Decisions under Poverty: The Effects of Scarcity on Cognitive Mindset and Financial Decisions

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Abstract

This paper studies the causal effect of poverty on decision making. We theorize that the experience of scarcity induces a 'narrow mindset', characterized by short-term thinking and focus on details and feasibility instead of desirability of plans. In the first experiment (participants from Amazon MTurk, $N = 325$), we failed to replicate the finding by Mani, Mullainathan, Shafir, and Zhao (2013) that when people with a low income are asked to think about difficult financial problems, they perform worse on a cognitive control task and an intelligence test. We also added a new condition where we measure global vs. local focus. We find that for participants who think about hard financial problems, the association between subjective wealth and global focus is more positive than for participants who think about less stringent financial problems. However, interpretation of the experiment is hindered by some technical issues. In a second experiment, we attempted to induce feelings of scarcity in college students ($N = 177$) by changing response scales for questions on participants' financial situation. Although we found no effect of this manipulation on subjective wealth or delay of gratification, we did find a positive association between subjective wealth and preference for delaying gratification. We conclude that our theory is not yet strongly supported, but future research is needed to address some technical and methodological issues present in our studies.

Keywords: poverty, scarcity, decision making, financial decisions, mindsets

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Even in a relatively wealthy country such as the Netherlands, about 7.6% of the population lives in poverty, not earning enough to pay for food, clothes, accommodation and social participation (CBS/SCP, 2013). About 32% of this group has been living in poverty for at least three consecutive years. Globally, 25% of the population lives in extreme poverty, based on a poverty line of $1.25 per day (Chen & Ravallion, 2010). While many studies have focused on structural causes of poverty, other work shows that the poor sometimes display behavior that decreases their chances of escaping poverty. For example, compared to richer people, the poor show more impatience in their financial decisions (Carvalho, 2010), manage their finances less well (Blank & Barr, 2009), take more unfavorable loans (Mendel, 2005), and use less preventive health care (Katz & Hofer, 1994).

In this paper, we examine the situational effect of poverty on the decision making process and its outcomes. Specifically, we argue that acute scarcity of financial resources induces a 'narrow' cognitive mindset, as opposed to a 'broad' mindset, causing a focus on the short term instead of the long term, on specific problems instead of general and more complex issues, and on the feasibility as opposed to the desirability of possible solutions. Although this narrow mindset is often useful to attend to the immediate situation at hand, it can have detrimental long-term consequences because long-term issues are neglected. This perspective on poverty provides new insights into why people have trouble escaping poverty and suggests new interventions to improve decision making under poverty.

Theoretical perspectives

The recently emerged situational view on poverty is a departure from classical research on poverty, which has often taken a structural perspective. Most traditional theories fall in one of

two camps (Bertrand, Mullainathan, & Shafir, 2004). The first, the "rational adaptation" view, assumes that the poor make optimal economic decisions given their circumstances (e.g., Carvalho, Meier, & Wang, 2014). The poor are viewed as rational decision makers with full information and coherent beliefs who effectively pursue their goals. Proponents of this view argue that for every decision, the poor rationally weigh the costs and benefits of every possible option and pick the one with the highest marginal utility. For example, they would argue that the reason that the poor are more likely to be unbanked (Bricker, Kennickell, Moore, & Sabelhaus, 2012), is because the benefits of a bank account do not outweigh its costs. The "culture of poverty" perspective (Lewis, 1975; Small, Harding, & Lamont, 2010), in contrast, argues that the poor sometimes make suboptimal decisions due to their attitudes and preferences. It argues that the poor form a specific culture consisting of a set of values that is adaptive to their situation on the short term, but ultimately traps them in a cycle of poverty. This view would argue that the poor are unbanked because, for example, they mistakenly believe that they would not profit from having a bank account, or because of a lack of trust of banking firms. Importantly, these two perspectives suggest completely opposing policies on relieving poverty. The rational adaptation view suggests that the poor are perfectly capable of making optimal decisions on their own, and should therefore be free to make their own decisions. The culture of poverty perspective, on the other hand, suggests that the poor can make fallible choices and are therefore in need of paternalistic guidance.

Recently, a situational view of poverty has emerged, that focuses on the consequences of living in poverty instead of the causes of poverty. A first version of this view, recently reviewed by Haushofer and Fehr (2014), argues that poverty causes stress and negative affect. These psychological states can increase impatience (Lerner, Li, & Weber, 2013) and risk aversion

(Kandasamy et al., 2014) which, in turn, might decrease the chances of escaping poverty. A second version of this perspective uses insights from behavioral economics to argue that the poor show the same weaknesses and cognitive biases as richer people (Bertrand et al., 2004). The crucial difference with the affluent, however, is that for the less affluent the consequences of mistakes are much more severe due to the poor's narrow margins of error. A third, more recent version of this explanation argues that the experience of financial scarcity impairs decision-making (Mani, Mullainathan, & Shafir, 2013; Shah, Mullainathan, & Shafir, 2012; Spears, 2011). Specifically, Mullainathan and Shafir (2013) argue that the poor are under a permanent cognitive load because they continuously have to make decisions that involve difficult trade-offs. This leads to a reduction in cognitive capacity (or 'tunneling'), which lowers decision quality because less mental resources are available for making decisions.

This idea that experiencing scarcity can impair decision making has been experimentally examined in only a few studies, with mixed results. Positive results were found by Shah and colleagues (2012), who tested the idea in a laboratory setting by having participants play several games. Wealth and poverty was simulated by giving participants either a large or a small number of turns. In these games, 'poor' participants put more effort into the tasks, making them mentally depleted, which caused a lower performance in a subsequent cognitive control task. In addition, in some games participants were allowed to 'borrow' turns from later rounds. The poorer participants tended to borrow more, which turned out to be counterproductive as their payoffs would have been higher if they had not borrowed. A second study with positive results by Mani, Mullainathan, Shafir, and Zhao (2013) showed that after people with a low income reflected on financial problems involving high stakes, they showed a decreased performance on both the Raven intelligence test and a cognitive control test, compared to thinking about financial

problems involving low stakes. There was no effect of reflecting on difficult financial problems for participants with a high income. This finding was replicated in a field study with Indian farmers who performed worse on intelligence and cognitive control tests before harvest (when they were relatively poor) than after harvest (when they were relatively rich). Third, Spears (2011) found similar effects as the previous two studies in a laboratory experiment and a partially randomized field experiment. Despite these positive findings, a recent study by Carvalho and colleagues (2014) had mostly negative results. Low-income U.S. households were surveyed either shortly before payday (when relatively poor) or shortly after payday (when relatively rich). Although the participants showed a stronger present bias when relatively poor, the research found no differences in quality of decision making, cognitive biases, or cognitive functioning between the before and after payday measures. The authors argue that these findings support a rational adaptation view, as their participants did not make worse decisions when relatively poor (as their decision quality was unaffected), but acted rationally given their circumstances. A present bias is not necessarily irrational, because poverty can cause liquidity constraints, causing the poor to act as if they were present biased. Furthermore, participants showed present bias in monetary tasks, but not in non-monetary tasks, again pointing at the role of liquidity constraints.

