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Abstract

Many professional and educational settings require individuals to be willing and able to perform under time pressure. We use a lab experiment to elicit preferences for working under time pressure in an incentivized way by eliciting the minimum additional payment participants require to complete a cognitive task under various levels of time pressure versus completing it without time pressure. We make three main contributions. First, we document that participants are averse to working under time pressure on average. Second, we show that there is substantial heterogeneity in the degree of time pressure aversion across individuals and that these individual preferences can be partially captured by simple survey questions. Third, we include these questions in a survey of bachelor students and show that time pressure preferences correlate with future career plans. Our results indicate that individual differences in time pressure aversion could be an influential factor in determining labor market outcomes.

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1 Introduction

Many professional and educational settings require individuals to be willing and able to perform under time pressure. Entering ambitious educational and professional career tracks often requires candidates to perform well in time pressured exams (e.g., the GRE, LSAT or SAT tests) or assessments (e.g., case interviews). Moreover, in many ambitious careers performing under time pressure is a prominent feature of the work environment itself. While there is a sizable literature in psychology and experimental economics that studies the effect of time pressure on decision making, little is known about individual preferences for working under time pressure.

We use a pre-registered lab experiment to elicit preferences for working under time pressure in an incentivized way. Participants first perform a cognitive task under varying levels of time pressure. We then elicit the minimum additional payment participants require to complete the task under various levels of time pressure versus completing it without time pressure, while controlling for risk preferences and ability. We make three main contributions. First, we document that participants are averse to working under time pressure on average. Second, we show that there is substantial heterogeneity in the degree of time pressure aversion across individuals and that these individual preferences can be partially captured by simple survey questions. Third, we include these questions in a survey of bachelor students and show that time pressure preferences correlate with future career plans. Students who enjoy working under time pressure and are confident about it are more likely to aim at high-paying, high-pressure careers such as investment banking and consulting.

We also look into gender differences in time pressure aversion. We find that female participants, on average, require a higher premium than male participants to accept working under time pressure, likely because time pressure has a larger negative impact on their performance. Women also rate themselves lower on time pressure enjoyment and confidence. Finally, we use the baseline rounds to explore the overall impact of time pressure on performance in the cognitive task and find a concave relationship between time pressure and productivity: while any level of time pressure leads to more mistakes, intermediate levels of time pressure still increase the number of correct answers per unit of time.

The psychological literature has long been interested in the impact of time pressure on decision quality, generally documenting a negative impact (Diederich and Busemeyer, 2003; Diederich, 1997). This negative effect is related to the reduced

possibility to search for potential solutions (Bowden, 1985). When individuals are under time pressure, they tend to collect less information and rely more on heuristics (Christensen-Szalanski, 1980; Rieskamp and Hoffrage, 2008). Time pressure hence hinders the exploration of information, inhibits cognitive capacity, and diminishes performance (Moore and Tenney, 2012). Although time pressure hampers individual decision quality, forcing people to decide quickly may elicit intuitive responses that are beneficial for society, such as increased cooperation (Rand et al., 2012, 2014) and more altruistic behaviors (Rand et al., 2016), though see Tinghög et al. (2013), Bouwmeester et al. (2017) and Recalde et al. (2018) for other potential explanations for these results.

A small number of papers in experimental economics have investigated the impact of time pressure on economic decision making. Conducting a lab experiment on bargaining behavior using an ultimatum game, Sutter et al. (2003) show that time pressure results in high efficiency costs through higher rejection rates of offers, although this effect vanishes with repetition. In the context of auctions, El Haji et al. (2019) find that participants are less likely to place a bid under high time pressure. Those who do bid significantly less than those who bid under low time pressure. Kocher and Sutter (2006) run a lab experiment using a beauty-contest game and show that although time pressure diminishes the quality of decision making, time-dependent payoffs under high time pressure induce significantly quicker decision making without hampering decision quality. In risky decisions, individuals are more risk averse for losses under time pressure, while risk attitudes for gains are not affected (Kocher et al., 2013). Kocher et al. (2019) augment the design in Kocher et al. (2013) to study individual ability to make decisions under time pressure and the relationship between this ability and personality traits, cognitive ability, and intellectual efficiency. They find that risky decisions under time pressure can be predicted by an individual's decision style, cognitive ability, and intellectual efficiency. These studies suggest that time pressure can have both a negative effect (by diminishing the quality of decisions) and a positive effect (by speeding up decision making) on economic decisions.

Less is known about the causal impact of time pressure on performance in cognitive tasks and whether this effect systematically varies across individuals. The few studies that exist tend to focus on gender differences. In a laboratory experiment, Shurchkov (2012) finds that although women outperform men in a low-time pressure verbal task, they perform worse than men on average in a high-time pressure

math tournament. In a university-exam setting, De Paola and Gioia (2016) find a detrimental effect of time pressure on the performance of women but not men. Dilmaghani (2020) finds that in time-limited games, female chess players underperform their male counterparts with equal chess skills relative to a no-time pressure setting.[1]

Other papers in economics have documented the performance effects of other sources of pressure, including high stakes and competition. While high stakes should incentivize higher effort, Ariely et al. (2009) show that very high stakes can lead to lower performance. Several studies have documented gender differences in the response to high stakes in educational settings, where women tend to underperform relative to men in high-stakes exams (Azmat et al., 2016; Iriberri and Rey-Biel, 2019; Cai et al., 2019; Montolio and Taberner, 2021). Similarly, men have been found to respond more strongly than women to competitive incentives both in the lab (Gneezy et al., 2003) and in educational settings (Ors et al., 2013).

This literature on time pressure in economics and psychology has so far largely ignored people's preferences, that is, whether people, on average, enjoy or are averse to working under time pressure and how this varies across individuals.[2] Our results indicate that people are substantially averse to time pressure on average and that the degree of aversion varies across individuals. This has economic implications. Educational and professional careers that require people to work under time pressure might push away otherwise talented individuals. Even if time pressure leads to increased performance, which is questionable in light of our results and those of the decision-making literature, there might still be a trade-off between incentive effects and attracting a sufficient number of qualified individuals, in particular women. On an individual level, our survey results imply that preferences for time pressure might be an important determinant of career choices.

[1] These gender differences might translate into differences in the labor market. Amer-Mestre and Charpin (2021) find that among medical students, women prefer medical specializations that are characterized by lower levels of time pressure. Shastry and Shurchkov (2022) find that female assistant professors who have a paper rejected by a top journal are more pessimistic than male assistant professors about the possibility of subsequently publishing the paper in a leading journal, possibly because of the time pressure induced by the upcoming tenure review.

[2] The exception is Shurchkov (2012) who shows that for women, but not for men, willingness to enter a math competition depends on the degree of time pressure.

Figure 1: Overview of the experiment

Part 1: Personality Questionnaire
- 15-item Big Five Inventory
- 2 survey questions eliciting time pressure preferences
- 2 survey questions eliciting risk preferences and competitiveness

Part 2: Real Effort Puzzle Task
- Rounds 1-4 (baseline): exogenous per-game time limit varying from game to game
  Payment of €10 minus €1 per game not solved correctly
- Round 5 (choice): Time limit and payment chosen by participants
  36 choices, one selected to be implemented

Part 3: Post-Experimental Survey
- Incentivized risk preferences elictiation
- Demographic questions

Payment
- Participation fee of €4
- Earnings for one of the five rounds in Part 2 (chosen at random)
- Earnings for the incentivized risk preferences elicitation in Part 3

2 Experimental Design

We study time pressure using an online laboratory experiment consisting of three parts. In our experiment, participants first fill out a personality questionnaire and then solve five rounds of a mathematical puzzle task. Prior to the fifth round, we elicit participants' preferences for time pressure in an incentive compatible way. The experiment ends with a survey that elicits risk preferences and basic demographics. Figure 1 presents an overview of the experiment, the full instructions can be found in appendix C.

The personality questionnaire at the beginning of the experiment consists of the short 15-item Big Five Inventory (Lang et al., 2011) plus four additional items. The first two of these additional items serve as simple survey measures of attitudes towards time pressure: "I see myself as someone who enjoys working under time

pressure" and "I see myself as someone who is productive under time pressure". Following Buser et al. (2021) and Dohmen et al. (2011) we also include two items to measure attitudes towards competition and risk taking: "I see myself as someone who is competitive" and "I see myself as someone who is willing to take risks". The 15 standard Big Five questions measure five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Participants answer by choosing the extent to which each statement describes them. Seven answer options are given: "Strongly Disagree", "Disagree", "Slightly Disagree", "Neutral", "Slightly Agree", "Agree", and "Strongly Agree".

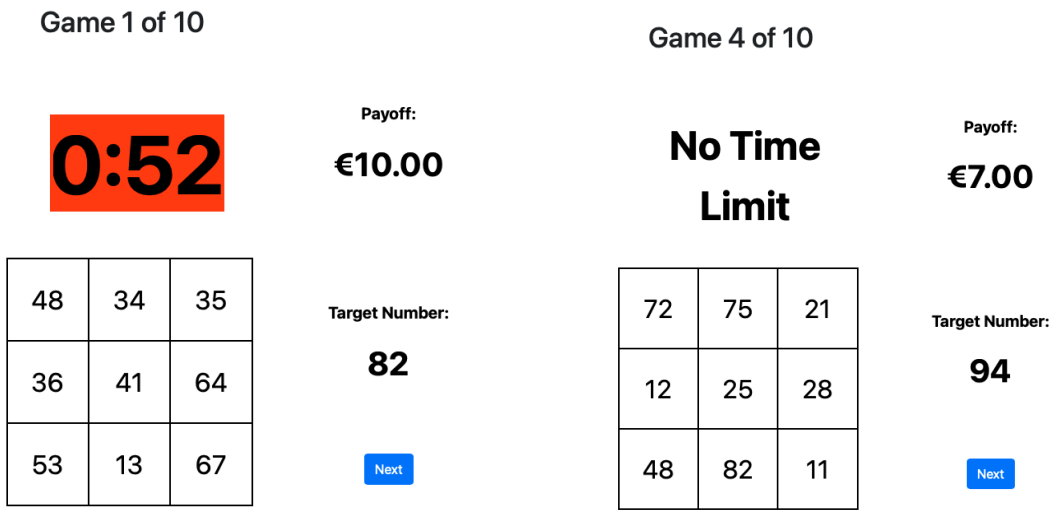
After filling out the questionnaire, participants are introduced to the real-effort mathematical puzzle task that is used in the main part of the experiment (see Figure 2). Each task (or "game") consists of a 3 by 3 board with nine different two-digit numbers. The goal of the task is to find the two numbers (out of the nine) that jointly add up to a "target number". Participants can select a number by clicking it. Once clicked, the number turns green. They can click the number again to deselect it. After selecting their two numbers, participants need to press a button to submit their answer and continue to the next task. Participants are able to familiarize themselves with the interface through three non-incentivized practice tasks. We chose this task because it can be repeated many times in a relatively short time span and requires higher-level cognitive functions that have the greatest potential to be impeded by time pressure (see e.g., Moore and Tenney, 2012).

After reading the instructions and completing the practice games, participants play the game for five rounds. Prior to the start of the first round, they are told that one round will be randomly selected for payment. Each round consists of 10 games and each game needs to be solved within a game-specific time limit which changes from game to game. For any particular game, the time limit is either 15, 25 or 60 seconds or no time limit.[3]

Figure 2 shows examples of the interface with and without a time limit. When the time limit is 15, 25 or 60 seconds (as shown on the left), a countdown is placed directly above the board of numbers. The payoff and the target number are shown to the right of the board. To make time pressure salient, the background of the countdown blinks red every second. When there is no time limit (as shown on the right), the blinking countdown is replaced by "No Time Limit" while everything else

[3]An implicit timer of 5 minutes (not shown on task screen) was implemented for games under no time limit. All participants from our pilot sessions managed to solve all games within 2 minutes.

