	32.1%	98.6%
20-40	2.9%	29.3%	1.4%
40-60	0.0%	38.6%	0.0%
% of No Choice:			
for Loan Choice	0%	3%	0%
for Repayment Choice	0%	5%	0%

Table 4: Decision time by treatment

Result 3*: When complexity is introduced, decision times among loans increase significantly compared to SIMPLE. However, there change is not significant between COMPLEX REPAYMENT and COMPLEX VALUE in decision time. Thus, we reject Hypothesis 3.*

Choosing among the different repayment schemes also takes longest in COMPLEX REPAYMENT, where subjects frequently need 40 to 60 seconds (38.6% of the time). This is in stark contrast to decision times in SIMPLE and COMPLEX VALUE, where almost all of the subjects (97.1% and 98.6%, respectively) need less than 20 seconds to choose the repayment scheme. The differences in decision times are significant (COMPLEX REPAYMENT compared to SIMPLE, p-value<0.01, and compared to COMPLEX VALUE, p-value<0.01).

Overall, although choices took longer when complexity was introduced, subjects rarely ran out of time, as reported in the bottom part of Table 4. This only happened in COMPLEX REPAYMENT:

In 3% of the cases when choosing among loans and 5% of the time when choosing among repayment schemes.

The data on decision times also allows us to explore whether there is a relationship between particular loan choices and decision times. Ex-ante it is unclear whether mistakes are made by those who decide fast or those individuals who need more time, but do not manage to find the loan with the highest net payoff within the time limit. We explore whether a relationship is present with Figure 5, which displays the frequency with which the High, Medium and Low loan are chosen over time, by treatment.

In general, subjects who decide very fast, in less than 20 seconds, display a tendency to choose High in all treatments. In COMPLEX REPAYMENT this effect lasts longer: individuals who take less than 60 seconds choose the High loan in the majority of the cases. This frequency falls for decisions that take between 60 and 100 seconds, but increases again to 40% for decisions that take more than 100 seconds. This suggests that both individuals who make fast choices and those who almost exhaust their decision time (a substantial proportion, 52.9% as shown in Table 3) frequently choose the High loan. Given the presence of these two groups, the relationship between decision times and the frequency with which the High loan is chosen is not linear. The Spearman rank correlation is negative, -0.228, but not significantly different to 0 (p-value=0.19). In contrast, the time pattern for the Low loan appears to be constant, though few choices are observed. The time pattern for the Medium loan is hence complementary to that of High.

The consequences of complexity are reflected in payoffs. Since the Medium loan offers the highest maximum payoff, it follows naturally that complexity leads to lower payoffs. Indeed, we find that subjects earn 28.5 points in COMPLEX REPAYMENT, which is about 4 points less than in SIMPLE (32.4). COMPLEX VALUE leads to a relatively lower loss, of only 0.6 points, compared to SIMPLE.

The results from Study 1 show that complexity leads to suboptimal decisions. Interestingly, the type of mistakes varies with the type of complexity introduced. COMPLEX REPAYMENT biases decision makers towards the High loan very strongly, while COMPLEX VALUE does not. However, these patterns may change if some loans are simple and other complex. In particular, the strong tendency towards the High loan may disappear if other loans are simple, and High is the only complex loan. To examine this issue, we conduct a second study with heterogeneous loans in terms of complexity, focusing on complexity in repayment schemes.