In addition to the scarce and mixed evidence for the idea that poverty impairs decision making, it is not yet clear what psychological processes would underlie this effect. One account is that poverty consumes mental resources, leaving less cognitive capacity available for other tasks (Mani et al., 2013). It is argued that when engaged in a particular task, the poor cannot free up enough mental resources because their cognitive capacity is being taxed by financial problems. A second explanation, brought forward by Spears (2011), argues that poverty changes the consequences of decisions. Because the poor's decisions are often more complex, the act of

making these decisions depletes their cognitive control–the ability to resist impulsive behavior and to focus attention. In turn, this lack of self-control leads to more impulsive behavior in other decisions. Both accounts of the underlying processes are limited, for different reasons. The first account has difficulty explaining why the poor have problems with decisions concerning financial problems. In fact, it predicts that the poor should make more efficient monetary decisions because they should spend more mental resources on these decisions. The cognitive control account, on the other hand, is problematic because recent research shows self-control is not a limited resource (Inzlicht, Schmeichel, & Macrae, 2014). Instead, Inzlicht and colleagues argue that using self-control leads to a motivated switch of priorities from 'have-to' goals to 'want-to' goals. Our mindset approach suggests a will address both of these issues. First, it predicts that scarcity should lead to increased performance on a task when this task is specifically focused on, due to increased cognitive investment. Second, it does not assume that scarcity depletes mental resources or self-control but, similarly to Inzlicht and colleagues (2014), changes priorities and motivations. Finally, a third explanation of why poverty can impair decision making is that poverty induces stress and negative affect which, in turn, can lead to suboptimal decisions (Haushofer & Fehr, 2014). However, this account is fully compatible with ours, and our mindset account could be seen as an addition to this perspective. Stress and negative affect have been shown to induce cognitive focus (Derryberry & Reed, 1998; Chajut & Algom, 2003). Therefore, if the poor experience more negative affect and stress, they should also be more likely to adopt a narrow mindset.

Scarcity Induces a Narrow Mindset

Scarcity, we suggest, induces a narrow mindset, which leads to a focus on details and on the current demanding situation, hindering a more abstract and future-oriented mindset. Our

concept of a narrow versus a broad mindset builds upon various theories that have proposed ways in which people can approach and organize information. Specifically, a narrow versus a broad mindset entails a local versus a global focus (Navon, 1977), a low versus a high construal level (Trope & Liberman, 2003), context independence versus dependence (Witkin, 1950), and analytic versus holistic thinking (Nisbett, 2001). Although different in their goals and specifics, all these theories distinguish two mindsets: A narrow mindset, focusing on the local, concrete, specific, and on the feasibility of solutions, and a broad mindset, focusing on the global, abstract, general, and on the desirability of solutions.

Our idea that financial scarcity induces a narrow mindset finds initial support in research showing that people adopt a narrow mindset when they are stressed or anxious (e.g., Derryberry & Reed, 1998; Chajut & Algom, 2003), focus on prevention as opposed to promotion (Förster & Higgins, 2005), are primed with low power (Smith & Trope, 2006), or when their goals are threatened (Schwarz & Bless, 1991). Furthermore, a narrow mindset has been shown to lead to a reduction in self-control and a preference for immediate gratification (Fujita & Trope, 2006; Fujita & Carnevale, 2012), and a stronger present bias (Malkoc, Zauberman, & Brettman, 2010). The mindset account provides a feasible explanation of the effects found in earlier research on the effects of poverty on the decision making process. For example, the small number of turns the 'poor' participants had in the first experiment by Mani and colleagues (2012) could have induced a narrow mindset. This would lead participants to focus on the short term, resulting in better concentration and higher performance, but also in overborrowing because of a too strong focus on short-term outcomes. In Mani and colleagues' (2013) first experiment, the financial scenarios involving high stakes could also have put participants in a narrow mindset, decreasing

their performance on the intelligence test, which requires abstract reasoning, and on the cognitive control test, which requires a global focus.

In research on poverty, there have been many different definitions of when someone experiences poverty (e.g., Chen & Ravallion, 2010). As our theory concerns the consequences of experiencing scarcity, we study the subjective experience of poverty. Therefore, we adopt Mani and colleagues' (2014) definition of poverty as "the gap between one's needs and the resources available to fulfill them" (p. 976). This allows us to circumvent the problem of relative versus absolute poverty, as in both cases people can experience scarcity.

Experiment 1

The first experiment has two goals. First, we attempt to replicate the findings by Mani and colleagues that poverty impairs cognitive functioning (2013, experiment 1). As in their study, participants will think about four financial problems with either low stakes (easy condition) or high stakes (hard condition). While thinking about a solution to one of these problems, participants are asked to do a short intelligence test (Raven's Progressive Matrices, Raven, 2000) and a cognitive control task (adapted from Davidson, Amso, Anderson, & Diamond, 2006). Our predictions are the same as in the original experiment:

> H_1: In the difficult condition, but not in the easy condition, participants with a lower income score lower on the intelligence test and the cognitive control task, compared to those with a higher income.

Second, we add a new condition in which we measure global versus local focus using a Navon letter task (Navon, 1977). Because we theorize that the experience of scarcity induces a narrow mindset, of which a local focus is an aspect, we predict:

H_2: In the difficult condition, but not in the easy condition, participants with a lower income have a more local focus, compared to those with a higher income.

Although we do not expect this to influence our results substantively, our method diverges from the original in several ways. First, our experiment was conducted online using participants recruited via Amazon Mechanical Turk, whereas originally volunteers were recruited in a mall. Second, whereas the original study only reported measures of accuracy for the intelligence and cognitive control tests, we will also study the differences in reaction times. Our expectations for the reaction time measures are similar to those of accuracy:

H_3: In the difficult condition, but not in the easy condition, participants with a lower income react slower than those with a higher income on the intelligence test and the cognitive control task.

Third, we increased the number of trials in the cognitive control task from three to five, in order to get a more sensitive measure of cognitive control. Fourth, we measured not only objective wealth (i.e., income level), but also subjective wealth. We expect similar or perhaps stronger effects of this variable on the dependent measures, because we expect that people's cognitive mindset is more strongly influenced by their perceived scarcity (i.e., the experience of scarcity) than by their actual level of scarcity.

H_4: In the difficult condition, but not in the easy condition, participants with a lower level of subjective wealth score lower on the intelligence test and the cognitive control task than those with a higher level of subjective wealth.

Finally, our survey starts with an instructional manipulation check, to exclude participants who do not closely read and follow the instructions.

Method[1]

Participants. Participants were recruited via Mechanical Turk, a website for online recruitment (for details on the use of Mechanical Turk, see Buhrmester, Kwang, and Gosling, 2011). The number of participants was based on a power analysis. To detect an effect size of $\eta_p^2 = 0.05$ with $1-\beta = .8$ and $\alpha = .05$ in a design with two groups and one covariate, a minimum of 76 participants per cell is needed. A total of 325 participants completed the survey. Participants were excluded from further analyses if they (1) did not successfully complete the instructional manipulation check, (2) did not complete a part of the survey, or (3) spent less than 5 seconds reading the scenarios. A total of 236 participants remained in the sample, who were between 18 and 67 years old ($M_{age} = 35$) of which 51.1% was male. Median yearly household income was $35,000, median yearly effective income was $24,749 (calculated by dividing household income by the square root of household size; Buhmann, Rainwater, Schmaus, & Smeeding, 1988).

Design. The experiment employed a 2 (difficulty of the financial problems: easy vs. hard) × 2 (dependent variable: replication vs. mindset) design. Participants started with an instructional manipulation check in which they were instructed to respond in a specific pattern (Oppenheimer, Meyvis, & Davidenko, 2009). A total of 22 participants were excluded because they failed this check.

After receiving instructions for the upcoming tasks, participants were presented with four financial scenarios in random order. The scenarios presented participants with a particular financial problem, and participants were asked to think about how they would deal with these problems. Difficulty of the problems was manipulated by using either low or high stakes (easy vs. difficult condition, respectively). For example, participants were asked how they would react to either a 5% or a 15% cut in their salary. While thinking about a financial problem, participants were asked to solve a series of tasks, the dependent measured. All these measures were

conducted using ScriptingRT, a software framework that has been successfully used to measure reaction time in online studies (Schubert, Murteira, Collins, & Lopes, 2013).