Figure 2: Examples of the puzzle task with and without time limit



remains the same. After each game, participants see a result page that includes the time limit, whether the game was solved, and the cumulative payoff for the current round of 10 games.

The incentives for the game depend on the round. In the first four rounds (the baseline rounds), participants start with a budget of €10 in a given round. €1 is deducted for each game for which they give an incorrect answer, or fail to provide an answer within the time limit for that game. The earnings for a given round are then equal to the amount left when the 10 games in that round are finished. The time limit for a particular game is randomly determined under the constraint that each time limit needs to occur exactly 10 times across the four rounds, and that no more than two games can have the same limit in a row.

In the fifth round, we instead allow participants to choose their preferred amount of time pressure. We elicit preferences for time pressure in the following way. First, for each time limit x, participants make a binary choice between "No time limit per game with a starting budget of €10" and "x seconds per game with a starting budget of €y". Due to expected performance differences, we set the starting budget in the second option to €16 for the 15-second limit, €15 for the 25-second limit, and €14 for the 60-second time limit. In a second step after making this first initial choice, participants are given a full price list where they make 11 choices between

no time limit per game with a starting budget of €10 and performing under time pressure with a starting budget varying from €10 to €20 in integers. Some decisions are already filled in based on the decision in the binary choice that preceded the price list. Figure 3 shows an example of a pre-filled price list. In this example, the participant chose "25 seconds per game with a starting budget of €15" over "No time limit per game with a starting budget of €10" in the binary choice. The price list therefore assumes that they also prefer working under the 25-second limit if the starting budget for working under time pressure is higher than €15.[4]

Conditional on performance in the 40 baseline games, these 33 choices serve as a measure of participants' preferences for performing under time pressure. We will also use these choices to construct measures of aggregate aversion to time pressure. In particular, we are interested in whether, on average, participants require a positive premium above their baseline performance to be willing to perform under a particular time limit.

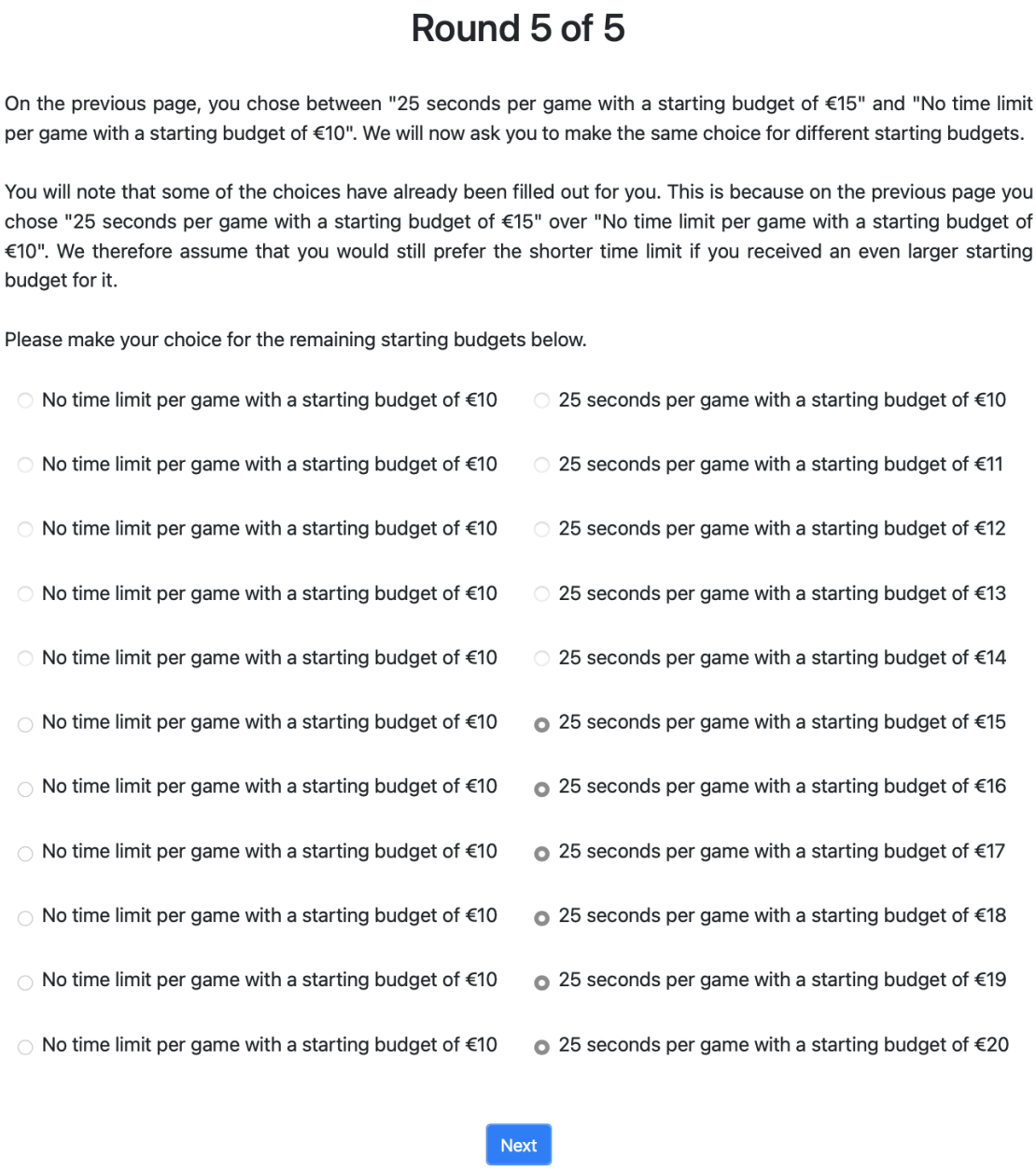
Note, however, that risk-averse participants may also shy away from time pressure because they expect their performance to be noisier under tighter time limits. If participants are risk averse on average, this may bias our estimates of aggregate time pressure aversion upward.

On top of directly eliciting and controlling for risk preferences, we also experimentally control for this potential confound by asking participants to choose the time limit for a two-person winner-takes-all tournament. In particular, we inform participants that they will compete against the performance under the same time limit of another participant from another session.[5] In three separate binary choices, we then ask participants whether they would prefer to compete with a 15 or 25, a 15 or 60, and a 25 or 60 seconds limit. Participants receive €10 if their score is superior to the opponent's and nothing if their score is inferior, with ties broken randomly. Since the comparison performance comes from a participant who worked under the same time limit and the prize is fixed, this amounts to a choice between two risky lotteries. A time pressure neutral participant should choose the time limit under

[4]The price list also serves as a rationality check. If participants switch more than once between no time limit and time limit, they receive a pop-up message mentioning that their choices are inconsistent. Only one participant still switched multiple times after the message.

[5]To get the performance of this other participant, we ran one separate session for each of the three time limits on Prolific, an online platform for experiments (www.prolific.co). In each session, ten participants solved the exact same set of ten games current participants solve in the choice round. One performance (out of the ten) was randomly selected as the comparison performance for each participant in the choice round.

Figure 3: The price list in round 5 with a 25-second limit



which they perform *relatively* better (i.e., have a greater chance of winning) regardless of their risk preferences. Differences in absolute ability are likewise irrelevant for this choice. Hence, these three competition choices serve as alternative measures of time pressure preferences that control for potential differences in absolute ability and risk preferences by experimental design.

In total, participants make 36 decisions in round 5, one of which is randomly chosen and implemented. After the five rounds, participants reach a final survey. In addition to basic demographics like age and gender, we also elicit risk preferences using a price list containing 11 choices between a sure amount of €4 and a random lottery between €2 and €6 with changing probabilities. The probability of receiving the high payment increases from 0% in the first decision to 100% in the last decision in increments of 10 percentage points. After all 11 decisions are made, one decision is randomly selected and the additional earnings are determined according to the option participants chose in this decision.

The analysis plan was pre-registered in the AEA RCT Registry.[6] We also reprinted the analysis plan in appendix B. The experiment was programmed with oTree (Chen et al., 2016) and conducted online using the subject pool of the CREED laboratory of the University of Amsterdam in June 2021. Based on power calculations reported in the analysis plan, we aimed to collect data from a minimum of 200 participants. Overall, 16 sessions took place with 9 to 18 subjects each. In accordance with our analysis plan, we excluded the one participant who switched multiple times in the choice round and another participant who took a long break in the middle of the experiment, leaving us with a sample of 209 participants of whom 48% are female. Average earnings in the experiment are €16.62 including a participation fee of €4.[7]

3 Results

We present our results in four steps. In Section 3.1, we use the data from the four baseline rounds to estimate the impact of time pressure on performance. In

[6] https://doi.org/10.1257/rct.7667-1.0

[7] Three pilot sessions with 40 participants each were run on Prolific prior to the main experiment. One session was run to test whether the game was suitable for testing the effect of time pressure on performance, one session was run to determine the proper time limits and finalize the design details, and one session was run to determine the starting budgets for the binary choices in the choice round (round 5). Another pilot session was run with 20 participants from the CREED subject pool to ensure there were no technical issues.

Section 3.2, we move to the main focus of this paper and analyze preferences for working under time pressure. We establish that a large majority of participants in our experiment are averse to working under time pressure. In Section 3.3, we describe the answers to the survey questions and show that they are significantly correlated with individual differences in time pressure aversion in the incentivized choices. In Section 3.4, we show that our survey questions predict the career expectations of two cohorts of undergraduate students. In Section 3.5, we analyze gender differences in performance, elicited preferences, and survey answers.

3.1 The impact of time pressure on performance

Table 1 presents the average impact of time pressure on performance. The table shows results from OLS regressions where we regress different performance measures on time limit dummies, controlling for individual and game fixed effects, using observations from the 40 games in the first four (baseline) rounds. We consider three performance measures: whether a game is solved, the average time spent per game, and productivity. Productivity is defined as the number of games solved per minute and is constructed by dividing the total number of games (out of ten) solved at each time limit by the total number of minutes spent working at each time limit. This implies that for the productivity measure there are four observations per participant (one for each level of time pressure).

Relative to no time limit, both the likelihood of a game being solved as well as the average number of seconds spent on the game diminish at all time limits. However, the relative impact on success and time spent differs across the three limits, resulting in differential impacts on productivity. As a first step, imposing a not-very-strict 60-second limit diminishes the likelihood of a game being solved by 6.5 percentage points (relative to 98 percent of games being solved without a time limit) and lowers the average time spent on each game by 5.2 seconds (a 19 percent reduction), resulting in 0.22 additional games solved per minute (a 9 percent increase).[8]

Not surprisingly, the likelihood of a game being solved (as well as the number of seconds spent on each game) declines much more strongly at the stricter 25- and

[8]Some of these effects may be driven by the 8 percent of no-time-limit games in which participants took more than 60 seconds. However, a similar shift in speed is observed throughout the distribution, to the point where distribution of seconds spent under no time limit first order stochastically dominates the 60-second distribution (see Figure 5 in the appendix). This implies that adding time pressure also increased the speed of participants who are able to finish the games within 60 seconds.

15-second time limits. At 25 seconds, participants are 28 percentage points less likely to solve a game while being 11.4 seconds faster relative to no time limit. Relative to the performance under the 60-second limit, these two effects cancel each other out, leading to a productivity that is similar to the 60-second limit (albeit with a much greater number of mistakes and games that are left unsolved) and significantly higher than when solving the games without a time limit. At 15 seconds, participants are 50 percentage points less likely to solve a game while being 16 seconds faster relative to no time limit. In terms of productivity, the strong decrease in the likelihood of solving a game now dominates the time reduction. The number of games solved per minute is similar to no time limit and significantly lower than under the 60-second time limit (while the number of mistakes and games that are left unsolved is much higher). This suggests a concave relationship between time pressure and productivity: individuals are more productive under intermediate time pressure than under stringent or no time pressure. This means that both too much or no time pressure may hamper productivity. The optimal level of time pressure will then depend on how one weighs productivity and the likelihood of mistakes and games that are left unsolved.