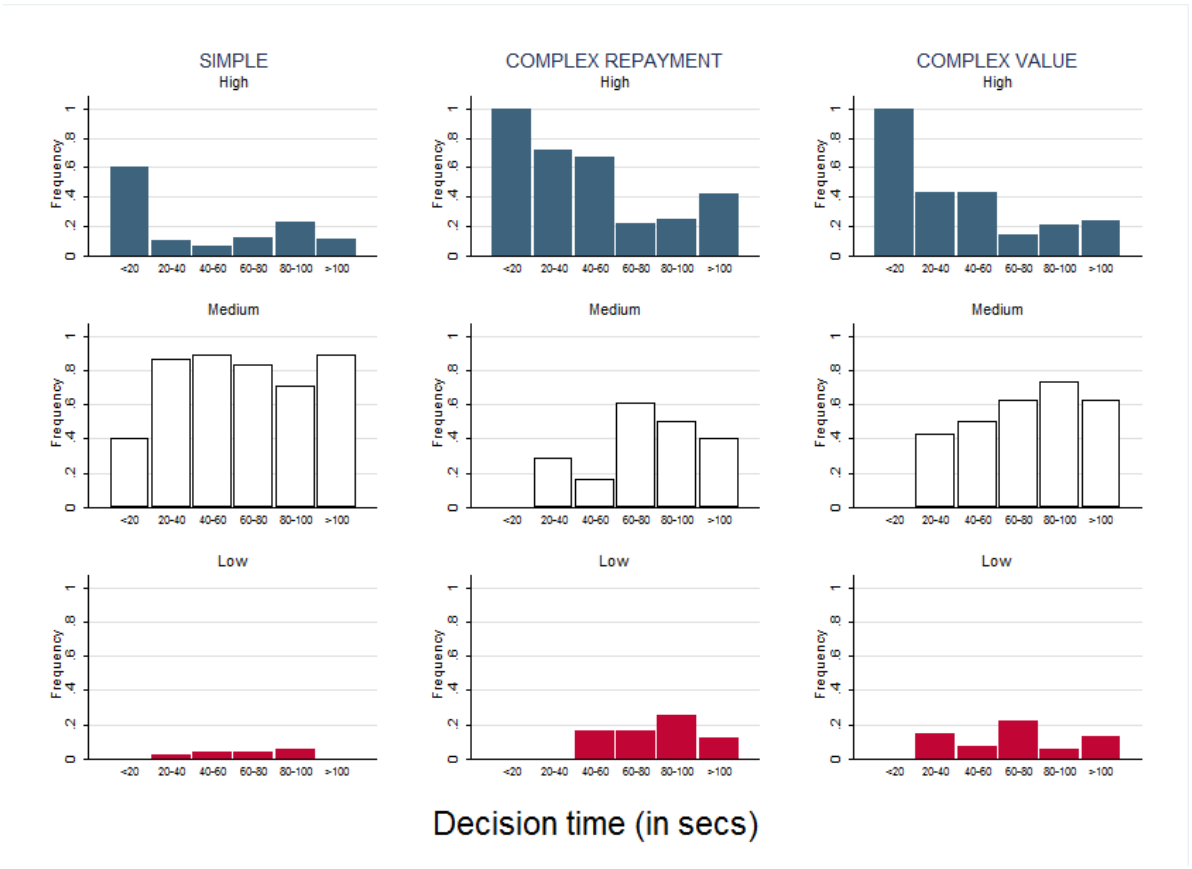

Figure 5: Loan choices over time, by treatment

3 Study 2

3.1 Experiment

Study 2 replicates the SIMPLE and COMPLEX REPAYMENT treatments of Study 1, and adds two treatments. To examine whether individuals still choose the High loan if it is the only with complex repayment schemes, we include an additional treatment, called ONLY HIGH COMPLEX. In this treatment only the repayment schemes for High are complex, while the repayment schemes for Low and Medium loans are simple. Next, we examine choices when both the High and Low loan are complex, and the Medium loan simple. We use a second treatment, called HIGH & LOW COMPLEX, for this purpose.

To distinguish the treatments in this study, we use different labels for the treatments that are replicated from Study 1. We call the treatment where all loans' repayment schemes are simple ALL SIMPLE (instead of SIMPLE) and the treatment where the repayment schemes of all loans are complex ALL COMPLEX (instead of COMPLEX REPAYMENT). The treatment conditions

in Study 2 are summarized in Table 5 below.

Treatment	Loan value	Repayment alternatives		
		High option	Medium option	Low option
ALL SIMPLE	Simple	Simple	Simple	Simple
HIGH COMPLEX	Simple	Complex	Simple	Simple
MEDIUM SIMPLE	Simple	Complex	Simple	Complex
ALL COMPLEX	Simple	Complex	Complex	Complex

Table 5: Treatments

As in Study 1, a within-subject design is employed.[8] The experiment was run at Tilburg University's CentERLab in June 2010. Thirty-two subjects in two sessions participated in the study. Overall, the procedure was the same as in Study 1. The experimental sessions lasted about 80 minutes and subjects on average earned about 16 Euros.

3.2 Hypotheses

Here we use the random utility model discussed in Study 1 as our benchmark model as well. As before, increasing complexity is likely to increase mistakes or, equivalently, decrease μ. In the new treatments, complexity is gradually introduced by increasing the number of loans with complex repayment schemes. There are none in ALL SIMPLE, one (the High loan) in ONLY HIGH COMPLEX, two (the High and Low loans) in HIGH & LOW COMPLEX, and three (all loans) in ALL COMPLEX. We hence hypothesize that mistakes will be increasing across these treatments.

Hypothesis 4*: Mistakes increase when the number of loans with complex repayment schemes increases.*

If the only effect of complexity is through the increase in noise, as we assume with the random utility model, we would not expect a difference in the increase in mistakes between the High and Low loans. This leads to Hypothesis 5, which is the same as Hypothesis 2 for this study.

Hypothesis 5*: If mistakes increase with the number of loans with complex repayment schemes, the increase will be equally directed towards the High and Low loan.*

[8] In this study we aimed to repeat each choice three times. However, due to a programming error the actual number of repetitions turned out to be 3, 3, 2 and 4 for ALL SIMPLE, ONLY HIGH COMPLEX, HIGH & LOW COMPLEX and ALL COMPLEX. Therefore, in the analysis only data from the first two repetitions will be used. However, if we include all repetitions, our results remain qualitatively the same.

Note that although mistakes show a tendency towards the High loan when all repayment schemes are complex in Study 1, heterogeneity in complexity may reverse this result. In ONLY HIGH COMPLEX, both the Medium and the Low loan are simple. If individuals display a dislike for complex loans, as they do for complex lotteries (Huck and Weizsäcker, 1999), we would expect the Medium and Low to have a 'premium' and be chosen more often.

The effect of increasing complexity is also likely to affect decision times. In line with Hypothesis 4, we would expect decision times for choosing among loans to increase across treatments.