In the replication condition participants completed a cognitive control task and a series of Raven's progressive matrices (the order of these tasks was counterbalanced across participants). For the Raven's progressive matrices (Raven, 2000), we used the same pretested items as Mani and colleagues (2013). Per scenario, three items were presented in random order. Participants clicked the figure out of eight figures that they thought completed the pattern of the matrix. There was a time limit of 120 seconds; when participants did not answer in this time the trial was counted as incorrect. Participants received two practice trials at the beginning of the experiment, and could only advance when they answered both correctly or tried to answer the set three times. In the cognitive control task (adapted from Davidson, Amso, Anderson, & Diamond, 2006) participants were asked to fixate on the middle of the screen. Either a square or a triangle appeared for 500 milliseconds on either the right or left side of the screen. When the square appeared, participants had to press the 'Q' key when it appeared on the left side of the screen, or the 'P' key when it appeared on the right side. For the triangle, it was the other way around; participants had to press the 'P' key and the 'Q' key when the triangle on the left or right, respectively (the role of the square and the triangle was counterbalanced between participants). Participants received five trials per scenario. The experiment started with a practice set of four trials, and participants could only advance when they answered all the trials correctly or completed the practice set thrice.

In the mindset condition, the cognitive control task and the Raven's progressive matrices were replaced by a measure of global vs. local focus; the Navon letter task (adapted from Navon, 1977). In this task, participants are asked to focus on a fixation cross, after which for 500

milliseconds a letter composed of smaller letters is shown on screen. Participants are asked whether they see a 'T' or an 'H' on screen, either as the big letter or as smaller letters, and respond by pressing the 'T' or the 'H' key, respectively. Per scenario, participants completed eight trials. Participants first completed a practice set of eight trials and could advance when they answered all eight correctly or completed this practice set thrice.

At the end of the survey, all participants answered demographic questions on their employment status, personal and household income, gender, and age. Furthermore, we added a subjective wealth scale consisting of three items asking for the participants' perception of their current financial situation (Gasiorowska, in press).

Results

Replication. Performance on the Raven's Matrices and the cognitive control tasks are plotted in Figures 1 and 2. For both tasks, we regressed accuracy on difficulty, effective income, and the interaction between difficulty and effective income (Tables 1 and 2). Contrary to our predictions, for the Raven's Matrices there were no statistically significant effect of the easy and hard conditions (b = -0.002, $t(70)$ = -0.02, p = .985, η_p^2 = .0002) and effective income (b < 0.0001, $t(70)$ = 0.20, p = .843, η_p^2 = .0008), and there was also no significant interaction between difficulty and income (b < 0.0001, $t(70)$ = -0.05, p = .843, η_p^2 = .00004). Similarly, we found no statistically significant effects on the cognitive control task of difficulty (b = -0.036, $t(70)$ = -0.83, p = .410, η_p^2 = .018), effective income (b < 0.0001, $t(70)$ = -1.19, p = .238, η_p^2 = .000003), or an interaction between difficulty and income (b < 0.0001, $t(70)$ = 1.70, p = .086, η_p^2 = .043). In separate tests for each independent variable, there were no effects of difficulty (Raven's: $t(65)$ = 0.13, p = .894, Cohen's d = 0.03, 95% CI [-0.46, 0.52]; cognitive control: $t(72)$ = -0.61, p = .543, d = -0.14, 95% CI [-0.61, 0.32]) and effective income (Raven's: b < 0.0001, $t(65)$ = 0.24,

p = .814, r = .029, 95% CI [-0.21, 0.27]; cognitive control: b < 0.0001, $t(68)$ = -0.10, p = .924, r = -.012, 95% CI [-0.25, 0.22]).

Subjective wealth. We performed a similar regression for both tasks using subjective wealth instead of effective income, with similar results (Tables 3 and 4 and Figures 3 and 4). For the Raven's Matrices, again there were no statistically significant effects of difficulty (b = -0.032, $t(70)$ = -0.34, p = .734, η_p^2 = .00003) and effective income (b = -0.003, $t(70)$ = -0.25, p = .804, η_p^2 = .00002), and there was also no significant interaction between difficulty and income (b = 0.005, $t(70)$ = 0.32, p = .750, η_p^2 = .002). The regression of cognitive control showed similar results: There were no statistically significant differences on the cognitive control task as a function of difficulty (b = -0.048, $t(70)$ = -1.07, p = .288, η_p^2 = .011), effective income (b = -0.002, $t(70)$ = -0.30, p = .765, η_p^2 = .021), or an interaction between difficulty and income (b = 0.015, $t(70)$ = 1.85, p = .067, η_p^2 = .047). When examined a separate regression of accuracy on the two tasks on subjective wealth, we also found no significant effects (Raven's: b = -0.0001, $t(65)$ = -0.02, p = .986, r = -.002, 95% CI [-0.24, 0.24]; cognitive control: b = 0.004, $t(72)$ = 1.03, p = .306, r = .121, 95% CI [-0.11, 0.34]).

Reaction time. In addition to the accuracy of the responses on the Raven's Matrices and the cognitive control task, we measured reaction time on all the dependent measures. In a regression of reaction time for accurate trials on difficulty and effective income, we found no significant effects both on the Raven's Matrices and the cognitive control task (for the statistics, see Tables 5 and 6). Similarly, we regressed reaction time for accurate trials on difficulty and subjective wealth, but again found no significant effects (Tables 7 and 8).

Overall, there were also no main effects on reaction time for accurate trials of difficulty (Raven's: $t(58)$ = 0.61, p = .544, d = 0.15, 95% CI [-0.34, 0.64]; cognitive control: $t(58)$ = 1.09,

p = .281, d = 0.25, 95% CI [-0.21, 0.72]) or effective income (Raven's: b = .027, $t(58) = 0.46$, p = .650, η_p^2 = .004; cognitive control: b = -0.004, $t(68) = -1.95$, p = .055, η_p^2 = .053). Finally, when we regressed reaction time for accurate trials on the two tasks on subjective wealth, we also found no significant effects (Raven's: b = -494.998, $t(58) = -0.72$, p = .476, r = -.094, 95% CI [-0.34, 0.16]; cognitive control: b = -22.268, $t(72) = -0.95$, p = .348, r = -.111, 95% CI [-0.33, 0.12]).

Mindset. To create a measure of global-local focus, we subtracted the mean reaction time on correct trials that required a local focus (i.e., trials where the letter to be detected was small) from the mean reaction on trials that required a global focus (i.e., trials where the letter to be detected was big). This means that a positive score reflects a global focus, whereas a negative score reflects a local focus.

In a regression of global vs. local focus on difficulty and effective income (Table 9 and Figure 5), we found no statistically significant effect of difficulty (b = -7.480, $t(101) = -0.10$, p = .918, η_p^2 = .001) or the interaction between difficulty and effective income(b = 0.001, $t(101)$ = 0.40, p = .693, η_p^2 = .002). However, there was, unexpectedly, a small negative effect of effective income (b = -0.003, $t(70) = -2.092$, p = .039, η_p^2 = .065), meaning that those with a higher effective income had a slightly more local focus (controlling for effects of difficulty, a standard deviation increase in effective income led to a decrease of 0.29 standard deviation on the global vs. local measure).

In separate regressions, there was no significant difference in global-local focus between conditions ($t(98.215) = -0.18$, p = .855, d = -0.04, 95% CI [-0.43, 0.36]), although variance was significantly greater in the hard condition ($F(47, 65) = 0.54$, p = .032). As in the combined

regression, there is a significant negative effect of effective income on global vs. local focus (b = -0.003, $t(97)$ = -2.59, p = .011, r = -.255, 95% CI [-.43, -.06]).