3.2 Preferences for working under time pressure

We will now turn to our main focus, preferences for working under time pressure. We are interested in both whether (and to what extent) participants are averse to working under time pressure and in how the degree of time pressure aversion varies across participants. In order to judge whether a given individual is time pressure averse, we will use their performance under the different time limits in the first 40 games as a baseline. That is, we will compare their choices in the fifth round to the choices that would be optimal assuming the proportion of games they would be able to solve in the fifth round under a given time limit is equal to the proportion of games they managed to solve under the same limit over the four baseline rounds.[9]

As a reminder, for each of the time limits (15, 25, and 60 seconds), participants first made a binary choice between a starting budget of €10 for solving the ten games

[9] A potential issue with this approach is that participants could improve their performance over the course of the experiment, in particular if the extent of the improvement depends on the degree of time pressure. However, we find no evidence that the fraction of games solved changes over the course of the experiment for any amount of time pressure ($p>.30$ for each level of time pressure, OLS with standard errors clustered at the participant level).

Table 1: The impact of time pressure on performance

	(1) Solved	(2) Time spent	(3) Solved per min
Constant	0.980***	28.315***	2.462***
	(0.007)	(0.608)	(0.054)
60 seconds	-0.065***	-5.244***	0.216***
	(0.008)	(0.799)	(0.077)
25 seconds	-0.283***	-11.449***	0.195**
	(0.013)	(0.851)	(0.091)
15 seconds	-0.497***	-16.103***	0.050
	(0.014)	(0.869)	(0.103)
Difference btw 15 & 25	-0.215***	-4.654***	-0.145
	(0.014)	(0.184)	(0.103)
Difference btw 15 & 60	-0.432***	-10.859***	-0.167*
	(0.014)	(0.462)	(0.095)
Difference btw 25 & 60	-0.218***	-6.205***	-0.021
	(0.012)	(0.436)	(0.084)
N	8,360	8,360	836

The table shows coefficients from OLS regressions of three performance measures on time limit dummies with individual fixed effects and game fixed effects, using observations from the first four rounds (first 40 games). The dependent variable in column 1 is a binary indicator for having correctly solved the game within the time limit. The dependent variable in column 2 is the number of seconds spent on each game (until a solution is submitted or the time runs out). The dependent variable in column 3 is the total number of games solved within the time limit divided by the total number of minutes spent on the ten games for a given time limit (no time limit, 60 seconds, 25 seconds or 15 seconds). The bottom panel presents the differences in the three performance measures between different time limits. Standard errors are shown in parentheses and are clustered at the individual level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

without a time limit and a higher starting budget for solving the games with a time limit (€16 for the 15-second limit, €15 for the 25-second limit, and €14 for the 60-second limit). We can get a first impression of aggregate time pressure preferences by comparing these choices to choices time pressure neutral individuals would have made given the baseline performances. For the tightest time limit (15 seconds), 57 percent of our participants would have maximized their expected earnings by choosing to work under time pressure under a starting budget of €16 (they solved at least 5 out of 10 puzzles under the 15-second limit in the baseline rounds). Nevertheless, only 16 percent of participants chose to do so. For the 25-second limit, 56 percent of participants prefer to solve the game with a 25-second limit and a starting budget of €15, which is less than the 79 percent who scored 6 or more correct answers under the 25-second limit. For the 60-second limit, virtually all participants (94 percent) are willing to solve the games with the time limit for a starting budget of €14, which makes sense given that all participants solved at least 7 games under the 60-second time limit.

These binary choices already suggest that a majority of participants are averse to working under time pressure to some degree. We can use the price lists to get a more detailed picture of the extent of this aversion. Remember that after each of the three binary choices, participants were presented with a price list where they could determine the starting budgets (from €10 to €20 in integers) for which they prefer solving the games with time pressure over solving them without time pressure (and a starting budget of €10). This gives us three switching points that give the minimum starting budget participants required to choose performing under each time limit over solving the games without the time limit.

We can construct individual measures of aversion to time pressure by subtracting these switching points from the switching points that would maximize expected payments given performance in the baseline rounds. This gives us three measures of time pressure aversion for each participant, one for each time limit. For example, consider a participant who solved 6 out of 10 games under the 15-second limit in the baseline rounds, and would therefore maximize their expected earnings by selecting the 15-second time limit over no time-limit for starting budgets of €14 or more. If this participant actually only switched to the 15-second time limit for a budget of

€18, they would then be classified as having a time pressure premium of €4.[10] [11]

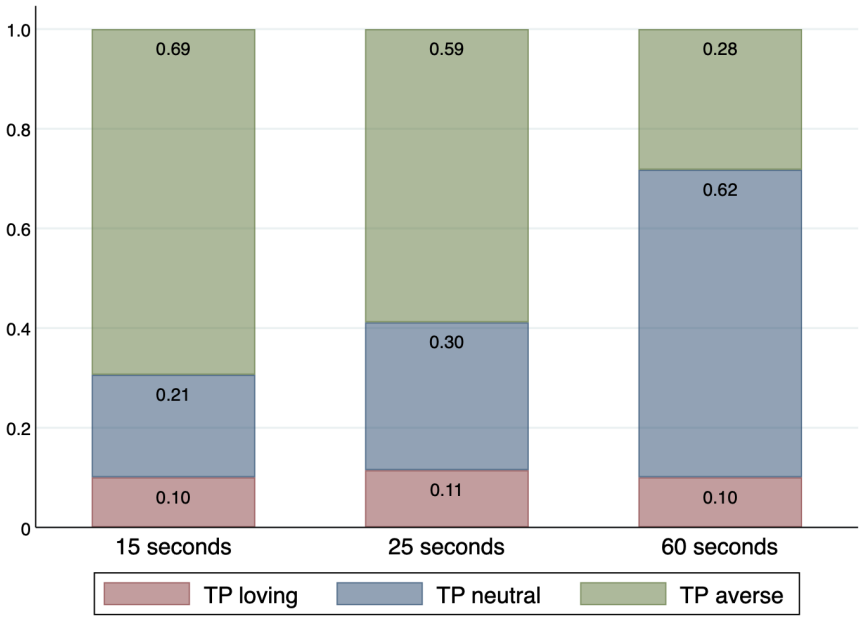
For ease of exposition, Figure 4 summarizes the data by dividing participants into three groups for each time limit: time pressure averse (requiring a premium strictly greater than €1 to accept the time limit), time pressure neutral (requiring a premium of €0 or €1 to accept the time limit), and time pressure loving (requiring a negative premium to accept the time limit).[12] For the 15- and 25-second limits, a majority of participants are classified as time pressure averse. In particular, 69 percent and 59 percent are willing to forgo at least €2 in expectation to avoid performing under the 15-second limit and 25-second limit respectively. By contrast, under the 60-second time limit most participants (62 percent) are classified as time pressure neutral. This is consistent with 60 seconds not being seen as a stringent time limit for this task (51% of participants were able to solve all 10 games under the 60-second limit in the baseline rounds). In line with this, the average premium required to perform under time pressure (given our assumptions on censored observations) is €2.75 for the 15-second limit, €2.11 for 25 seconds, and €1.26 for 60 seconds. The full distributions of

[10] In constructing these measures, we need to make a number of choices. First, some participants (16 percent for the 15-second limit, 3 percent for the 25-second limit, and 1 percent for the 60-second limit) are unwilling to choose time pressure even with a starting budget of €20 which would guarantee weakly higher earnings. We code their switching point as €21 for the following analyses. Other participants (0.5 percent for the 15-second limit, 4 percent for the 25-second limit, and 12 percent for the 60-second limit) choose time pressure even without a premium, that is with a starting budget of €10. We code their switching point as €10. We will assume that participants believe they can solve all 10 games correctly when performing without a time limit (98% of games were solved in the baseline under no time limit). Note that this is a conservative choice in the sense that we err in the direction of underestimating an individual's degree of time pressure aversion.

[11] We also need to keep in mind that – because it depends on each participant's performance under each time limit – our aversion measure is censored. The aversion measure of participants who performed poorly under time pressure is censored from above whereas the aversion measure of participants who scored highly under time pressure is censored from below. For example, the aversion measure of a participant who scored 10 out of 10 correct answers under all time limits in the baseline rounds cannot be lower than €0. In practice, both types of extremes are rare under the 15- and 25-second time limits. Under 15 seconds (25 seconds), only 1 participant (21 participants) solved all 10 games correctly and only 2 participants (1 participant) had 0 correct games. Out of the 21 participants who solved all games within 25 seconds, only 1 chose to accept time pressure without extra compensation, leading to a censored observation. 107 participants (51 percent) solved every game under the 60-second time limit, 17 of whom chose to accept time pressure without additional compensation.

[12] Note that a €1 premium is consistent with both time pressure neutrality and (modest) time pressure aversion. By classifying these participants as time pressure neutral, Figure 4 therefore presents a conservative estimate of the number of time pressure averse individuals. If we instead classify participants with a premium of €1 as time pressure averse, the fraction of time pressure averse participants increases to 80, 76, and 67 percent under 15-second, 15-second, and 60-second time limits respectively.

Figure 4: Preferences for working under time pressure



The figure shows the proportions of participants who are classified as time pressure averse, time pressure neutral, and time pressure loving at each of the three time limits. The classification is based on comparing the starting budget at which participants prefer performing under time pressure (as opposed to completing the games with no time pressure and a starting budget of €10) to their expected earnings based on their performance in the baseline games. Participants who require a premium of more than €1 to perform under time pressure are classified as time pressure averse. Participants who switch to performing under time pressure at a negative premium are classified as time pressure loving. Participants who require a premium of €1 or €0 are classified as time pressure neutral.

time pressure aversion for each time limit are presented in Figure 6 in the appendix.[13]

These numbers indicate that a majority of participants in the experiment are willing to sacrifice money to avoid working under time pressure under the stricter time limits. A possible challenge to interpreting this as evidence for an aversion to working under time pressure is that stricter time limits may generate greater performance uncertainty, leading to riskier payoffs. The average decision maker might then require a premium to choose a stricter time limit not because of an

[13]Time pressure aversion could conceivably also reflect a desire to avoid the time pressure game screen with its blinking red light. Yet since this screen is constant across all time limits, this cannot explain the increasing time pressure premium for the more stringent limits nor the time pressure aversion observed in the competition choices described below (which always have at least some time pressure).

aversion to working under time pressure but because of an aversion to risk. We can tackle this issue in two ways.

First, we can look at the binary competition choices which should be independent of risk preferences. Recall that for these choices, participants chose under which limit they want to compete against the performance of another participant who previously performed under the same limit. Hence, a participant should choose low time pressure if either (a) they are time pressure averse or (b) they expect their relative performance to be greater under low time pressure. Risk preferences should not play a role as this is essentially choice between two random lotteries where the winning probabilities depend on the expected performances of the participants. When asked whether they prefer to compete under a 15- or 25-second limit, only 9 percent of participants choose the 15-second limit. 21 percent choose to compete under the 15-second limit rather than under the 60-second limit. Only when asked to choose between a 25-second and 60-second limit are participants close to indifferent, with 46% choosing the 25-second limit. Note that, as expected, the proportion of participants who had a higher rank under the tighter limit is close to 50% in all three cases. In other words, even in choices where risk preferences (and ability) confounds are ruled out by design, we find strong evidence of time pressure aversion in two out of three cases.