Hypothesis 6: *Decision times for choosing among loans will increase with the number of loans with complex repayment schemes.*

3.3 Results

3.3.1 Choices

Figure 6 shows the average choice frequencies for each loan for all 4 treatments. We start by comparing the frequency with which the Medium loan is chosen across treatments. As hypothesized, Medium is chosen more often in ALL SIMPLE, 95% of the time, than in ONLY HIGH COMPLEX, 70% of the time (p-value<0.01), HIGH & LOW COMPLEX, 77% of the time (p-value<0.01), and ALL COMPLEX, 44% of the time (p-value<0.01). However, the decrease in frequency of the Medium loan is not strict. It does not decrease between ONLY HIGH COMPLEX and HIGH & LOW COMPLEX (p-value=0.35), while it does when more complexity is introduced, in ALL COMPLEX (p-value<0.01 in both cases). Hence, having one or two loans with complex repayment schemes does not seem to affect mistakes significantly.

If we turn to the changes in the frequency with which the High and Low loan are chosen, we find, as in Study 1, that the changes are not symmetric. The increase in High is strong in ONLY HIGH COMPLEX, from 3% of the cases to 25% of the cases (p-value<0.01). In contrast, there is no increase in the frequency with which the Low loan is chosen, 2% and 5% (p-value=0.32). If we compare the difference in the increases between High and Low, we also find that these are significantly different (p-value=0.01). Hence, even if High is the only complex loan, subjects display a strong tendency to choose it. If we do the same comparison for HIGH & LOW COMPLEX, we find similar results. The increase in High is stronger than that in Low, compared to ALL SIMPLE.

In ALL COMPLEX we find both a significant increase in High and Low (p<0.01 and p=0.01 respectively). The difference in increases is stronger in High, from 3% to 38%, than in Low, from

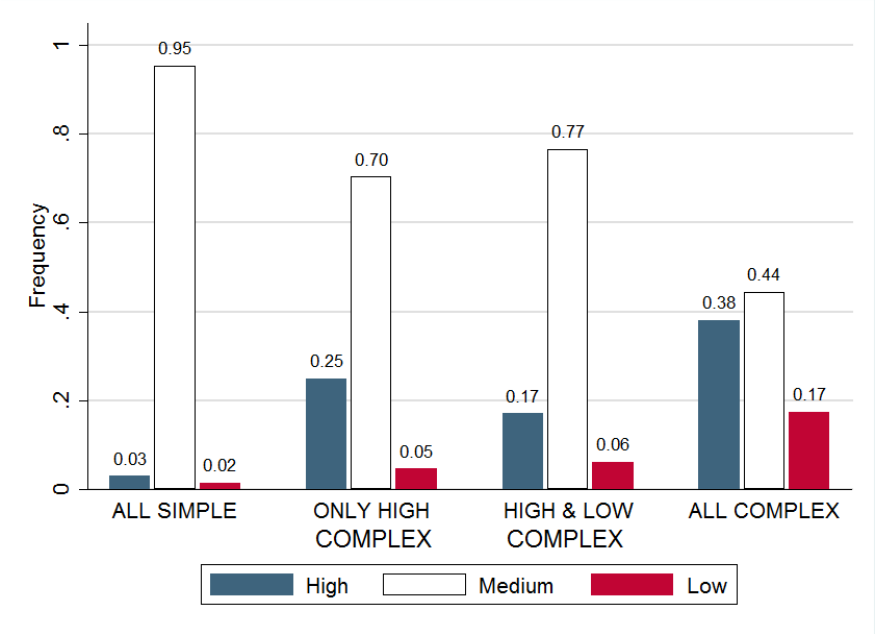

Figure 6: Loan choices by treatment

2% to 17%, but only marginally significant using non-parametric tests (p-value=0.1).

Next we examine choices within the random utility model, by estimating μ for each treatment in Study 2. The results are displayed in Table 6. As in Study 1, the estimated μ is largest in ALL SIMPLE, 0.74. It falls to 0.40 and 0.44 in ONLY HIGH COMPLEX and HIGH & LOW COMPLEX, and is lowest in ALL COMPLEX, 0.09. The latter estimate is very similar to the estimated μ in Study 1 under COMPLEX REPAYMENT, 0.11. If we examine the predicted probabilities implied by the estimated μ, we find that the predictions for the Medium loan are close to actual behavior. In contrast, these predictions are often distant from actual choice frequencies for the High and Low loan, as in Study 1. For example, in ONLY HIGH COMPLEX, the predicted probabilities for High and Low are 0.14, in both cases, while the actual frequencies are 0.25 and 0.05, respectively. Thus, if at least one complex repayment option is introduced, mistakes display a tendency toward the High loan, which cannot be captured by the random utility model.

Choices in Study 2 reveal that increasing the number of loans with complex repayment schemes weakly increases mistakes made by subjects. This is in line with Hypothesis 4. We also find confirmation of our results in Study 1, in that the effect of complexity is different across the High and Low loan. Individuals display a stronger tendency to choose High with any increase in the number of loans with complex repayment schemes. Interestingly, this increase is present, even if High is the only complex loan.

	Treatment							
	ALL SIMPLE		ONLY HIGH COMPLEX		HIGH & LOW COMPLEX		ALL COMPLEX	
Estimated μ	0.74		0.40		0.44		0.09	
Probability of choosing	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual
High	0.03	0.03	0.14	0.25	0.12	0.17	0.28	0.38
Medium	0.95	0.95	0.72	0.70	0.76	0.77	0.43	0.44
Low	0.03	0.02	0.14	0.05	0.12	0.06	0.28	0.17

Note: This table reports maximum likelihood estimates for μ, the noise parameter in the random utility model, by treatment in Study 2. These estimates are then used to predict the average probability of choosing each loan option, given the loan value of each option in each period. They are then compared to actual choice probabilities by treatment, listed under Actual.