Subjective wealth. Second, we regressed global vs. local focus on condition and subjective wealth (Table 10 and Figure 6). There was a significant of effect of difficulty (b = -225.318, $t(101)$ = -1.99, p = .0497, η_p^2 = .0001), meaning that participants were more locally focused in the hard condition. There was no effect of subjective wealth (b = -27.254, $t(101)$ = -1.31, p = .192, η_p^2 = .0021). However, these main effects should not be interpreted as there was, as expected, a significant disordinal interaction between difficulty and effective income (b = 61.616, $t(101)$ = 2.19, p = .031, η_p^2 = .046): For participants in the hard condition the correlation between subjective wealth was more positive (although not significantly different from zero, r = 0.216, p = .114, 95% CI [-0.05, 0.45]) than for participants in the easy condition (but also not significantly different from zero, r = -0.228, p = .119, 95% CI [-0.48, 0.06]).

Discussion

In the first experiment, we did not find evidence for an effect of the difficulty manipulation, effective income or subjective wealth, or an interaction between these variables on performance on the cognitive control test and the Raven's matrices. We also found no effects or interactions of difficulty and effective income or subjective wealth on accuracy and reaction time, both for the cognitive control test and the Raven's matrices. For the mindset condition, in which we global-local focus was the dependent variable, one of the predicted interactions was statistically significant in the predicted direction: the interaction between the effects of subjective wealth and difficulty on global-local focus. In the hard condition, the association between subjective wealth and global focus was more positive than in the easy condition. However, note that the evidence for this effect was not very strong (p = 0.031), the effect size was small (η_p^2

= .046), and the chance of a type I error is substantial due to the large number of statistical tests ran. Furthermore, although the correlation between income and global focus was positive in the hard condition, it was significantly different from 0. We explore several possible reasons for the failure to replicate and the mostly negative results for the mindset condition in the general discussion.

Poverty and Time Preferences

Several studies have found that people in poverty more strongly discount future payoffs (i.e., they are more present-biased; for an overview, see Haushofer & Fehr, 2014). For example, Carvalho (2010) studied poor households in rural Mexico, and found they had a very low discount rate (61%, annually). Within the US, poorer households are also more likely to discount future payoffs than richer households (Lawrance, 1991). Based on these findings, poverty might cause stronger discounting of future outcomes, but the reverse causal chain is also possible: perhaps people who discount the future more strongly are also more likely to become poor. However, recently multiple studies show a causal effect of poverty. For example, Tanaka, Camerer, and Nguyen (2010) used rainfall as an external manipulation of income for Vietnamese villagers. They found that when the amount of rain was low, and the villagers were poor, they were also more impatient than in times of heavy rainfall.

There are at least two possible explanations for these studies that suggest poverty has a causal effect on intertemporal preferences. First, even if the poor and the rich would have equal discounting preferences, market imperfections can cause the poor to act as if they are present biased (Lawrance, 1991; Carvalho et al., 2014). For example, if the poor have difficulty getting access to credit markets, their marginal utility of a sooner, smaller outcome might be higher than that of a later, larger outcome. The poor might also choose a safe payment now in anticipation of

future liquidity constraints. A second explanation, predicted by our theory, is that poverty has psychological effects that in some situations might lead to suboptimal decisions. If poverty causes people to adopt a narrow mindset, the poor should focus more strongly on short-term payoffs, even if this would not be beneficial in the long term.

We test these explanations in the second experiment by studying the effects of induced feelings of scarcity on delay of gratification. To reduce the role of market imperfections and future liquidity constraints, we study college students (who are unlikely to face market imperfections and liquidity constraints) and use relatively small amounts of money in the delay of gratification task (so the money is unlikely to be enough to safeguard against future liquidity constraints).

Experiment 2

In experiment 2, we try to induce feelings of scarcity in college students, and test whether this leads to stronger discounting of future payoffs. The experiment has two goals. First, we test whether a manipulation of scarcity (adapted from Nelson & Morrison, 2005) changes feelings of subjective wealth. All participants answer the same questions about their financial situation, but the response scales vary per condition. In the *low scarcity* condition the response scales contain options with low numbers, causing most participants to answer on the high end of the scale. In the *high scarcity* condition the response scales contain options with higher numbers, causing participants to answer on the low end of the scale. To test whether this manipulation induces feelings of scarcity, participants are then asked to fill in a short subjective wealth scale (Gasiorowska, in press). We predict:

H_5: Participants in the high scarcity condition score lower on the subjective wealth scale than participants in the low scarcity condition.

After the manipulation and subjective wealth scale, participants make nine choices between a smaller reward now and a bigger reward a certain number of days later (adapted from Kirby, Petry, & Bicker, 1999). We expect:

H_6: Participants in the high scarcity condition are less willing to delay rewards than participants in the low scarcity condition.

Method

Power analysis. To detect a medium effect size ($d = 0.5$) with $1-\beta = .8$ and $\alpha = .05$ we need to collect 64 participants per condition. For a more efficient data collection, we used sequential analyses (see Lakens, 2014). We planned to collect 160 participants, in two batches of 80 participants. This yields adjusted alpha levels of 0.0250 and 0.0336 for the first and second batch, respectively (calculated using the *GroupSeq* package in R, using the function *Power Family:* αt^{φ}).

Participants. Participants were recruited on the Tilburg University campus and received a drink for their participation. The experiment was conducted on paper. As we did not find support for our hypotheses after the first batch was completed, we continued the data collection. A total of 177 participants completed the survey ($M_{age} = 22.3$, 40.7% was female).

Design. The experiment had a between-subjects design with two conditions: a high scarcity and a low scarcity condition. First, all participants received questions about their financial situation (i.e., about their savings, salary, disposable income, and expected future income). In order to induce an experience of either high or low scarcity, we changed the response scales for these questions. For example, in the low scarcity condition, the answering scale for savings was €0, €50, and up to €500, whereas in the high scarcity condition it was €0, €500, and up to €5000. Similarly, for the rest of the financial questions we used small numbers in the low

scarcity condition and large numbers in the high scarcity condition (for all the questions and their response scales, see Appendix A). We predict that participants in the high scarcity condition will answer on the left side of the scale. In turn, this should cause participants to make inferences about their personal circumstances (Schwarz, 1999), causing an experience of scarcity in the high scarcity condition and an experience of abundance in the low scarcity condition. As a manipulation check, we include a short subjective wealth scale (Gasiorowska, in press), asking about participants financial situation, whether they are able to make ends meet, and whether their income fulfills their needs and wants. Finally, we use an adapted version of Kirby and colleagues' (1999) monetary-choice questionnaire to measure participants' preferences regarding delay of gratification. In the original experiment, participants made 27 choices between a smaller reward now, and a bigger reward a certain number of days later. We selected those nine questions for which, in Kirby and colleagues' (1999) study, the proportion of participants who chose the later, larger option ranged from 20% to 90%, in order to attain as much variance as possible in participants' responses.

Results

The subjective wealth scale showed good scale properties (Cronbach's $\alpha = .85$; item-rest correlations ranging from .86 to .90), so the items were averaged to create one subjective wealth score. An index for objective wealth was created by averaging the scores on the questions on savings, current salary, disposable income, and expected income (note that these should only be interpreted separately for each condition, as the answering scales differed across conditions). As expected, this index of objective wealth differed substantively across conditions ($M_{low} = 8.49$, $M_{high} = 4.76$, $t(175) = 14.34$, $p < .0001$, $d = 2.16$, 95% CI [1.78, 2.53]). The scores for subjective

wealth and objective wealth correlated moderately both in the low scarcity condition (r = .421, p < .001, 95% CI [.23, .58]) and in high scarcity condition (r = .394, p <.001, 95% CI [.20, .56]).

As a manipulation check, a t-test was conducted on the subjective wealth score as a function of condition. Although the effect was in the expected direction, there was no significant difference in subjective wealth between the conditions (M_{low} = 5.11, M_{high}= 4.91, t(175) = 1.11, p = .268, d = .17, 95% CI [-0.13, 0.46]).