Second, we can control for elicited risk preferences. In Figures 8 and 9 in the appendix, we graph the proportion of participants who are classified as time pressure averse – based on the premium they require to work under the 15- and 25-second time limits – as a function of their risk preferences. Figure 8 uses the lottery measure and Figure 9 uses self-judged willingness to take risk. Independent of the measures used, there is little evidence of a correlation between risk attitudes and time pressure preferences. Whether they are very risk averse or risk loving, a majority of participants require a premium to work under time pressure. All in all, we therefore conclude that time pressure aversion is a preference that is to a large extent orthogonal to risk aversion.

3.3 A survey measure of time pressure preferences

Our data also show that among the majority who are time pressure averse, there is substantial variation in the degree of aversion (see Figure 6 in the appendix for the full distributions of time pressure aversion levels for each of the three time limits). If these individual differences carry over to contexts outside of the lab, time pressure

aversion could influence economically important professional or educational choices. To investigate this link, we need to be able to measure time pressure preferences in large samples and link them to survey data on relevant outcomes. Unlike e.g. lottery-choice tasks to measure risk preferences, our incentivized measures based on real-effort tasks are too cumbersome to include in large-scale surveys. A solution to this problem is to measure individual attitudes towards working under time pressure through survey questions that are validated by incentivized choices. This approach has been pioneered by Dohmen et al. (2011) for risk preferences and was later expanded by Falk et al. (2018) for a range of economic preferences.[14]

Figure 7 in the appendix shows the distributions of answers to our two survey questions. The first measure is the degree to which participants agree with the statement "I see myself as someone who enjoys working under time pressure", which we will refer to as *TP enjoyment*. The second measure is the degree to which participants agree with the statement "I see myself as someone who is productive under time pressure", which we will refer to as *TP confidence*. For most of our analyses, we combine the two measures into a single measure. We refer to this combined measure as *TP preference*.

We will now look into the correlation between our two self-judged measures of attitudes towards working under time pressure and the choices participants made in the fifth round of the experiment. To properly estimate the resulting correlation in the presence of measurement error, we use the obviously related instrumental variables method (ORIV, Gillen et al., 2019). This approach eliminates the uncorrelated part of the measurement error in the two time pressure measures by using the two measures as instruments for each other. For brevity, we will also combine the experimental choices into a few aggregate choice measures. Standard OLS estimates and disaggregated results for each survey question and choice can be found in Table 4 and 5 in the appendix.

In the top panel of Table 2, we regress five different indicators of choices and performance in the experiment on our preference measure using ORIV. The indicators are: 1. The sum of the three binary choices between working under time pressure and solving the games without a time limit; 2. the sum of the switching points in

[14]These papers show that general survey items for traits such as risk taking and time discounting capture both the choices individuals make in incentivized preference elicitation tasks and predict relevant choices and outcomes outside of the lab. Other examples include Buser et al. (2021), who establish a survey measure for willingness to compete, and Buser and Yuan (2022), who establish a survey measure for public speaking aversion.

Table 2: Relationship between the survey measures and experimental outcomes

	(1) Binary	(2) Switching	(3) Competition	(4) Component	(5) Performance
TP preference	0.189*	-0.239**	0.249**	0.260**	-0.045
	(0.102)	(0.102)	(0.115)	(0.102)	(0.121)
Performance controls	Yes	Yes	Yes	Yes	No
TP preference	0.182	-0.229**	0.250**	0.252**	-0.103
	(0.113)	(0.110)	(0.115)	(0.110)	(0.129)
Performance controls	Yes	Yes	Yes	Yes	No
Personality traits	Yes	Yes	Yes	Yes	Yes
N	209	209	209	209	209

The table shows coefficients from ORIV regressions of five experimental time pressure measures on the survey measure of time pressure preference. "Binary" is the sum of the three binary choices between working under time pressure (1) and solving the games without a time limit (0). "Switching" is the sum of the switching points in the three price lists (that is, the premium required to choose time pressure over no time pressure under each of the three limits). "Competition" is the sum of the three competition choices (that is, the number of times out of three a participant decided to compete under the stricter time limit). "Component" is the first component from a principal components analysis of all the previously mentioned choices. "Performance" is the total number of puzzles solved in all baseline games with a time limit (15, 25 or 60 seconds). TP preference captures both our survey measures by using one as an instrument for the other following the ORIV approach. The first four regressions control for the number of games solved (out of ten) under the 15-, 25-, and 60-second time limits in the baseline rounds. The lower panel also controls for the big five personality traits, risk aversion and competitiveness. All dependent variables and independent variables are standardized. Robust standard errors are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

the three price lists (that is, the premium required to choose time pressure under each of the three limits);[15] 3. the sum of the three competition choices (that is, the number of times out of three a participant decided to compete under the stricter time limit); 4. the first component from a principal components analysis of the three previously mentioned choices; and 5. the total number of puzzles solved (out of thirty) in all baseline games with a time limit (15, 25 or 60 seconds). The first four regressions control for the number of games solved (out of ten) under the 15-, 25-, and 60-second time limits in the baseline rounds. We standardize both the dependent variables and the survey measures, which allows us to interpret the coefficients as partial correlations.

To summarize the results, attitudes towards working under time pressure as measured by our two survey items significantly predict all four experimental choice measures of the preference for working under time pressure, but not the aggregate performance under time pressure in the baseline rounds. The partial correlations between the survey measures and the experimental choices conditional on baseline performance range from 0.19 to 0.26 depending on the experimental measure, which is within the range of previously validated survey measures for established economic preferences.[16] This allows us to use the survey measures to look at the predictive power of time pressure preferences for student career choices in Section 3.5 below.[17]

The bottom panel of Table 2 also presents results controlling for the personality traits elicited in the questionnaire (Big Five, risk aversion and competitiveness). The estimates of the partial correlations between our preference measure and the experimental measures hardly change.[18] Table 7 in the appendix looks at how our

[15] As in the previous section, we code the switching point of those who never choose to perform with a time limit as 21 and the switching point for those who always choose time pressure as 10.

[16] Falk et al. (2022) examine correlations between experimental and survey measures for trust, reciprocity, altruism, and risk and time preferences. Out of 188 survey measures, 34 (18%) are greater than our median correlation of 0.244 (appendix D). Buser et al. (2021) find a correlation of 0.15 between a survey and experimental measure of competitiveness. Fallucchi et al. (2020) look at 10 survey measures of competitiveness and find a median correlation of 0.09 and a maximum correlation of 0.26.

[17] Table 5 in the appendix repeats the analysis in the top panel of Table 2 using disaggregated experimental choices and also shows results for each of the two survey items separately. Time pressure enjoyment tends to be more predictive of experimental choices than time pressure confidence. Table 8 in the appendix shows the correlation between our survey preference measure and the more detailed performance measures used in Table 1. The results again show no significant correlations between our survey measure and performance under time pressure.

[18] Table 6 in the appendix presents the coefficients on the personality traits. Less neurotic and less extraverted participants appear to perform better under time pressure, none of the personality traits significantly predict any of the other variables.

survey measure of time pressure preferences correlates with the personality traits. A stronger preference for working under time pressure is negatively correlated with neuroticism and positively correlated with risk tolerance, extraversion and (at the 10% level) competitiveness.

3.4 Time pressure preferences and career expectations in a student survey

Our validated survey measures make it possible to elicit time pressure preferences in large-scale surveys and study their relationship with career choices and labor market outcomes. As a first illustration of the possibilities, we added our two time pressure survey items, as well as survey questions eliciting career expectations, to a survey of a cohort of first-year economics and business bachelor students conducted at the University of Amsterdam for program evaluation purposes. The time pressure questions and the questions about career preferences were included in two different waves spaced several months apart. To elicit career plans, students were asked to rank the attractiveness of 12 career options. The choice of career options was based on the department website which lists the most common occupations of graduates. All surveys were distributed and collected at the start of mandatory tutorials or lectures. To fit with other questions in the student survey, answers to our time pressure questions were on a scale from 0 to 10, rather than from 1 to 7 as in the online lab experiment. We construct a single time pressure preferences measure by taking the average of the answers given to the two questionnaire items.

In Table 3, we regress – for each career option separately – the rank a student gave that career option on our combined time pressure preferences measure controlling for gender and study major (business or economics). The rank given to each career option is scored from 12 (favorite) to 1 (least favorite). In the table, the study options are ordered according to their ranking in terms of expected salaries given by another group of 200 students recruited through Prolific.[19]

The results show that students who state that they enjoy working under time pressure and are productive at it are significantly more attracted to several higher-paying career options – including investment banking, data analyst, and consulting –

[19]Participants on Prolific were selected to be similar to our student survey sample and included only current students with an economics or business administration related major. Participants were paid £1 to fill out the short survey.

Table 3: Correlation between survey measure of time pressure preferences and career option rankings

	Investment banking	Data analyst	Business analyst	Accoun-ting	Consul-ting	Back office	Ave. rank high pay
TP preference	0.121**	0.116**	0.062	-0.023	0.200***	-0.105*	0.158***
	(0.060)	(0.058)	(0.061)	(0.060)	(0.057)	(0.058)	(0.059)
N	795	795	795	795	795	795	795

	Entrepreneur	Front office	Academia	Management trainee	Public researcher	Sales	Ave. rank low pay
TP preference	-0.009	-0.134**	-0.018	-0.126**	-0.025	-0.036	-0.158***
	(0.060)	(0.061)	(0.059)	(0.054)	(0.059)	(0.060)	(0.059)
	795	795	795	795	795	795	795

The table shows coefficients from ORIV regressions of the rank given to each career option from 1 (least favorite) to 12 (favorite) by the surveyed bachelor students on the survey measure of time pressure preference. TP preference captures both our survey measures by using one as an instrument for the other following the ORIV approach. The regressions control for gender and study major (economics or business). All dependent variables and independent variables are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

and significantly less attracted to several lower-paying options – including front office positions and management traineeships. To test the overall statistical significance of the correlation between attitudes towards time pressure and career expectations, in the last column of Table 3 we show how our survey measure of time pressure preferences relates to the average rank given to the six higher-paying and the six lower-paying career options. The relationship is highly statistically significant. That is, more positive attitudes towards working under time pressure are associated with higher ranks given to the six higher-paying career options (and corresponding lower ranks given to the six lower-paying options).

In Table 11 in the appendix, we repeat this analysis controlling for the Big Five personality traits and survey measures of risk seeking and competitiveness, with very similar results. Table 12 in the appendix shows that we also obtain similar results using OLS instead of ORIV. More broadly, the fact that both the correlations between our preference measure and experimental outcomes (Table 2) and the correlations between our preference measure and career expectations (Table 3) are robust to controlling for a range of widely studied personality traits, suggests that preferences for working under time pressure are a separate trait that influences behavior for

reasons distinct from these traditional personality or economic preference variables.

3.5 Gender differences in performance and preferences

Several papers document gender differences in the effect of time pressure on performance (Shurchkov, 2012; De Paola and Gioia, 2016; Dilmaghani, 2020). In this section, we use our experimental data to look at gender differences in performance as well as preferences for working under time pressure.

Table 9 in the appendix shows gender differences in performance in the baseline rounds. We regress our performance measures on a gender dummy, time limit dummies, and the interactions among them. The first two columns show that female and male participants are equally likely to solve a game under no time limit and 60-second time limit. With a time limit of 15 or 25 seconds, female participants are significantly less likely to solve a game than their male counterparts. The regression reported in column (2) controls for performance under no time limit. Results are very similar. Column (3) shows that the time spent per game is not significantly different across gender at any time limit. Our results suggest that, in our sample, women do not perform worse at our task than men, but are worse at handling time pressure. This is in line with Shurchkov (2012) who finds no significant performance differences between men and women in a math task under low time pressure but finds a significant gender gap at high time pressure. Note, however, that we cannot fully exclude the possibility that women are worse at the task overall in a manner that only manifests when the task is relatively difficult, e.g. under time pressure. The fact that women solved the games at a similar speed to men (29.7 seconds per game vs 27.5 seconds per game; p=0.24, t-test) under no time limit makes this less plausible.