Table 6: Estimated Noise Parameter and Predicted Choices

Result 4*: Mistakes weakly increase with the number of loans with complex repayment schemes, in line with Hypothesis 4.*

Result 5*: Mistakes toward the High loan are however significantly more frequent than those toward the Low loan, across all treatments. We hence reject Hypothesis 5.*

Repayment choices are similar to those of Study 1. In the treatment ALL SIMPLE, the cheapest repayment scheme is chosen in 98% of the cases. Subjects choose the cheapest repayment scheme in 84% of the cases in ONLY HIGH COMPLEX and in 92% of the cases in HIGH & LOW COMPLEX.[9] In the treatment ALL COMPLEX, subjects choose the cheapest repayment scheme in 56%. In this case, the difference compared to all other treatments is statistically significant (p-value<0.01 in all cases). Again, in this treatment, those making mistakes in their repayment choices are most frequently subjects who chose the High loan in the first place.

3.3.2 Decision time

Introducing even only a little complexity (in one loan) increases decision times significantly. On average, decision time among loans is 54.4 seconds in ALL SIMPLE, and it jumps to over 90 seconds in all other treatments (90.5, 91.8 and 96.1 in ONLY HIGH COMPLEX, HIGH & LOW COMPLEX, ALL COMPLEX). Such difference is also reflected in the distribution of decision times presented in Table 7. The frequency of those choosing in the last seconds, 100 to 120, increases from 7.81 to 37.50, 53.13 and 60.94 with complexity. On average, the difference in decision times between

[9]The difference is not statistically significant (p-value=0.13).

ALL SIMPLE and ONLY HIGH COMPLEX is significant (p-value<0.01). However, comparing ONLY HIGH COMPLEX and HIGH & LOW COMPLEX we find no significant difference (p-value=0.38). Neither do decision times significantly differ between HIGH & LOW COMPLEX and ALL COMPLEX (p-value=0.20). It is interesting that, as with the case of mistakes, decision time does not change if one rather than two loans display complex repayment schemes.

	Treatment			
	ALL SIMPLE	ONLY HIGH COMPLEX	HIGH & LOW COMPLEX	ALL COMPLEX
Distribution of decision time (in seconds):				
Loan choice				
less than 20	1.56%	1.56%	3.13%	1.56%
20-40	32.81%	1.56%	3.13%	3.13%
40-60	32.81%	6.25%	7.81%	9.38%
60-80	20.31%	18.75%	14.06%	6.25%
80-100	4.69%	34.38%	18.75%	18.75%
100-120	7.81%	37.50%	53.13%	60.94%
Repayment choice				
less than 20	89.06%	64.06%	75.00%	23.44%
20-40	9.38%	17.19%	3.13%	18.75%
40-60	1.56%	18.75%	21.88%	57.81%
% of No Choice:				
for Loan Choice	0%	0%	0%	2%
for Repayment Choice	0%	0%	0%	3%

Table 7: Decision time by treatment

Result 6: *Decision times increase weakly with complexity, in line with Hypothesis 6. When moving from ALL SIMPLE to ONLY HIGH COMPLEX, decision times increase significantly. In contrast, decision times for loans do not change significantly when moving from ONLY HIGH COMPLEX to HIGH & LOW COMPLEX, and further on to ALL COMPLEX.*

Repayment choices are made mostly in less than 20 seconds in the treatments ALL SIMPLE, ONLY HIGH COMPLEX and HIGH & LOW COMPLEX. In contrast, in ALL COMPLEX, a majority of the choices take between 40 and 60 seconds. On average, decision times increase significantly from ALL SIMPLE to ONLY HIGH COMPLEX (p-value<0.01), while they do not from ONLY HIGH COMPLEX TO HIGH & LOW COMPLEX (p-value=0.17), and then increase again from HIGH & LOW COMPLEX to ALL COMPLEX(p-value<0.01).

Finally, we briefly explore the relationship between choices and decision times. Figure 7 displays

the frequency with which a loan is chosen by treatment. In ALL SIMPLE most choices are for the Medium loan, independent of the decision time. In ONLY HIGH COMPLEX and HIGH & LOW COMPLEX, in contrast, the High loan is chosen more frequently, but no clear pattern over time emerges. Interestingly, in ALL COMPLEX, the frequency with which the High loan is chosen decreases strongly over time (the Spearman rank correlation coefficient is -0.406, p-value=0.02). This pattern is similar to that found in Study 1, while the relationship between time and choices is stronger in this Study.