The delay of gratification items showed reasonable scale properties (Cronbach's α = .81; item-rest correlations ranging from .48 to .75), and were averaged into one delay of gratification score, reflecting the proportion of times the later, larger option was chosen. Contrary to our expectation, this score did not differ significantly between the conditions, although the effect was in the predicted direction (M_{low} = .795, M_{high}=.815, t(173) = -0.59, p = .556, d = -0.09, 95% CI [-0.39, 0.21]).

Exploratively, we analyzed the correlation between the index for objective wealth and delay of gratification, but found no significant differences (low scarcity condition: r = .06, p = .582, 95% CI -.15, .26], high scarcity condition: r = .15, p = .170, 95% CI [-.06, .35]). We also analyzed the correlation between the subjective wealth score and delay of gratification, and found evidence for a moderately small positive correlation (r = .193, p = .011, 95% CI [.05, .33]). This means that people who felt wealthier were more likely to pick the later options.

Finally, we noticed that a large amount of participants always chose the later, larger option (42%). As it is unclear whether this answering pattern reflects true preferences or a response style, we repeated the analyses with only participants who chose the 'now' option at least once. As in the full dataset, we found no evidence across conditions for a difference in subjective wealth (M_{low} = 5.08, M_{high}= 4.74, t(100) = 1.43, p = .157, d = .28, 95% CI [-0.11,

0.68]) or delay of gratification (M_{low} =.67, M_{high}=.66, $t(100) = 0.17$, $p = .864$, $d = .03$, 95% CI [-0.27, 0.32]). Finally, there was also a correlation between subjective wealth and delay of gratification ($r = .220$, $p = .026$, 95% CI [.03, .40]).

Discussion

In experiment 2, we found no evidence for an effect of our scarcity manipulation on preferences for delay of gratification. It seems that our manipulation did not influence feelings of scarcity, as we found no differences in subjective wealth across the conditions. Possible causes of these negative results are reviewed in the general discussion. We did find evidence for a relation between subjective wealth and delay of gratification: Participants who felt wealthier were more likely to pick the later, bigger rewards over the sooner, smaller rewards. This suggests that people who experience scarcity are more likely to focus on short term payoffs.

General Discussion

In two experiments, we studied the effect of the experience of scarcity on decision-making. We argue that scarcity induces a narrow mindset, associated with a focus on short-term rather than long-term outcomes, specific rather than abstract problems, and on the feasibility as opposed to the desirability of possible solutions. In the first experiment, we failed to replicate the finding by Mani and colleagues (2013) that when people think about hard financial problems, those with a low income perform worse on a cognitive control task and an intelligence test. We found some evidence that when thinking about difficult financial problems, compared to when thinking about less stringent problems, those who feel less wealthy are more likely to adopt a narrow mindset, measured by the Navon letter task. However, the risk for a type I error is substantial, as evidence was not very strong and a large number of statistical tests were run. In experiment 2, we found no evidence for an effect of our manipulation of scarcity on delay of

gratification. As we also did not find evidence for a difference in subjective wealth across conditions, it is likely that our manipulation did not (strongly) create an experience of scarcity in the participants.

There are several possible reasons for the failure to replicate the findings from Mani and colleagues (2013). As noted in the method section, our experiment differs in several ways from the original. Most notably, our study was conducted online, as opposed to the original study, which was conducted in a mall. Therefore, our population might differ from the original population. For example, participants in online studies can be experienced in completing surveys, which might bias their responses in later studies (Chandler, Mueller, & Paolacci, 2014). A further concern could be that participants online might have less variance in their incomes, both on the low end of the spectrum (as the very poor are less likely to have access to computers) and the high end of the spectrum (as the very rich are less likely to spend time on online surveys). However, the distribution of income (Figure 7) seems diverse and is very similar to that of the participants in the original study by Mani and colleagues (2013). Furthermore, some participants may have had difficulties completing the survey, as shown by the large number of incomplete records. As the dependent measures were programmed in ScriptingRT, participants were directed to a different website to perform the dependent tasks, which sometimes caused problems and can also have slowed down the participants who did complete the study, and might thus have influenced the results. Especially for the cognitive control task, a task which requires rather precise measurement of reaction times, these kinds of problems can have decreased the reliability of the measure. Furthermore, this caused the final sample in the analysis to be much smaller than anticipated, substantially reducing statistical power. Finally, the reward for

completing the study was lower than in the original, although it is within common rewards for online studies.

The lack of a strong effect of scarcity on cognitive mindset might be caused by some of the same problems. Notably, the online sample and the problems with the survey can have reduced the strength of the manipulation and the sensitivity of the measure, and the small size of the sample reduced statistical power. Similar to the cognitive control task, the Navon letter task requires an accurate measure of reaction times.

In experiment 2, it appears our manipulation failed to significantly influence feelings of scarcity. There are several possible reasons for this failure. For the manipulation to have the hypothesized effect, participants would have to answer on the right side of the scale in the low scarcity condition, and on the left side of the scale in the high scarcity condition. Although the first requirement was met (participants answered on average 8.49 on a scale of 1 to 11), in the high scarcity condition participants answered, on average, only slightly below the scale midpoint (5.14). Therefore, although there were significant differences in the answers across conditions, participants in the high scarcity condition were probably not experiencing a strong feeling of scarcity. Another possibility is that feelings of subjective wealth are hard to influence, either because it is a stable trait that changes little from situation to situation, or because participants recall other information when determining their subjective wealth (for example, we didn't ask questions about loans, support from parents, etc.). A second problem in experiment 2 was the low variance in responses to the delay of gratification scale, as 42% of the participants always chose the later option. Future studies should make the later options less attractive.

We did find a positive association between subjective wealth and delay of gratification. This suggests that, in accordance with our theory, scarcity causes people to focus on short-term

outcomes. This finding seems to deviate from earlier research which suggests that the wealthy are more likely to focus on the long-term when experiencing scarcity (Griskevicius et al., 2013). Furthermore, contrary to the findings by Carvalho and colleagues (2014), it is unlikely that the differences in time preferences were caused by liquidity constraints, as most college students are relatively wealthy, and the delay of gratification choices were concerned with relatively small amounts of money. Therefore, we can conclude that even among more affluent people feelings of scarcity can be associated with more short-term preferences for intertemporal choices, although we cannot make strong claims about the causal order.

Theoretically, we have not found strong evidence for our idea that scarcity induces a narrow mindset. This might have been caused by the aforementioned methodological problems. A different possibility is that our idea of cognitive mindset is too broadly defined. Perhaps scarcity does induce a narrow mindset, but only in the same domain as where the experience of scarcity originated. For example, financial scarcity might lead to a narrower mindset only concerning financial decisions. This would mean that financial scarcity would not affect, for example, scores on a Navon letter task. However, a study based on experiment 2, that addresses its methodological concerns, should still show an effect of feelings of financial scarcity on intertemporal financial decisions. Finally, we did find support for the idea that feelings of scarcity are associated with a focus on more short-term financial outcomes. This results is in line with our theory, as a narrow mindset should create a short-term focus. However, based on this experiment we cannot infer what the process underlying this effect is.

Limitations & Future Research

In general, the studies were limited by their samples: There were no or only a very small number of (absolutely or relatively) poor participants involved. However, our theory predicts

general effects of feelings of scarcity, which can also affect people with higher incomes. Similarly, our experiments are limited because they involved only hypothetical situations; participants made no real financial decisions. This means that our experiments were a conservative test of the theory. As discussed, experiment 1 was conducted online, which caused some technical problems, hindering interpretation of the results. Furthermore, online samples might be experienced, which can potentially bias their responses (Chandler, Mueller, & Paolacci, 2014). Finally, experiment 2 lacked a control condition which could hinder the interpretation of effects of the manipulation, as there is no baseline against which the effects of high vs. low scarcity can be compared. Furthermore, it is possible that the questions about financial situation induced either feelings of scarcity or feelings of abundance in all participants, depending on whether they are in general optimistic or pessimistic about their financial situation.