Next, we look at gender differences in preferences for working under time pressure. This is done through regressing the choice indicators on a gender dummy, with and without controlling for the total number of games solved under different time limits in the baseline rounds. Columns (1) to (8) in Table 10 in the appendix present the results. Compared to male participants, women are less likely to choose the more stringent time limit in the binary choices, switch to the more stringent time limit option at a higher starting budget, and are less likely to choose the more stringent time limit in the competition choices. These differences can largely be explained by the gender gap in performance under time pressure. After controlling for performance

under different time limits (the even columns), the estimated gender differences in preferences diminish substantially.

In Columns (9) and (10), we look at the gender difference in how the survey items are answered. Women's average score is about one point lower for the sum of the two questions on time pressure preferences. The exact distributions of the answers to the two survey measures split by gender are shown in Figure 10 in the appendix. More male than female participants chose "Agree" and above for both questions. The gender difference in our survey measure is confirmed by the student survey data where women's average score for the sum of the two questions is around 1.4 points lower ($p<0.001$).[20]

In summary, compared to male participants, women perform worse under time pressure, require a higher premium to work under time pressure, and rate themselves as more time pressure averse. We also find evidence that at least some of the gender difference in time pressure aversion is driven by gender differences in performance under time pressure.

4 Conclusion

We use an incentivized experiment to investigate preferences for working under time pressure. Our first main contribution lies in documenting the presence of aggregate time pressure aversion in an incentivized task. That is, the average participant is willing to leave money on the table to avoid working under time pressure. We also show that the degree of time pressure aversion varies substantially across individuals. Because willingness to perform under time pressure is a prerequisite to many steps on the career ladder – studying for tertiary degrees generally requires the ability and willingness to perform in timed exams and access to many high-profile careers depends on assessment methods that involve a high degree of time pressure – this heterogeneity could be an explanatory factor for economically consequential career decisions. There is also substantial variation in the presence of time pressure in the day-to-day reality across different careers and people who are averse to working under time pressure might be willing to forgo expected wages to reduce the degree of time pressure they face.

[20] This is based on an OLS regression of the time pressure preference measure on a female dummy using the same sample as the regressions in Table 3. The coefficient on the female dummy is equal to -1.376 (robust standard error 0.279).

To investigate whether preferences for working under time pressure have consequences for people's careers, we need to be able to measure preferences for working under time pressure in large-scale surveys. Compared to some standard incentivized elicitation methods for, say, risk or time preferences, our experimental method for eliciting time pressure preferences is too cumbersome to include in most surveys. We therefore formulate two survey items in the spirit of Dohmen et al. (2011) and Falk et al. (2018). We show that these self-reported measures are significantly correlated with participants' choices in the experiment. Despite this being the first experiment that uses either the survey or the experimental measures for time pressure preferences, the resulting correlations are comparable to correlations found in previous work. This suggests that our survey measure may have a validity that is comparable to widely used survey measures for e.g. risk and social preferences.

As an illustration of the possibilities, we elicit our survey items in a survey of economics and business students. We also ask these students about their future career plans and show that students who enjoy working under time pressure more are also more attracted to high-paying careers such as investment banking or consulting. Our survey items can be easily added to survey panels and will enable researchers in all social sciences to elicit preferences for working under time pressure in large samples and link them to survey or registry data on educational and labor market outcomes.

We also find evidence that women are both less productive and more averse to working under time pressure than men. These differences may contribute to explaining gender differences observed in the labor market. For example, women may be less likely to end up in high-profile or high-earning positions if either the positions themselves or the selection process into these positions are characterized by high degrees of time pressure. One interesting open question (in light of the results of Shurchkov, 2012) is whether the gender differences in preferences and performance we observe carry over to other contexts and tasks, in particular those that may be thought of as less stereotypically male. At the same time, it is useful to note that we also observe gender differences in our survey measure, which is not directly linked to a specific cognitive task.

References

Amer-Mestre, J. and Charpin, A. (2021). Gender differences in early occupational choices: Evidence from medical specialty selection. SSRN 3976273.

Ariely, D., Gneezy, U., Loewenstein, G., and Mazar, N. (2009). Large stakes and big mistakes. *The Review of Economic Studies*, 76(2):451–469.

Azmat, G., Calsamiglia, C., and Iriberri, N. (2016). Gender differences in response to big stakes. *Journal of the European Economic Association*, 14(6):1372–1400.

Bouwmeester, S., Verkoeijen, P. P. J. L., Aczel, B., Barbosa, F., Bègue, L., Brañas-Garza, P., Chmura, T. G. H., Cornelissen, G., Døssing, F. S., Espín, A. M., Evans, A. M., Ferreira-Santos, F., Fiedler, S., Flegr, J., Ghaffari, M., Glöckner, A., Goeschl, T., Guo, L., Hauser, O. P., Hernan-Gonzalez, R., Herrero, A., Horne, Z., Houdek, P., Johannesson, M., Koppel, L., Kujal, P., Laine, T., Lohse, J., Martins, E. C., Mauro, C., Mischkowski, D., Mukherjee, S., Myrseth, K. O. R., Navarro-Martínez, D., Neal, T. M. S., Novakova, J., Pagà, R., Paiva, T. O., Palfi, B., Piovesan, M., Rahal, R.-M., Salomon, E., Srinivasan, N., Srivastava, A., Szaszi, B., Szollosi, A., Thor, K. Ø., Tinghög, G., Trueblood, J. S., Bavel, J. J. V., van 't Veer, A. E., Västfjäll, D., Warner, M., Wengström, E., Wills, J., and Wollbrant, C. E. (2017). Registered replication report: Rand, greene, and nowak (2012). *Perspectives on Psychological Science*, 12:527–542.

Bowden, E. M. (1985). Accessing relevant information during problem solving: Time constraints on search in the problem space. *Memory & Cognition*, 13(3):280–286.

Buser, T., Niederle, M., and Oosterbeek, H. (2021). Can competitiveness predict education and labor market outcomes? Evidence from incentivized choice and survey measures. Working Paper 28916, National Bureau of Economic Research.

Buser, T. and Yuan, H. (2022). Public speaking aversion. *Management Science*, forthcoming.

Cai, X., Lu, Y., Pan, J., and Zhong, S. (2019). Gender gap under pressure: Evidence from China's national college entrance examination. *Review of Economics and Statistics*, 101(2):249–263.

Chen, D. L., Schonger, M., and Wickens, C. (2016). oTree—an open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9:88–97.

Christensen-Szalanski, J. J. (1980). A further examination of the selection of problem-solving strategies: The effects of deadlines and analytic aptitudes. *Organizational Behavior and Human Performance*, 25(1):107–122.

De Paola, M. and Gioia, F. (2016). Who performs better under time pressure? Results from a field experiment. *Journal of Economic Psychology*, 53:37–53.

Diederich, A. (1997). Dynamic stochastic models for decision making under time constraints. *Journal of Mathematical Psychology*, 41(3):260–274.

Diederich, A. and Busemeyer, J. R. (2003). Simple matrix methods for analyzing diffusion models of choice probability, choice response time, and simple response time. *Journal of Mathematical Psychology*, 47(3):304–322.

Dilmaghani, M. (2020). Gender differences in performance under time constraint: Evidence from chess tournaments. *Journal of Behavioral and Experimental Economics*, 89:101505.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., and Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3):522–550.

El Haji, A., Krawczyk, M., Sylwestrzak, M., and Zawojska, E. (2019). Time pressure and risk taking in auctions: A field experiment. *Journal of Behavioral and Experimental Economics*, 78:68–79.

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., and Sunde, U. (2018). Global evidence on economic preferences. *The Quarterly Journal of Economics*, 133(4):1645–1692.

Falk, A., Becker, A., Dohmen, T., Huffman, D., and Sunde, U. (2022). The preference survey module: A validated instrument for measuring risk, time, and social preferences. *Management Science*, forthcoming.

Fallucchi, F., Nosenzo, D., and Reuben, E. (2020). Measuring preferences for competition with experimentally-validated survey questions. *Journal of Economic Behavior& Organization*, 178:402–423.

Gillen, B., Snowberg, E., and Yariv, L. (2019). Experimenting with Measurement Error: Techniques with Applications to the Caltech Cohort Study. *Journal of Political Economy*, 127(4):1826–1863.

Gneezy, U., Niederle, M., and Rustichini, A. (2003). Performance in competitive environments: Gender differences. *The Quarterly Journal of Economics*, 118(3):1049–1074.

Iriberri, N. and Rey-Biel, P. (2019). Competitive pressure widens the gender gap in performance: Evidence from a two-stage competition in mathematics. *The Economic Journal*, 129:1863–1893.

Kocher, M. G., Pahlke, J., and Trautmann, S. T. (2013). Tempus fugit: Time pressure in risky decisions. *Management Science*, 59(10):2380–2391.

Kocher, M. G., Schindler, D., Trautmann, S. T., and Xu, Y. (2019). Risk, time pressure, and selection effects. *Experimental Economics*, 22(1):216–246.

Kocher, M. G. and Sutter, M. (2006). Time is money–time pressure, incentives, and the quality of decision-making. *Journal of Economic Behavior & Organization*, 61(3):375–392.

Lang, F. R., John, D., Lüdtke, O., Schupp, J., and Wagner, G. G. (2011). Short assessment of the Big Five: Robust across survey methods except telephone interviewing. *Behavior Research Methods*, 43(2):548–567.

Montolio, D. and Taberner, P. A. (2021). Gender differences under test pressure and their impact on academic performance: A quasi-experimental design. *Journal of Economic Behavior & Organization*, 191:1065–1090.

Moore, D. A. and Tenney, E. R. (2012). Time pressure, performance, and productivity. *Research on Managing Groups and Teams*, 15:305–326.

Ors, E., Palomino, F., and Peyrache, E. (2013). Performance gender gap: Does competition matter? *Journal of Labor Economics*, 31(3):443–499.

Rand, D. G., Brescoll, V. L., Everett, J. A., Capraro, V., and Barcelo, H. (2016). Social heuristics and social roles: Intuition favors altruism for women but not for men. *Journal of Experimental Psychology: General*, 145(4):389.

Rand, D. G., Greene, J. D., and Nowak, M. A. (2012). Spontaneous giving and calculated greed. *Nature*, 489:427–430.

Rand, D. G., Peysakhovich, A., Kraft-Todd, G. T., Newman, G. E., Wurzbacher, O., Nowak, M. A., and Greene, J. D. (2014). Social heuristics shape intuitive cooperation. *Nature Communications*, 5(1):1–12.

Recalde, M. P., Riedl, A., and Vesterlund, L. (2018). Error-prone inference from response time: The case of intuitive generosity in public-good games. *Journal of Public Economics*, 160:132–147.

Rieskamp, J. and Hoffrage, U. (2008). Inferences under time pressure: How opportunity costs affect strategy selection. *Acta Psychologica*, 127(2):258–276.

Shastry, G. K. and Shurchkov, O. (2022). Reject or revise: Gender differences in persistence and publishing in economics. SSRN 4167238.