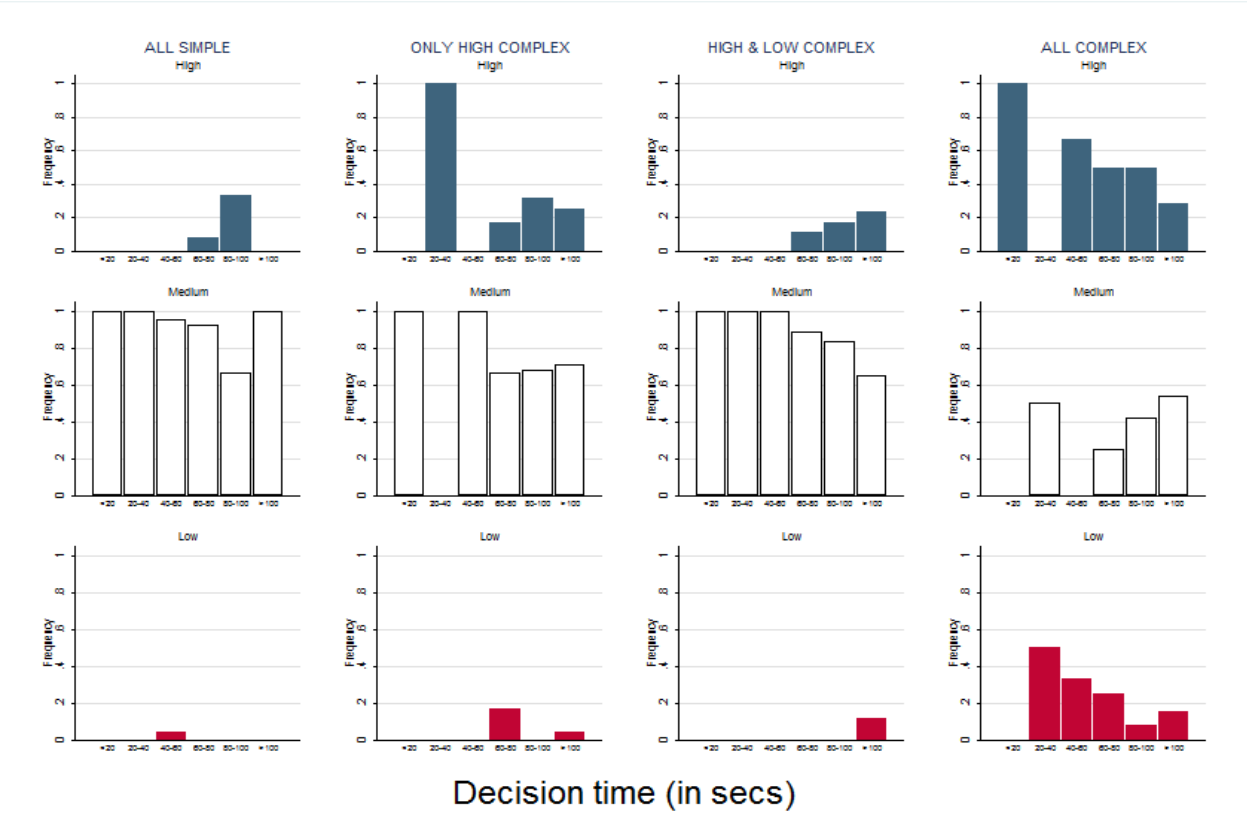

Figure 7: Loan choices over time, by treatment

As in Study 1, results from Study 2 show that complexity is costly for individuals, not only in terms of time but also in payoffs. In ALL SIMPLE subjects make the largest profit, 32.9. In contrast, in ONLY HIGH COMPLEX and HIGH & LOW COMPLEX subjects earn on average 31.7 and 31.8 points, respectively. The lowest earnings are in ALL COMPLEX, 28.4, where subjects earn 15% less than they earn in ALL SIMPLE. The difference in earnings between ALL SIMPLE and ALL COMPLEX is significant (p-value<0.01).

4 Discussion

Our two studies reveal that, in the presence of complex repayment schemes, subjects display a tendency to choose the High loan, which has a high value but unfavorable repayment schemes. We have suggested that this is in line with narrow bracketing. We discuss this explanation in further detail below. We also address salience, another potential alternative explanation for our results.

4.1 Narrow Bracketing

Narrow bracketing is generally defined as making choices in isolation, while broad bracketing refers to integrating the consequences of multiple choices (Read et al., 1999). In the setup of our experiment, we define narrow bracketing as disregarding the future choice among repayment schemes, and making the choice of a loan solely based on its value. This would lead to choosing High, which offers the highest value. In contrast, we define broad bracketing as taking the future choice among repayment schemes into account at the moment of choosing a loan. This would result in choosing the Medium loan, which offers the highest net payoff.

Read et al. (1999) argue that narrow bracketing is a consequence of limitations in cognitive capacity, among others, in attention (Kahneman, 1973), memory (Baddeley, 1986), and analytical processing (Simon, 1957). In the experiment, choosing a loan by narrow bracketing requires the comparison of three loan values. Broad bracketing, however, is cognitively more demanding. It requires the individual to first find the minimum repayment scheme for each loan, then to calculate the payoff for each loan and finally to compare the payoffs across the different loans.

While narrow bracketing is easier than broad bracketing in most situations, relative ease of these two ways of bracketing depends on the complexity of the decision problem. Narrow bracketing is cognitively easy in COMPLEX REPAYMENT, while broad bracketing is demanding. This could explain the strong tendency to choose the High loan, relative to the Low loan, in this treatment. In contrast, in COMPLEX VALUE, narrow bracketing is not cognitively easier than broad bracketing, since repayment costs are simple. This could at the same time explain why individuals do not display the strong tendency to choosing High in this treatment. Since narrow bracketing is not easier, mistakes are then 'random', as in the random utility model.