Future research could address some of the methodological problems that came to light in our studies. Ideally, a closer replication of Mani and colleagues (2013) study 1 would be conducted in a mall. Together with a meta-analysis of the new and original studies, this can show more about the reliability of the original effects. As discussed, a slight alteration of experiment 2, using a stronger manipulation of scarcity, can show whether feelings of scarcity can be induced in college students, and its effect on delay of gratification. If this study would find a working manipulation, further studies could examine other effects of scarcity in college students, such as risk aversion. Finally, this manipulation could be used to study a more general population, in order to examine the effects of experiencing scarcity for people with different income levels.

Conclusion

In summary, in the first experiment we did not replicate findings that scarcity impedes cognitive functioning, but we did find some indication that scarcity induces a narrow mindset

among people with a low income. However, technical issues hinder making strong conclusions on the basis of these data. In the second experiment, we did not find an effect of induced scarcity on delay of gratification, but the manipulation seemed to have failed to create feelings of scarcity. However, we did find a positive association between subjective wealth and delay of gratification, showing that those who feel wealthier are more likely to choose long-term options.

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Footnotes

[1]We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the studies.

Appendix A

Experiment 2: Questions about financial situation and their answering scales

Question	**Scale (low scarcity)**	**Scale (high scarcity)**
How much money have you saved? *Combine and round the amount of money in your checking and saving accounts*	€0, €50, €100, …, €500 or more	€0, €500, €1000, …, €5000 or more
How much money do you approximately make a month (after taxes)?	€0, €50, €100, …, €350 or more	€0, €500, €1000, …, €5000 or more
What is your disposable income per week? (For food, clothes, going out, etc.) *How much money do you have left after paying for fixed costs as rent, insurances, etc.*	€0, €10, €20, …, €100 or more	€0, €30, €60, …, €300 or more
What do you expect your gross monthly income will be for your first job after graduation?	€1000 or less, €1100, …, €2000 or more	€1000, €1500, €2000, …, €6000 or more

Table 1

Experiment 1: Accuracy on Raven's Matrices regressed on difficulty and effective income

	b	*t*	*p*	η_p^2
(Intercept)	0.304	4.547	< .001	-
Difficulty (1=Hard)	-0.0018	-0.019	.985	.0002
Effective Income	3.725×10^{-7}	0.199	.843	.0008
Difficulty (1=Hard) × Effective Income	1.415×10^{-7}	-0.049	.961	.00004

Table 2

Experiment 1: Accuracy on the cognitive control task regressed on difficulty and effective income

	b	*t*	*p*	η_p^2
(Intercept)	0.928	29.826	<.0001	-
Difficulty (1=Hard)	-0.036	-0.829	.410	.018
Effective Income	-1.055×10^{-6}	-1.190	.238	.000003
Difficulty (1=Hard) × Effective Income	2.286×10^{-6}	1.700	.086	.043

Table 3

Experiment 1: Accuracy on Raven's Matrices regressed on difficulty and subjective wealth

	b	*t*	*p*	η_p^2
(Intercept)	0.331	4.647	<.001	-
Difficulty (1=hard)	-0.032	-0.342	.734	.0003
Subjective wealth	-0.003	-0.249	.804	.00002
Difficulty (1=Hard) × Effective Income	0.005	0.319	.750	.002

Table 4

Experiment 1: Accuracy on the cognitive control task regressed on difficulty and subjective wealth

	b	*t*	*p*	η_p^2
(Intercept)	0.911	27.348	<.0001	-
Difficulty (1=Hard)	-0.048	-1.071	.288	0.011
Subjective wealth	-0.002	-0.300	0.765	0.021
Difficulty (1=Hard) × Effective Income	0.015	1.850	0.067	0.047

Table 5

Experiment 1: Reaction time for accurate trials on Raven's Matrices regressed on difficulty and effective income

	b	*t*	*p*	η_p^2
(Intercept)	17900	6.434	<.0001	
Difficulty (1=Hard)	6.805	0.002	.999	.006
Effective Income	0.044	0.556	.580	.003
Difficulty (1=Hard) × Effective Income	-.044	-0.368	.714	.002

Table 6

Experiment 1: Reaction time for accurate trials on the cognitive control task regressed on difficulty and effective income

	b	*t*	*p*	η_p^2
(Intercept)	1009	10.624	<.0001	-
Difficulty (1=Hard)	-0.005	-1.704	.093	.058
Effective Income	-112.707	-0.843	.402	.015
Difficulty (1=Hard) × Effective Income	0.001	0.333	.740	.002

Table 7

Experiment 1:Reaction time for accurate trials on Raven's Matrices regressed on difficulty and subjective wealth

	b	*t*	*p*	η_p^2
(Intercept)	19324.806	4.497	<.0001	-
Difficulty (1=hard)	1972.839	0.353	.726	.003
Subjective wealth	-33.709	-0.032	.975	.016
Difficulty (1=Hard) × Effective Income	-953.788	-0.675	.503	.002

Table 8

Experiment 1: Reaction time for accurate trials on the cognitive control task regressed on difficulty and subjective wealth

	b	*t*	*p*	η_p^2
(Intercept)	1040.771	7.256	<.0001	-
Difficulty (1=Hard)	-41.580	-1.219	.227	.020
Subjective wealth	-186.968	-0.990	.325	.024
Difficulty (1=Hard) × Effective Income	24.872	0.515	.608	.004

Table 9

Experiment 1: Global vs. local focus regressed on difficulty and effective income

	b	*t*	*p*	η_p^2
(Intercept)	-2.633	-0.051	.960	-
Difficulty (1=Hard)	-7.480	-0.103	.918	.001
Effective Income	-0.003	-2.092	.039	.065
Difficulty (1=Hard) × Effective Income	0.001	0.395	.693	.002

Table 10

Experiment 1: Global vs. local focus regressed on difficulty and subjective wealth

	b	*t*	*p*	η_p^2
(Intercept)	4.643	0.058	.9535	-
Difficulty (1=hard)	-225.318	-1.987	.0497	.0001
Subjective wealth	-27.254	-1.314	.1920	.0021
Difficulty (1=Hard) × Effective Income	61.616	2.194	.0306	.0464

Figure 1

Experiment 1: Accuracy on the Raven's Matrices in the easy and hard conditions as a function of effective income.