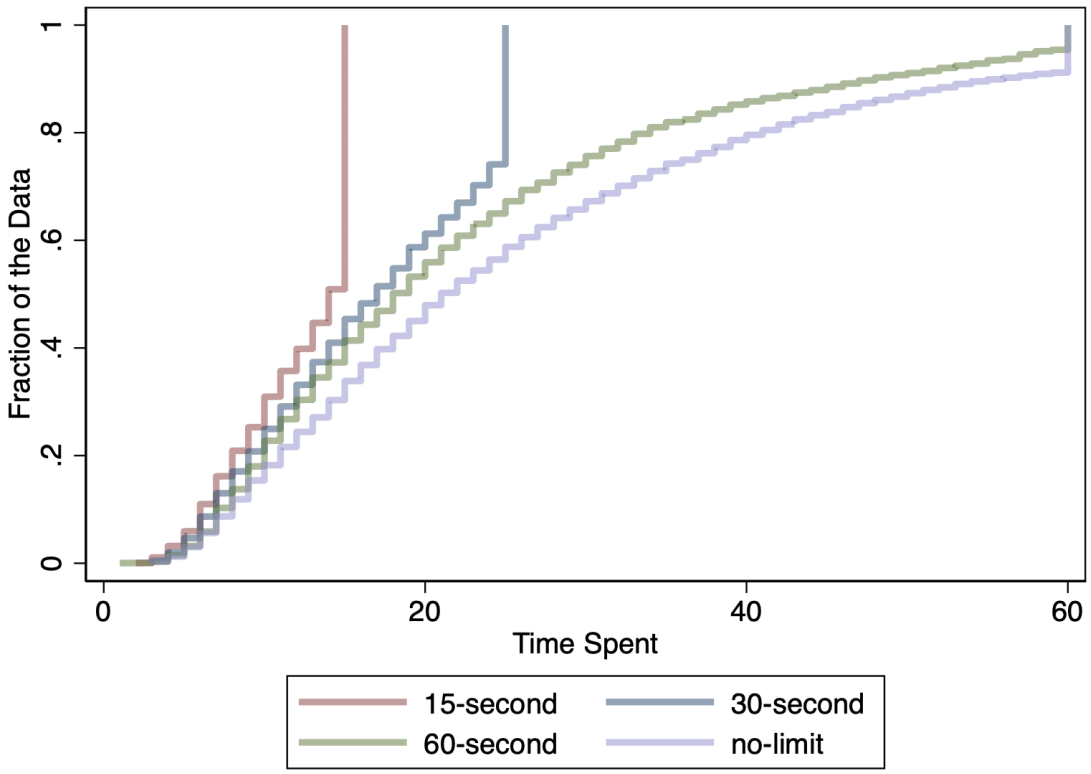
Shurchkov, O. (2012). Under pressure: Gender differences in output quality and quantity under competition and time constraints. *Journal of the European Economic Association*, 10(5):1189–1213.

Sutter, M., Kocher, M., and Strauß, S. (2003). Bargaining under time pressure in an experimental ultimatum game. *Economics Letters*, 81(3):341–347.

Tinghög, G., Andersson, D., Bonn, C., Böttiger, H., Josephson, C., Lundgren, G., Västfjäll, D., Kirchler, M., and Johannesson, M. (2013). Intuition and cooperation reconsidered. *Nature*, 498:E1–E2.

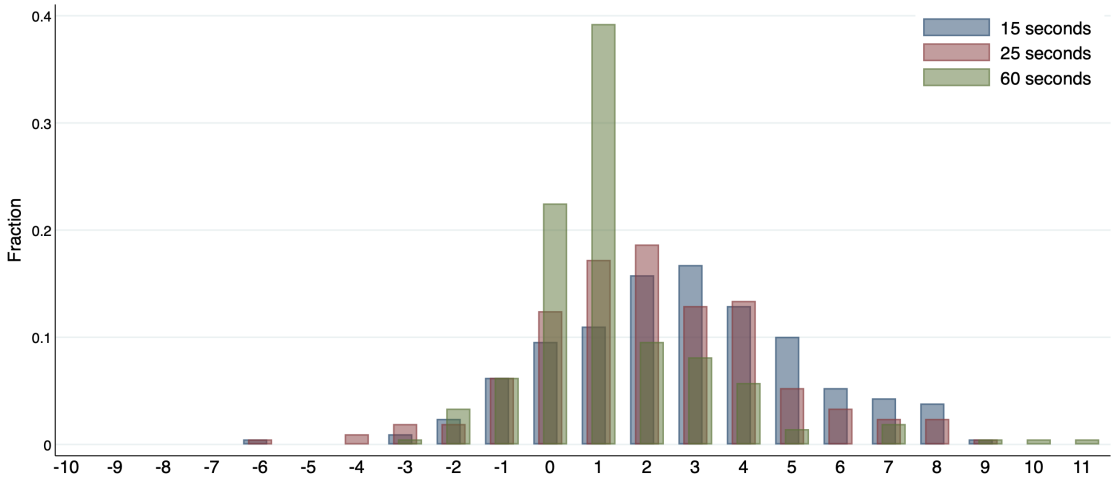
Appendix A: Additional Tables and Figures

Figure 5: CDF of time spent on each game under the different time limits over the four baseline rounds



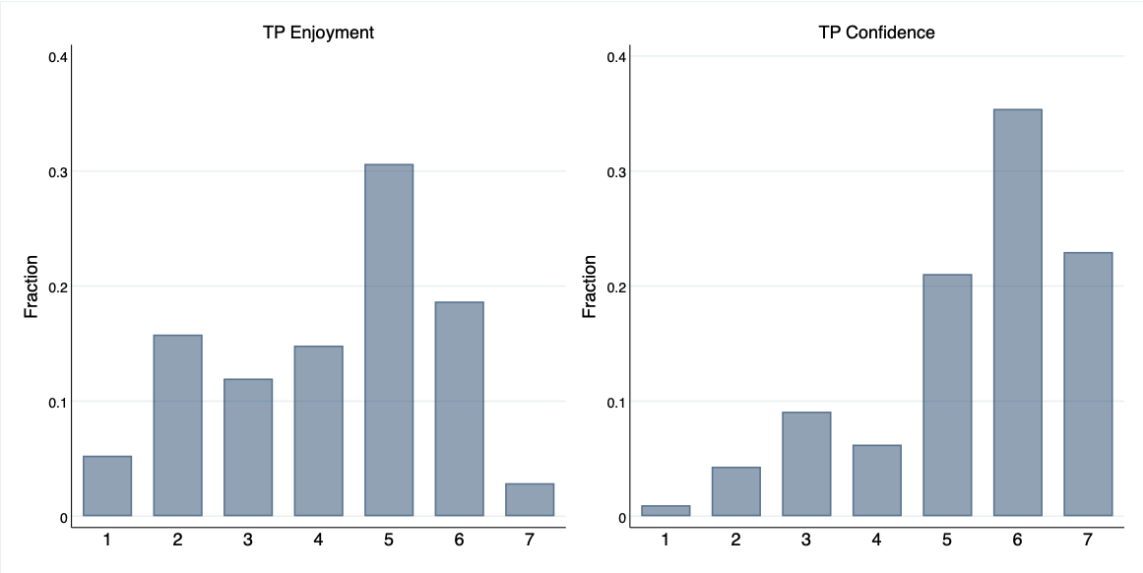
The figure presents the empirical cumulative density functions (CDFs) for the number of seconds spent on each game over the four baseline rounds, for each of the four time limits. For games with no time limit we censor observations at 60 seconds.

Figure 6: Distribution of time pressure aversion



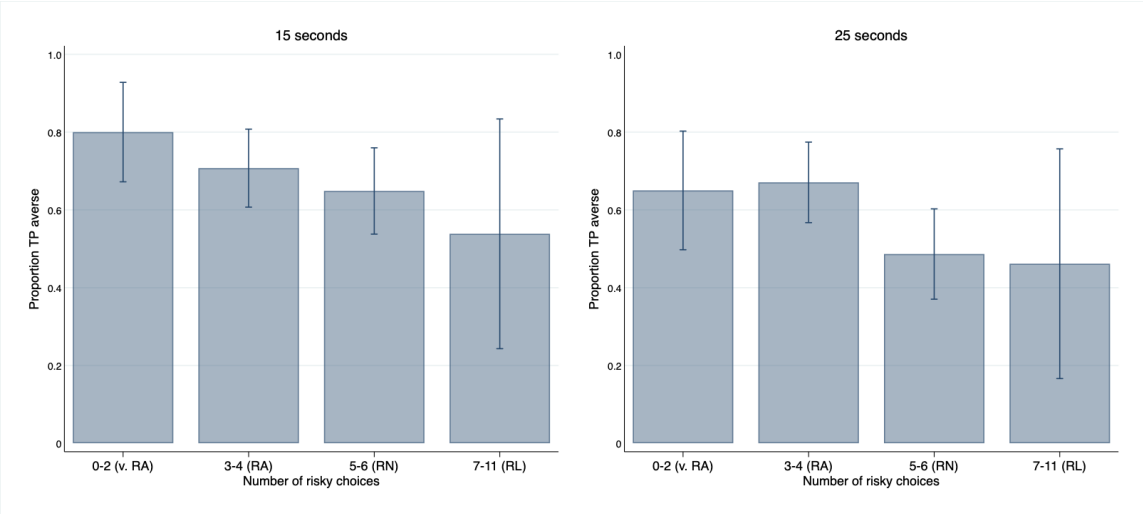
The figure shows the full distribution of time pressure aversion for each time limit. Time pressure aversion is calculated by subtracting the optimal switching point (based on the performance in the four baseline rounds under each time limit) from the actual starting budget participants chose to perform under the time limit over solving the games without a time limit. The detailed way of calculating time pressure aversion is presented in Section 3.2.

Figure 7: Distribution of the two survey measures



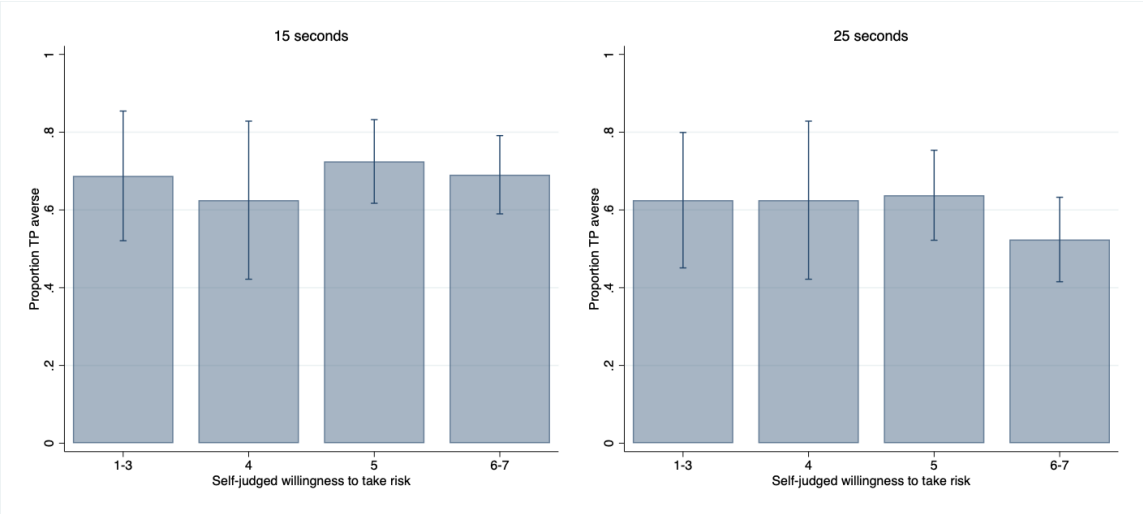
The figure shows the distributions of answers to our two survey questions: "I see myself as someone who enjoys working under time pressure" and "I see myself as someone who is productive under time pressure". Each bar represents the fraction of participants who chose each of the seven options: "Strongly Disagree", "Disagree", "Slightly Disagree", "Neutral", "Slightly Agree", "Agree", and "Strongly Agree". 1 corresponds to "Strongly Disagree" and 7 corresponds to "Strongly Agree".