Furthermore, if we consider the results in Study 2, we find additional evidence for narrow bracketing. When all loans are simple, it is easy to bracket broadly and choose the Medium loan. However, when one loan is complex, the difficulty in broad bracketing increases and is likely to

cause some individuals to bracket narrowly. Hence, we observe a substantial share, 25%, choose the High loan. We would also expect more narrow bracketing when two loans are complex, the High and Low loan in HIGH & LOW COMPLEX. However, we do not observe an increase in the choices of the High loan. This may be due to the fact that narrow bracketing is activated with the presence of one loan, and hence does not increase substantially if another loan, especially the Low loan has complex repayment schemes.

Within narrow bracketing two (complementary) bracketing effects could potentially play a role in our experiment. First, emergent properties: with complexity subjects may not realize the trade-off between value and costs, because computing total costs is difficult. Hence, they do not realize important properties of each loan when these are complex. Such an effect is common when lottery choices are framed as separate, instead of joint (Tversky and Kahneman, 1981, Rabin and Weizsäcker, 2009). This would be in line with our findings too.

Second, subjects may perceive complex costs to be smaller, since these are the addition of three items in our experimental setup. This would be a type of adding-up effect (Read et al., 1999), which is common when costs aggregate over time, such as in smoking. If we interpret the adding-up effect as making repayment costs in our experiment appear smaller overall, it could explain the choices observed. An alternative interpretation of adding-up, though, could be that it makes small repayment costs appear smaller and hence be ignored. Since there are three elements adding up to the total repayment cost, subjects could potentially have ignored the smallest of these, the percentage fee on the loan value. We set the parameters in the experiment such that even if subjects ignore the percentage term, the Medium loan continues to be the loan with the highest net payoff. Hence, if the adding-up effect would take this form, we would expect subjects to nevertheless choose the Medium loan in the treatments with complex repayment, which is not what we observe.

4.2 Salience

Another potential explanation for our findings is that complexity affects the 'salience' of certain attributes of a loan. We discuss two alternative ways complexity can affect salience. First, consider an attribute to be salient if it is presented in a relatively simpler manner. In Study 1, in the treatment COMPLEX REPAYMENT this would imply that loan value is salient and hence subjects choose High. This is what we observe. By the same argument, in COMPLEX VALUE this would imply that costs are salient and subjects choose Low. However, moving from SIMPLE to COMPLEX VALUE the frequency with which Low is chosen increases from 4% to 12%, which

is a smaller increase than when moving to COMPLEX REPAYMENT, when Low increases from 4% to 15%.

Second, let us consider the models of Bordalo et al. (2011), Köszegi and Szeidl (2011) and Gabaix (2011). The effect of complexity in our experiments is to separate or spread a dimension, either value or costs, into three sub-dimensions. In the case of COMPLEX REPAYMENT, instead of having a single number, repayment has a standard fee, a percentage fee minus a bonus. Both Bordalo et al. (2011) and Köszegi and Szeidl (2011) imply that the complex dimension receives less attention, either through the "compromise effect" or through the fact that this dimension is not concentrated. Hence, this implies that costs receive less attention in COMPLEX REPAYMENT, while value receives less attention in COMPLEX VALUE. As indicated above, the former prediction is sustained in our data, while the latter is not. Similarly, Gabaix (2011) suggests in section 6.3.1 of his paper that when cognitive load increases, decision making becomes more 'sparse', i.e. individuals do not consider all information available when maximizing utility. This could imply that consumers simply randomize over which information they focus on, or that they focus on simple dimensions. Again, this would imply that subjects choose the Low loan more frequently in COMPLEX VALUE than in COMPLEX REPAYMENT, which we do not observe.

In Bordalo et al. (2011) another potential consequence of complexity could be to increase the degree of local thinking. We interpret this as having subjects choose the loan which is most salient even more often. If we consider the SIMPLE treatment, the High loan is most salient in terms of value but also in terms of cost (e.g., using their salience function, equation (4) in their paper). A similar observation holds for the Low loan, which is second most salient on both dimensions. Since there is no difference in the ordering of salience across the different dimensions, Medium would be chosen. By introducing complexity, we would hence not expect the degree of local thinking to bias the subject's decision towards a different loan.

5 Conclusion

Policy makers increasingly worry about suboptimal decisions in credit markets and the potential consequences of these decisions for the economy. In many policy circles the complexity of financial products is considered to be one of the main problems in financial markets. In our paper we examine how the complexity of loans affects individual's choices. By controlling the exact benefits and costs of a set of available loans, we examine whether complexity leads to more mistakes and find that it

indeed does.

Our aim, however, is to go one step ahead: understanding what drives mistakes. This is a crucially important step in order to guide policy makers in regulating the disclosure of information, for example. While complexity could simply lead to more mistakes, it could also lead to specific biases that are particularly harmful for consumers.

Our first study allows us to compare choices in three situations: when all loan terms are simple, when repayment schemes are complex and when loan values are complex. We hypothesize that complexity increases mistakes, but it does so equally towards the two loans with lower payoffs. We find that complexity in loan values is in line with this hypothesis. However, complexity in repayment schemes is different: individuals display a tendency to choose a high-valued loan, with higher repayment costs, that ends up making them worse off.