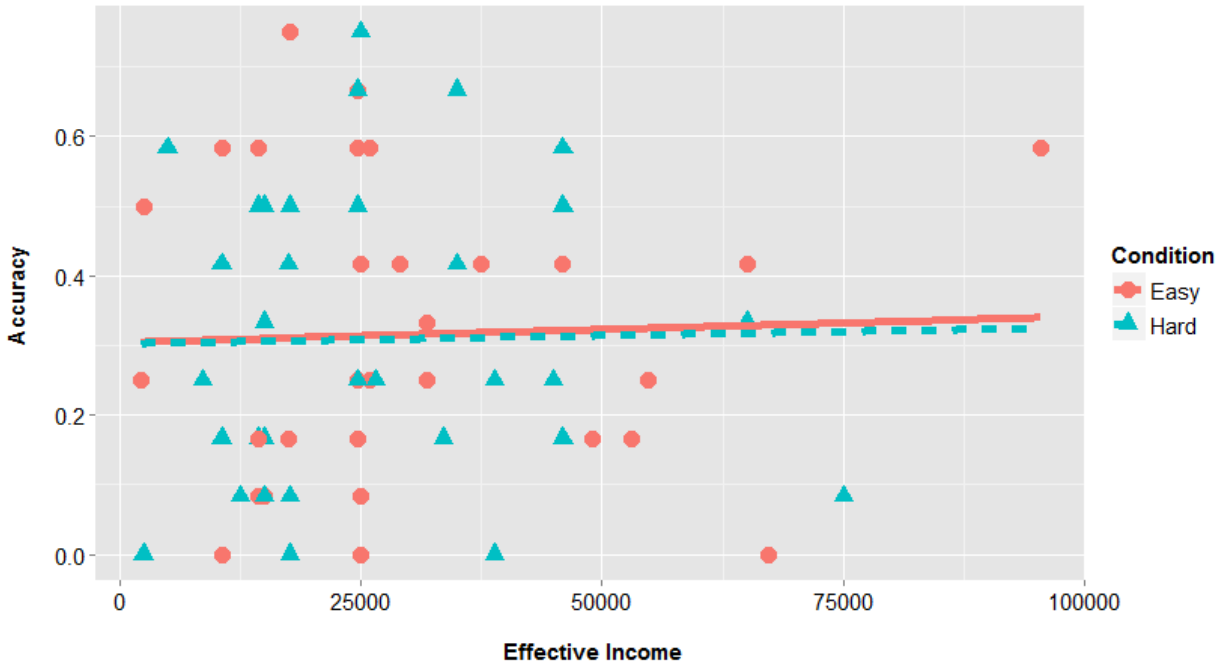

Figure 2

Experiment 1: Accuracy on the cognitive control task in the easy and hard conditions as a function of effective income.

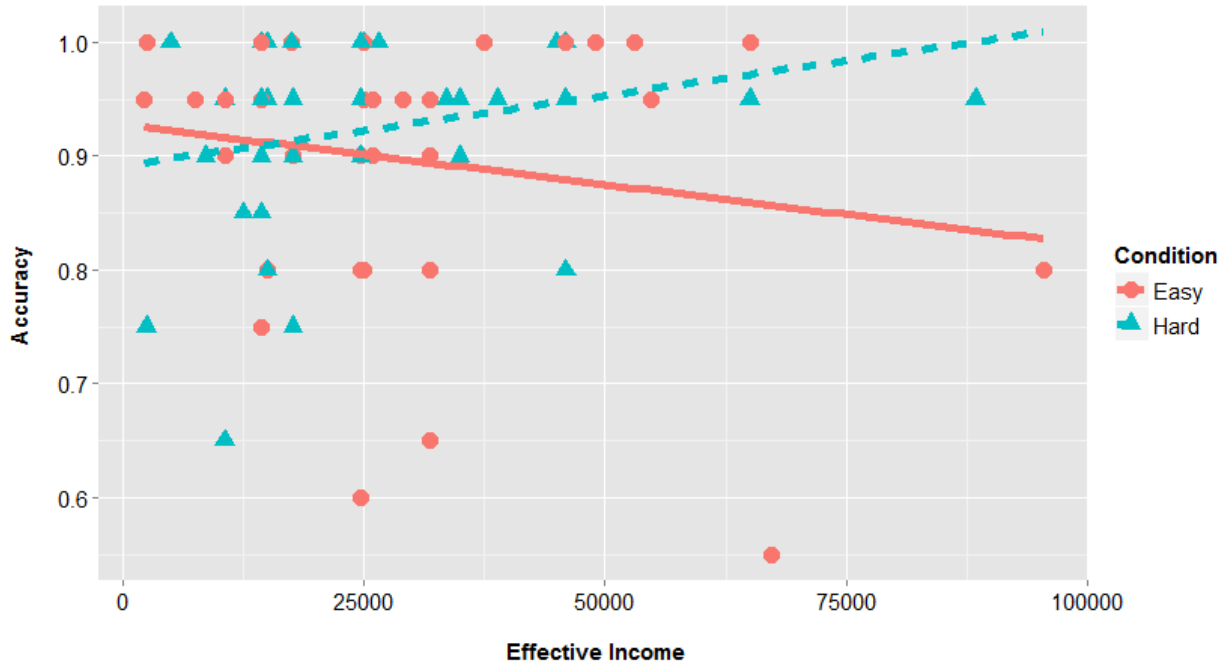

Figure 3

Experiment 1: Accuracy on the Raven's Matrices in the easy and hard conditions as a function of subjective wealth.

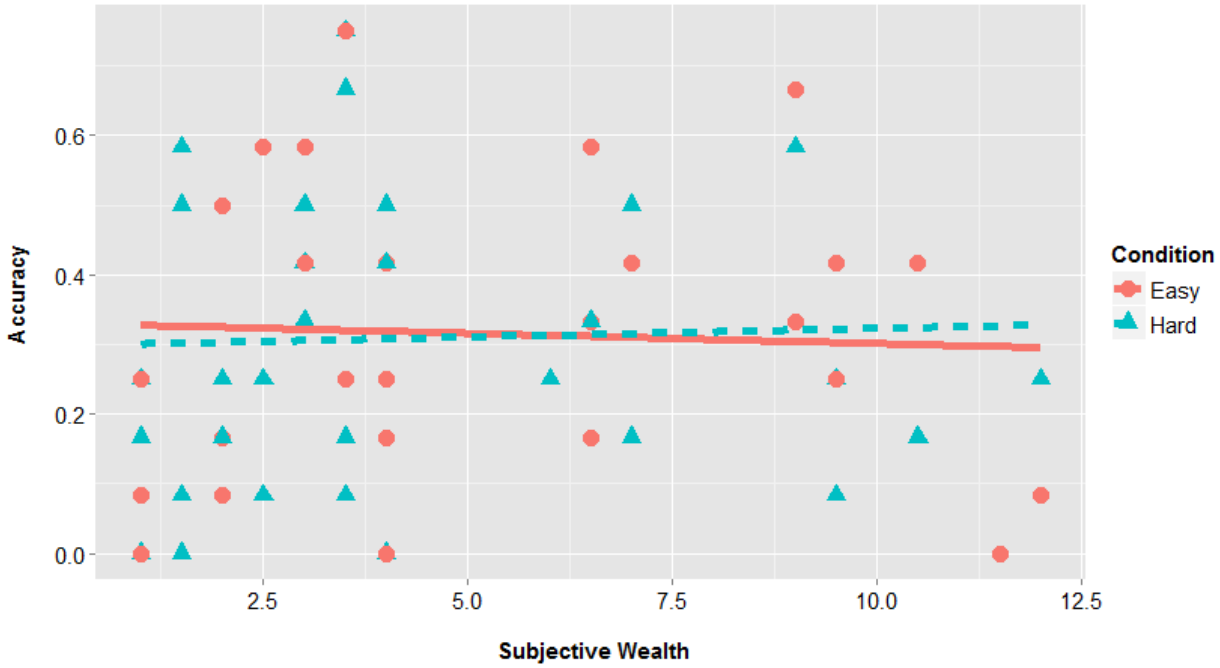

Figure 4

Experiment 1: Accuracy on the cognitive control task in the easy and hard conditions as a function of subjective wealth.