Figure 8: Time pressure aversion and lottery choices



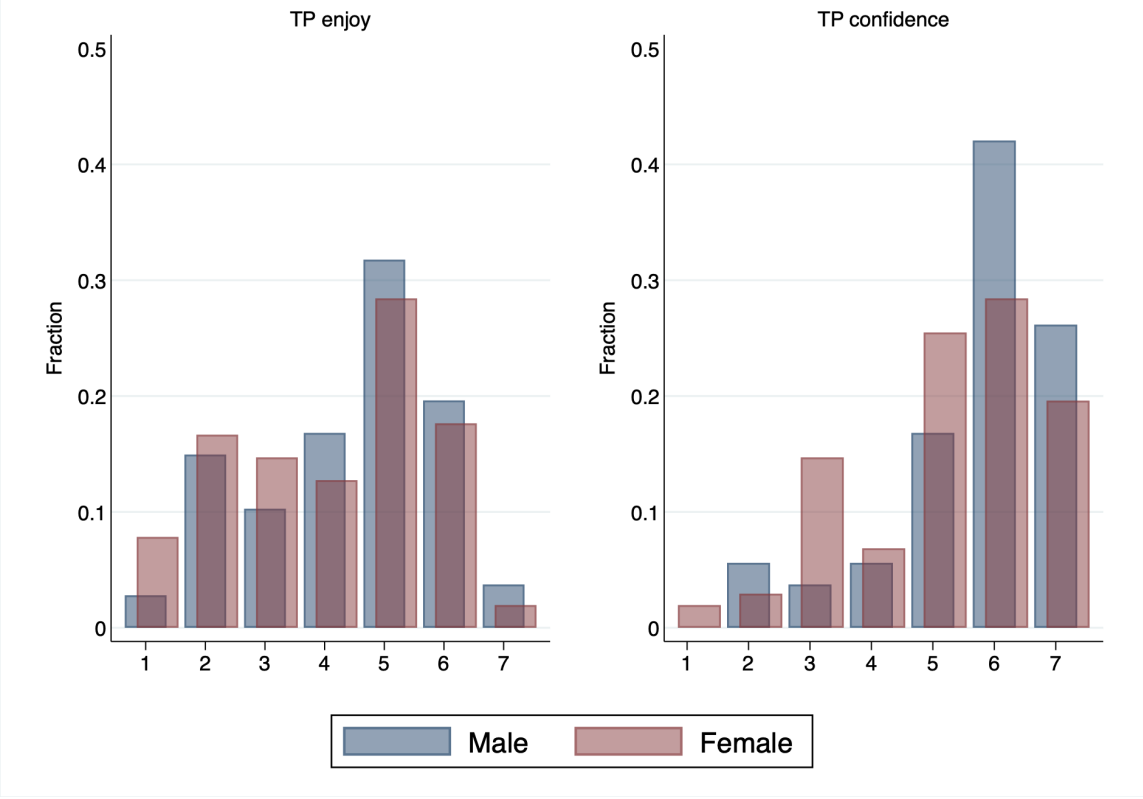
The figure shows the proportions of participants who are classified as time pressure (TP) averse for different numbers of risky choices made in the lottery choice. Participants who made 0 to 2 risky choices (out of 11) are classified as very risk averse (v. RA), those who made 3-4 risky choices are classified as risk averse (RA), those who made 5-6 risky choices are classified as risk neutral (RN), and those who made more than 6 risky choices are classified as risk loving (RL). The procedure used to classify participants as time pressure averse is presented in Section 3.2.

Figure 9: Time pressure aversion and self-judged willingness to take risk



The figure shows the proportions of participants who are classified as time pressure (TP) averse for different levels of self-judged willingness to take risk. This is based on the answers to the survey question "I see myself as someone who is willing to take risks". Seven options are given: "Strongly Disagree", "Disagree", "Slightly Disagree", "Neutral", "Slightly Agree", "Agree", and "Strongly Agree". 1 corresponds to "Strongly Disagree" and 7 corresponds to "Strongly Agree".The procedure used to classify participants as time pressure averse is presented in Section 3.2.

Figure 10: Distribution of the two survey measures by gender



The figure shows the distributions of answers to our two survey questions "I see myself as someone who enjoys working under time pressure" and "I see myself as someone who is productive under time pressure", separated by gender. Each bar represents the fraction of participants who chose each of the seven options: "Strongly Disagree", "Disagree", "Slightly Disagree", "Neutral", "Slightly Agree", "Agree", and "Strongly Agree". 1 corresponds to "Strongly Disagree" and 7 corresponds to "Strongly Agree".

Table 4: Relationship between survey measures and experimental outcomes (OLS)

	(1) Binary	(2) Switching	(3) Competition	(4) Component	(5) Performance
TP preference	0.103*	-0.131**	0.135**	0.141**	-0.024
	(0.054)	(0.052)	(0.060)	(0.052)	(0.066)
N	209	209	209	209	209

The table shows coefficients from OLS regressions of experimental choices on the survey measure of time pressure preference. For variable definitions and other details, please refer to the notes of Table 2. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Disaggregated relationship between survey measures and experimental outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Binary	Binary	Binary	Switching	Switching	Switching	Comp.	Comp.	Comp.
	15	25	60	15	25	60	15VS25	15VS60	25VS60
TP enjoyment	0.0315	0.127**	0.086	-0.083	-0.164***	-0.123*	0.002	0.081	0.192***
	(0.072)	(0.058)	(0.062)	(0.067)	(0.055)	(0.066)	(0.068)	(0.064)	(0.063)
TP confidence	-0.050	0.098	0.084	0.008	-0.101	-0.072	-0.011	0.077	0.107
	(0.072)	(0.062)	(0.066)	(0.065)	(0.063)	(0.064)	(0.062)	(0.062)	(0.066)
TP preference	-0.017	0.247**	0.187*	-0.083	-0.291***	-0.213**	-0.010	0.172	0.327***
	(0.133)	(0.111)	(0.113)	(0.119)	(0.110)	(0.107)	(0.120)	(0.111)	(0.122)
Performance	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	209	209	209	209	209	209	209	209	209

The table shows coefficients from regressions of detailed experimental choices on survey measures of time pressure preferences. The dependent variable in columns (1) to (3) is the binary choice between solving the games without a time limit (0) and working under time pressure (1) for each time limit. The dependent variable in columns (4) to (6) is the switching point in each of the three price lists (that is, the premium required to choose time pressure over no time pressure under each of the three limits). The dependent variable in columns (7) to (9) is the competition choice between competing under the stricter time limit (1) and competing under the less strict time limit (0) in each of the three choices. The first two rows use a single survey measure and therefore use OLS; the third row uses both survey measures and therefore uses ORIV. All regressions control for the number of games solved (out of ten) under the 15, 25, and 60-second time limits in the baseline rounds. All dependent variables and survey measures of time pressure preferences are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Relationship between personality traits and experimental outcomes

	(1) Binary	(2) Switching	(3) Competition	(4) Component	(5) Performance
TP preference	0.182	-0.229**	0.250**	0.252**	-0.103
	(0.113)	(0.110)	(0.115)	(0.110)	(0.129)
Competitiveness	0.054	-.004	0.114*	0.055	0.045
	(0.062)	(0.070)	(0.063)	(0.064)	(0.074)
Risk seeking	0.084	-0.081	-0.049	0.055	0.054
	(0.065)	(0.066)	(0.069)	(0.060)	(0.078)
Neuroticism	0.0108*	-0.068	-0.045	0.058	-0.172**
	(0.059)	(0.058)	(0.061)	(0.056)	(0.071)
Extraversion	0.075	-0.077	-0.071	0.042	-0.177***
	(0.054)	(0.056)	(0.065)	(0.051)	(0.068)
Openness	-0.018	0.060	0.064	-0.017	-0.067
	(0.062)	(0.064)	(0.068)	(0.059)	(0.071)
Agreeableness	0.095	-0.111*	0.022	0.094	0.028
	(0.066)	(0.066)	(0.063)	(0.067)	(0.067)
Conscientiousness	-0.061	0.078	-0.056	-0.077	0.106
	(0.065)	(0.068)	(0.076)	(0.069)	(0.079)
Performance controls	Yes	Yes	Yes	Yes	No
N	209	209	209	209	209

The table shows coefficients from ORIV regressions of five experimental time pressure measures on the survey measure of time pressure preference. For definitions of the dependent variables see the notes to Table 2. TP preference captures our survey measures, where one is used as an instrument for the other following the ORIV approach. The remaining independent variables are the two qualitative questions for risk attitudes and competitiveness and compound measures for each of the Big Five personality traits respectively. The latter combine the three relevant questions in the questionnaire for a given personality trait. All dependent variables and independent variables are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Relationship between survey measures and personality traits

	(1) Competitive	(2) Risk	(3) Neurotic	(4) Extrav	(5) Open	(6) Agreeable	(7) Consc
TP preference	0.245*	0.329**	-0.437***	0.334**	0.011	-0.006	0.131
	(0.128)	(0.143)	(0.131)	(0.140)	(0.133)	(0.124)	(0.130)
N	209	209	209	209	209	209	209

The table shows coefficients from ORIV regressions of five experimental time pressure measures on the survey measure of time pressure preference. For definitions of the dependent and independent variables, see the notes to Table 6.All dependent variables and independent variables are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Relationship between survey measures and performance under different time limits

	(1) Solved	(2) Time spent
TP preference	-0.001	-0.269
	(0.001)	(0.346)
TP preference × 60 seconds	-0.004	0.196
	(0.003)	(0.299)
TP preference × 25 seconds	0.000	0.319
	(0.005)	(0.316)
TP preference × 15 seconds	0.003	0.211
	(0.005)	(0.333)
N	8,360	8,360

The table shows coefficients from OLS regressions of performance measures on our combined survey preference measure, time limit dummies, and the interaction of the two. The main effects of the time limit dummies are omitted from the table. All regressions control for individual and game fixed effects using observations from the first four rounds. Robust standard errors are shown in parentheses and are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Gender differences in performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Solved		Time spent		Solved per min	
Female	0.001	0.004	1.516	-0.134	-0.224	-0.101
	(0.007)	(0.004)	(1.803)	(0.158)	(0.144)	(0.086)
Female × 60 seconds	-0.024	-0.020	0.038	1.141	-0.006	-0.051
	(0.016)	(0.015)	(1.606)	(0.876)	(0.133)	(0.128)
Female × 25 seconds	-0.061**	-0.052**	-0.550	0.981**	-0.117	-0.180
	(0.025)	(0.024)	(1.703)	(0.424)	(0.158)	(0.148)
Female × 15 seconds	-0.061**	-0.055**	-0.890	0.712***	-0.262	-0.328*
	(0.028)	(0.026)	(1.744)	(0.253)	(0.177)	(0.173)
Performance no time limit		✓		✓		✓
N	8,360	8,360	8,360	8,360	836	836

The table shows coefficients from OLS regressions of performance measures on gender, time limit dummies, and the interaction of the two. The main effects of the time limit dummies are omitted from the table. All regressions control for individual and game fixed effects using observations from the first four rounds. Performance controls consist of the number of correctly solved problems and total time spent in the baseline games without a time limit, interacted with time limit dummies. Robust standard errors are shown in parentheses and are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Gender differences in experimental choices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Binary		Switching		Competition		Component		TP preference	
Female	-0.243*	-0.052	0.285**	0.095	-0.369***	-0.225*	-0.338**	-0.134	-0.332**	-0.345**
	(0.139)	(0.119)	(0.138)	(0.118)	(0.136)	(0.127)	(0.137)	(0.114)	(0.138)	(0.142)
Perf.		✓		✓		✓		✓		✓
N	209	209	209	209	209	209	209	209	209	209

The table shows coefficients from OLS regressions of experimental choices on gender. For variable definitions and other details, please refer to the notes of Table 2. Performance controls consist of the number of games solved at each time limit (60, 25 and 15 seconds) in the baseline rounds. All dependent variables are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Relationship between survey measures of time pressure preferences and career option rankings controlling for personality traits