In a second study we examine whether mistakes display such a bias towards high-valued loans if loans differ in complexity. We find that, even if all other loans are simple, the high-valued loan with complex repayment schemes is still chosen. Hence, the bias is robust. We argue that this bias can be explained by narrow bracketing: the tendency of individuals to make choices considering their consequences in isolation. Narrow bracketing is common in many decision environments, such as in risk taking or when examining self-control problems. Our study suggests that it can also be present in financial decisions and that it may be activated through complexity, especially complexity in choices that are made 'later'.

Overall, the results in this paper suggest that there may be a case for consumer protection in complex markets, such as markets for credit and insurance. First of all, since these markets are inherently complex and many small investors display low levels of financial literacy, they are more likely to bracket narrowly and focus on short-term gains rather than having a long-term outlook. Second of all, financial companies may not have the incentives to simplify the decision environment for investors, even if other companies provide simplified products, since consumers are still likely to buy back-loaded products with high profit margins for the company.

References

[1] Ausubel, L., 1999. "Adverse Selection in the Credit Card Market". Working Paper, University of Maryland.

[2] Baddeley, A. D., 1986. *Working Memory*. Oxford: Oxford University Press.

[3] Barberis, N., Huang, M., and R.H. Thaler, 2006. "Individual Preferences, Monetary Gambles, and Stock Market Participation: A Case of Narrow Framing". *The American Economic Review* 96(4), 1069–90.

[4] Benartzi, S. and R.H. Thaler, 1995."Myopic Loss Aversion and the Equity Premium Puzzle". *The Quarterly Journal of Economics* 110 (1), 73–92.

[5] Bertrand, M. and A. Morse, 2011. "Information Disclosure, Cognitive Biases and Payday Borrowing". *The Journal of Finance* 66 (6), 1865–1893.

[6] Beshears J., Choi J. J., Laibson D. and B. C. Madrian, 2010. "How Does Simplified Disclosure Affect Individuals' Mutual Fund Choices?" In D. A. Wise, ed. *Explorations in the Economics of Aging*. Chicago: University of Chicago Press.

[7] Blavastkyy, P. and G. Pogrebna, 2010. "Stochastic Choice and Decision Theories". *Journal of Applied Econometrics* 25, 963–986.

[8] Bordalo, P., Gennaioli, N. and A. Shleifer, 2011. "Salience and Consumer Choice". Mimeo, Harvard University.

[9] Brown, J., Hossain, T. and J. Morgan, 2010. "Shrouded Attributes and Information Suppression: Evidence from the Field". *The Quarterly Journal of Economics*, 125 (2), 859–876.

[10] Campbell, J. Y., 2006. "Household Finance". *The Journal of Finance* 61 (4), 1553–1604.

[11] Caplin, A. and D. Martin, 2012. "Defaults and Attention: The Drop Out Effect". Working Paper, New York University.

[12] Carlin, B., 2009. "Strategic Price Complexity in Financial Retail Markets". *Journal of Financial Economics* 91, 278–287.

[13] Choi, J. J., Laibson, D. and B. C. Madrian, 2010. "Why Does the Law of One Price Fail? An Experiment on Index Mutual Funds". *Review of Financial Studies* 32 (4), 1405–1432.

[14] Fischbacher, U., 2007. "z-Tree: Zurich Toolbox for Ready-made Economic Experiments". *Experimental Economics* 10, 171–178.

[15] Gneezy, U. and J. Potters, 1997. "An Experiment on Risk Taking and Evaluation Periods". *The Quarterly Journal of Economics* 112(2), 631–45.

[16] Gabaix, X., 2011. "A Sparsity-Based Model of Bounded Rationality". Mimeo, NYU Stern.

[17] Gabaix, X. and D. Laibson, 2006. "Shrouded attributes, consumer myopia, and information suppression in competitive markets". *The Quarterly Journal of Economics* 121, 505–539.

[18] Haisley, E., Mostafa, R., and G, Loewenstein, 2008. "Myopic risk-seeking: The impact of narrow bracketing on lottery play". *Journal of Risk and Uncertainty* 37(1), 57–75.

[19] Heidhues, P. and B. Köszegi, 2010. "Exploiting Naiveté about Self-Control in the Credit Market". *The American Economic Review* 100 (5), 2279–2303.

[20] Huck, S. and G. Weizsäcker, 1999. "Risk, complexity, and deviations from expected-value maximization: Results of a lottery choice experiment". *Journal of Economic Psychology* 20, 699–715.

[21] Kahneman, D. 1973. *Attention and Effort*. Englewood Cliffs, NJ: Prentice Hall.

[22] Kalaycı, K. and J. Potters, 2011. "Buyer confusion and market prices". *International Journal of Industrial Organization* 29 (1), 14–22.

[23] Kalaycı, K., 2011. "Price complexity and buyer confusion in markets". Netspar Discussion Paper 2011–082.

[24] Köszegi, B. and A. Szeidl, 2011. "A model of focusing in economic choice". Mimeo, UC Berkeley.

[25] Kumar, A. and S.S. Lim, 2008. "How Do Decision Frames Influence the Stock Investment Choices of Individual Investors?". *Management Science* 54 (6), 1052–1064.

[26] Luce, D., 1959. *Individual Choice Behaviour*. Wiley: New York.

[27] Lusardi, A. and P. Tufano, 2009. "Debt Literacy, Financial Experiences, and Overindebtedness". NBER Working Paper 14808.

[28] McFadden, D., 1973. "Conditional Logit Analysis of Qualitative Choice Behavior". *Frontiers in Econometrics*, Chapter 4. Edited by P. Zarembka. Academic Press: New York.