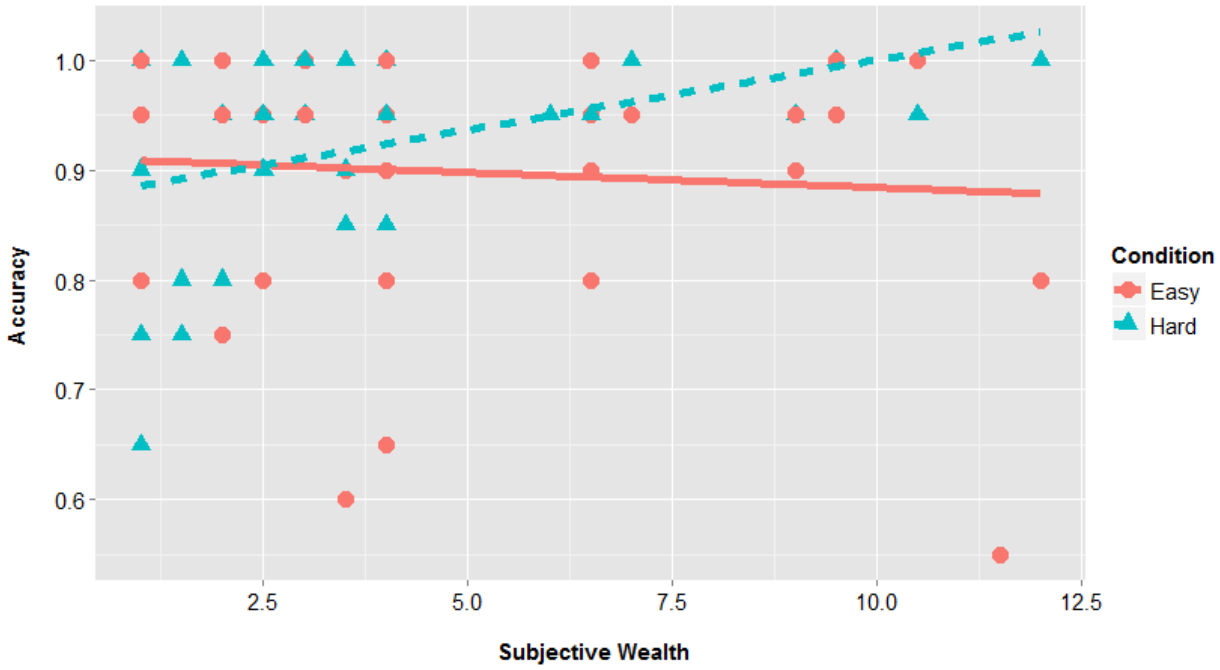

Figure 5

Experiment 1: Global vs. local focus in the easy and hard conditions as a function of effective income.

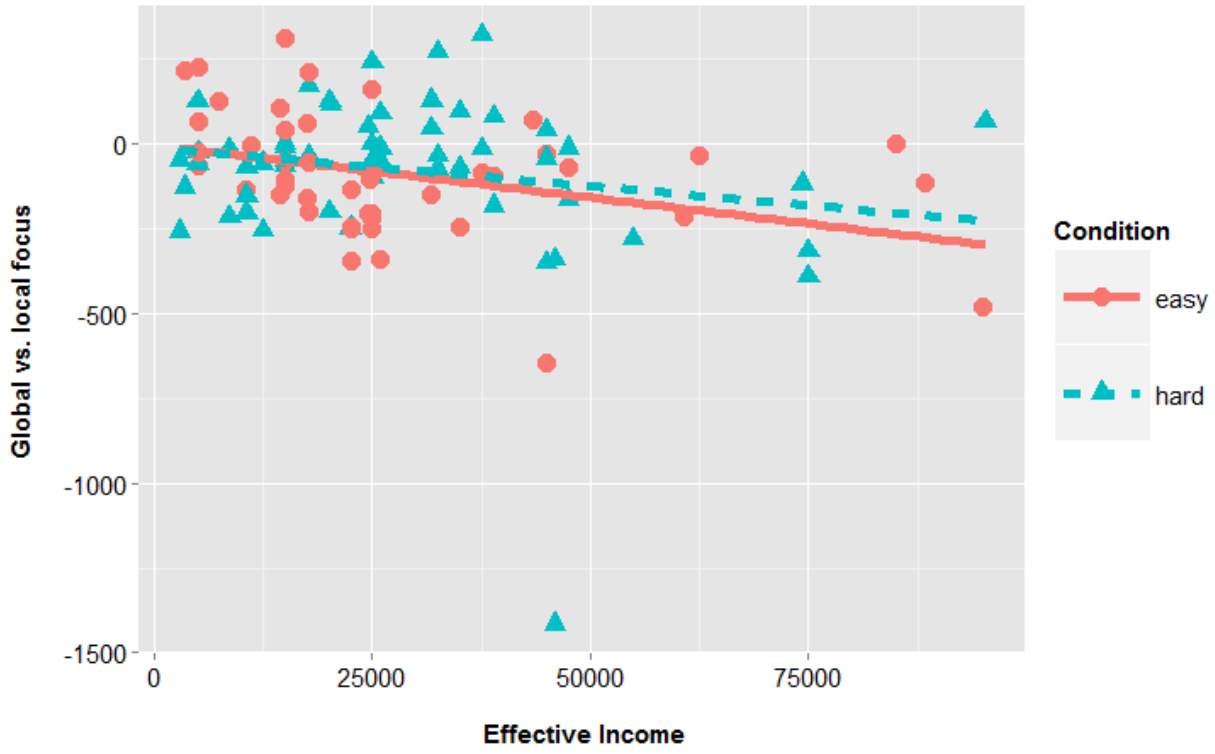

Figure 6

Experiment 1: Global vs. local focus in the easy and hard conditions as a function of subjective wealth.

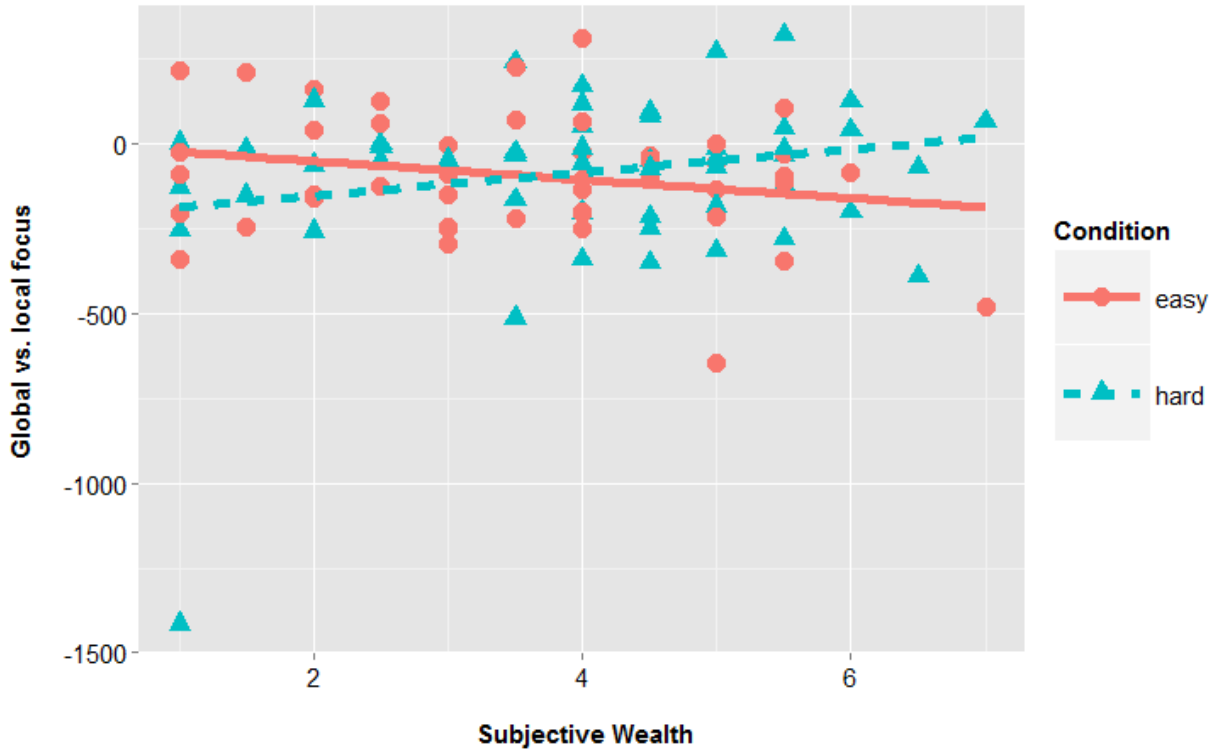

Figure 7

Experiment 1: Effective income distribution of the participants