[29] McKelvey, R. D., and T. R. Palfrey, 1995. "Quantal Response Equilibria for Normal Form Games". *Games and Economic Behavior* 10, 6–38.

[30] Meier, S. and C. Sprenger, 2010. "Present-Biased Preferences and Credit Card Borrowing". *American Economic Journal: Applied Economics* 2 (1), 193–210.

[31] OECD, 2005. *Improving Financial Literacy: Analysis of Issues and Policies*. OECD Publishing: Paris.

[32] Rabin, M. and G. Weizsäcker, 2009. "Narrow Bracketing and Dominated Choices". *The American Economic Review* 99 (4), 1508–1543.

[33] Read, D., Loewenstein, G. and M. Rabin, 1999. "Choice Bracketing." *Journal of Risk and Uncertainty* 19(1–3), 171–97.

[34] Simon, H. A. 1957. *Models of Man: Social and Rational*. New York: Wiley.

[35] Spiegler, R., 2006. "Competition over Agents with Boundedly Rational Expectations". *Theoretical Economics* 1, 207–231

[36] Spiegler, R., 2011. *Bounded Rationality and Industrial Organization*. Oxford University Press.

[37] Stango, V. and J. Zinman, 2009. "Exponential Growth Bias and Household Finance". *The Journal of Finance* 64 (6), 2807-2849.

[38] Tversky, A. and D. Kahneman. 1981. "The Framing of Decisions and the Psychology of Choice." *Science*, 211 (4481), 453–58.

[39] Wilcox, N., 1993. "Lottery Choice: Incentives, Complexity and Decision Time." *Economic Journal*, 103 (421), 1397–1417.

Appendix: Instructions

This session is part of an experiment in the economics of decision making. If you follow the instructions carefully and make good decisions, you can earn a considerable amount of money. At the end of the session your earnings will be paid to you in cash and in private. The amount you earn will depend on the decisions you make.

There are a number of people in this room who are participating in this session. It is important that you do not talk to any of the other people in the room until the session is over. Please TURN OFF your electronic devices such as phones and music players.

The session will consist of 24 periods, in each of which you can earn points. At the end of the experiment you will be paid an amount based on your total point earnings from all 24 periods. Points will be converted to cash using an exchange rate of 7000 points = 1 Euro. There will not be any show-up fee paid. Notice that the more points each individual earns, the more cash they will receive at the end of the session.

Each period in the experiment consists of two stages. In the first stage you make a choice among 3 Loans, each of which earns you the Value of the Loan. In the 2nd stage you get to choose between Repayment schedules for the Loan you have chosen in the 1st stage. Notice that the Repayment options for each Loan is different, therefore the options you have in the 2nd stage depends on your choice in the 1st stage. Your payoff for the period will be equal to the Value of the Loan minus the Repayment amount.

PAYOFF = VALUE of the Loan - REPAYMENT Amount

At the first stage of a period you will have a time limit of 120 seconds (2 minutes). The time limit for the 2nd stage will be 60 seconds (1 minute). Both of these time limits are strictly BINDING. If you do not make a choice in the time limit at any of the two stages in a period, you will get zero points for that period. However, even if you make a choice quicker than the allocated time limit for that stage you will have to wait until the time limit expires before you move to the next screen. You will see a waiting screen in the meantime.

When you have read the instructions carefully and are ready please click the OK button. After everyone in the session clicks OK the experiment will start.

If you have any questions please raise your hand, the experimenter will come to answer your question.

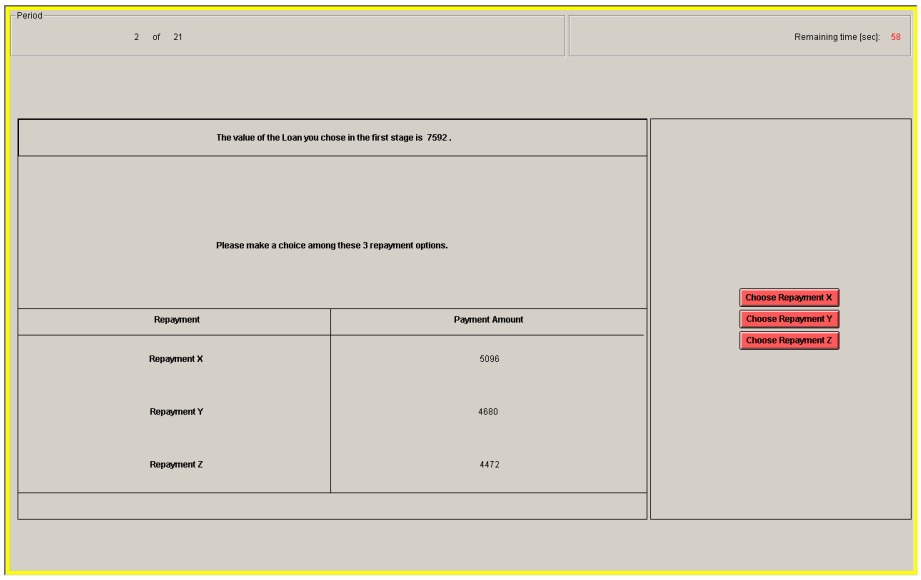

Figure 8: Example screen shot for repayment choice