	Investment banking	Data analyst	Business analyst	Accoun-ting	Consul-ting	Back office	Ave. rank high pay
TP preference	0.115*	0.145**	0.072	-0.017	0.231***	-0.027	0.220***
	(0.069)	(0.065)	(0.068)	(0.068)	(0.066)	(0.067)	(0.067)
Personality	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	711	711	711	711	711	711	711

	Entrepreneur	Front office	Academia	Management trainee	Public researcher	Sales	Ave. rank low pay
TP preference	-0.040	-0.151**	-0.035	-0.138**	-0.054	-0.060	-0.220***
	(0.068)	(0.071)	(0.068)	(0.0643)	(0.071)	(0.0768)	(0.067)
Personality	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	711	711	711	711	711	711	711

The table shows coefficients from ORIV regressions of the rank given to each career option from 1 (least favorite) to 12 (favorite) by the surveyed bachelor students on the survey measure of time pressure preference. TP preference captures both our survey measures by using one as an instrument for the other following the ORIV approach. Personality controls include the Big Five personality traits, competitiveness and risk preferences. The regressions control for gender and study major (economics or business). All dependent variables and independent variables are standardized. Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 12: Relationship between survey measure of time pressure preferences and career option rankings using OLS

	Investment banking	Data analyst	Business analyst	Accoun-ting	Consul-ting	Back office	Ave. rank high pay
TP preference	0.112**	0.116**	0.053	-0.025	0.170***	-0.092*	0.056***
	(0.057)	(0.057)	(0.050)	(0.064)	(0.050)	(0.052)	(0.021)
N	795	795	795	795	795	795	795

	Entrepreneur	Front office	Academia	Management trainee	Public researcher	Sales	Ave. rank low pay
TP preference	-0.013	-0.120**	-0.007	-0.121**	-0.029	-0.044	-0.056***
	(0.065)	(0.055)	(0.067)	(0.055)	(0.058)	(0.067)	(0.021)
	795	795	795	795	795	795	795

The table shows coefficients from OLS regressions of the average rank given to each career option from 1 (least favorite) to 12 (favorite) by the surveyed bachelor students on the average answer given to the two time pressure survey items. The regressions control for gender and study major (economics or business). Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix B: Pre-Analysis Plan

In this section, we reproduce the pre-analysis plan (as registered on the AEA registry at https://doi.org/10.1257/rct.7667-1.0). After each section, we also add a few remarks explaining how our analysis differs from the pre-analysis plan (if at all). Note that our pre-analysis plan only applies to the analysis of the online experiment, and not the analysis of the student survey.

Introduction

The study has three aims:

1. Study the average performance impact of time pressure on performance in a cognitive task

2. Study individual heterogeneity in the impact of time pressure

3. Study individual preferences for working under time pressure using incentivized choices

Sample Restrictions

For our main analysis, we will exclude participants based on the following criteria:

1. Dropping out of the survey partway through.
2. Taking a longer break (>30 minutes) at some point during the survey.
3. People who solved fewer than 80% of the games without a time limit in rounds 1-4.

We will present robustness checks that include the participants mentioned in criterion (3) in the appendix. In addition, we will exclude participants based on the following criteria for tests that involve the following variables:

4. Questionnaire variables: participants who selected the same option (e.g., the minimum value) on all questions on a particular questionnaire page.
5. Decisions in round 5: participants who switched multiple times (after the program sent them a reminder).

Here too, we will repeat the analysis relaxing these restrictions in the appendix.

Authors' Notes: we ended up excluding one participant who switched multiple times and one participant who took a longer break. There were no participants who met any of the other criteria. Because so few participants were affected, our exclusion criteria did not affect our results, which led us to not include the analysis for the full sample in the appendix. However, the results are available to interested readers upon request.

Analysis

a) Analysis of average impact:

We will use data from the first four rounds (40 games) to estimate the average impact of time pressure on performance. We will use data at the game level and regress a dummy for whether the game was solved on time limit dummies controlling for subject dummies and game number dummies, clustering the standard errors at the subject level. We will do the same with time spent per game.

We will then look at productivity (games solved per minute spent working) by collapsing the data at the subject × time limit level and then regressing the number of correctly solved games at each time limit (out of ten) divided by the number of seconds spent working at each time limit on time limit dummies controlling for subject dummies and clustering the standard errors at the individual level.

We will also look at gender differences in the impact of time pressure.

Authors' Notes: the analysis on performance impacts is presented in Table 1 for the whole sample and in Table 9 for the analysis of gender differences.

b) Study individual heterogeneity in the impact of time pressure:

The experiment will be preceded by a questionnaire that elicits measures of personality traits on a Likert scale (Big Five, competitiveness, risk seeking). In between these standard items, we will add two items eliciting self-judged enjoyment and productivity when working under time pressure.

We will regress the number of games solved under a 15-second limit and a 25-second limit (out of 10), as well as the sum of the two (number of games solved out of 20) on the questionnaire measures (and the sum of the two questionnaire measures) at the subject level. We will also run regressions at the game level (as specified before under point a) where we interact the time limit dummies with the questionnaire measures.

Authors' Notes: We include the game-level regressions in Table 8 in the appendix. We omit the individual-level regressions because their results are identical to the game-level regressions in that we do not find evidence of heterogeneous effects of time pressure on performance by survey measure score.

c) Study individual preferences for working under time pressure:

We are both interested in determining whether participants are averse to time pressure in the aggregate as well as studying individual heterogeneity in time pressure aversion.

We will construct the following choice measures:

- First choice 15 seconds versus no time limit (binary)

- First choice 25 seconds versus no time limit (binary)
- The sum of these two choices
- Switching point 15 seconds versus no time limit
- Switching point 25 seconds versus no time limit
- The three binary competition choices

To look at individual heterogeneity in preferences, we will regress these choices on both our objective performance measures (number of games solved under 15 seconds and 25 seconds) and the questionnaire measures (productivity, enjoyment and the sum of the two), using OLS regressions at the subject level (tobit regressions for the switching points). Finally, we will also run regressions where we add the other elicited personality traits and correlate these traits with our new time pressure measures to check whether preferences for working under time pressure are captured by commonly studied traits and preferences.

We will also study gender differences both in choices and in self-rated preferences.

To study aggregate levels of time pressure aversion, we will compare actual choices to profit-maximizing choices (judged by performance in the first 40 games). In particular, we will compare the first choice for 15, 25 and 60 seconds versus no time limit to the profit-maximizing choice and determine the proportion of participants who are averse, neutral or attracted towards time pressure. We will do the same comparing actual to profit-maximizing switching points. Finally, we will compare these choices to choices under risk in the post-experimental lottery choice task to determine the role of risk aversion in determining aversion to time pressure.

Authors' Notes: The analysis of time pressure aversion is presented in Section 3.2. In addition to the choices mentioned above, we also looked at the binary choice and switching point for 60 seconds versus no time limit. We also decided to omit the sum of the two binary (15 seconds and 30 seconds) choices as an outcome for brevity; however, the results are identical to analyzing the two first binary choices individually. We present the specified regression analysis in Section 3.3 (Table 2) and the appendix (Tables 4 and 5). In our preferred specification in the main text, we used ORIV instead of OLS to deal with measurement error and focused on the sum across the three time pressure amounts as our main outcome variables for brevity. The pre-registered OLS specifications that look at individual outcomes are presented

in the appendix. We also decided to look at the principal component of time pressure preferences and at correlations between the survey measures and performance for completeness. The gender analysis is presented in Table 10 in the appendix. The analysis on personality traits is presented in Table 5 in the appendix.

Power Calculations and Minimum Detectable Effect Size

For part (a) we are interested in the effect of time pressure on performance. We can compute power using a paired means t-test for two levels of time pressure. This is equivalent to the regression analysis proposed under part (a), apart from not controlling for game number dummies. In a pilot experiment, we observed that going from no time pressure to 25 seconds decreased performance from 96% to 68% (the standard deviation of the difference is approximately 18 percentage points). With our intended sample size of 200 participants, our power to detect a similar effect size would be equal to 1. Similarly, even for the difference we observed between no time pressure (96% solved) and 60 seconds (93% solved), we would have a power of 1 with our intended sample size (standard deviation of the difference of approximately 9 percentage points). In other words, we have very high power to detect time pressure effects on performance.

For parts (b) and (c) we are essentially looking at correlations between different outcome variables. With our intended sample size (200), we can expect to have a power of greater than 0.80 to detect correlations of 0.20 or above.

Appendix C: Experimental Instructions

The experiment was programmed with oTree (Chen et al., 2016) and conducted online in Zoom sessions using the subject pool from the CREED laboratory of the University of Amsterdam in June 2021. There were 16 sessions with a total of 209 participants of which 101 are female and 108 are male. Due to the nature that participants were doing the experiment online at their desired location, extra instructions were given to facilitate the smoothness of the experiment. However, technical issues such as webpage crash due to unstable Internet from the participants' side are unavoidable. As long as a participant contacted the experimenter and reported a technical issue, observations from this participant were removed from the sample. Since the experiment is individual, problems that happened to one participant did not affect other participants in the same session. Below are the instructions used for the experiment.

Introduction

Thank you for taking part in this study on decision making. It will take approximately 40 minutes. You will receive a €4 participation fee with a chance to earn additional money during the study. Please use a laptop or computer to complete this experiment.

This is an online study. Please stay in the Zoom session during the entire study. Please keep your video off and stay muted throughout the experiment.

If you have any questions, you can message the experimenter during the experiment. The Zoom session only allows participants to message the experimenter. Any question you ask and the answer from the experimenter will not be shown to any other participant.

The study starts with a short questionnaire followed by a main part in which you will play a game for 5 rounds. Each round consists of 10 games. One of the 5 rounds will be randomly selected for payment. The study ends with a survey in which you can earn additional money.

If you are unable to make it to the end of the study, you will only receive the €4 participation fee.

You will not be asked for any personal information. The data we collect is fully anonymous. In case you have any questions regarding the data we collect, please

contact the university's Data Protection Officer at fg@uva.nl.

This study complies with General Data Protection Regulation (GDPR).

Please click "Next" if you consent to proceed with the study.

Introduction

Please do not switch to other webpages or applications while doing the experiment.
Please do not refresh the experiment page either.
Doing so risks crashing the experimental program.
Please also maximise your browser window or enter full screen mode.
Failing to do so may cause errors later.

Questionnaire

Before we explain how you can earn money in the study, we ask you to fill out a short questionnaire. For each item, please select the option that fits you the best.

Questionnaire Page 1/3

How well do the following statements describe your personality?

Question 1

I see myself as someone who worries a lot.

Question 2

I see myself as someone who gets nervous easily.

Question 3

I see myself as someone who remains calm in tense situations.

Question 4

I see myself as someone who is productive under time pressure.

Question 5

I see myself as someone who is talkative.

Question 6

I see myself as someone who is outgoing, sociable.

Questionnaire Page 2/3

How well do the following statements describe your personality?

Question 7

I see myself as someone who is reserved.

Question 8

I see myself as someone who is original, comes up with new ideas.

Question 9

I see myself as someone who enjoys working under time pressure.

Question 10

I see myself as someone who values artistic, aesthetic experiences.

Question 11

I see myself as someone who has an active imagination.

Question 12

I see myself as someone who is sometimes rude to others.

Questionnaire Page 3/3

How well do the following statements describe your personality?

Question 13

I see myself as someone who has a forgiving nature.

Question 14

I see myself as someone who is considerate and kind to almost anyone.

Question 15

I see myself as someone who is willing to take risks.

Question 16

I see myself as someone who does a thorough job.

Question 17

I see myself as someone who tends to be lazy.

Question 18

I see myself as someone who does things efficiently.

Question 19

I see myself as someone who is competitive.

Seven options were given for each question: "Strongly Disagree", "Disagree", "Slightly Disagree", "Neutral", "Slightly Agree", "Agree", and "Strongly Agree".

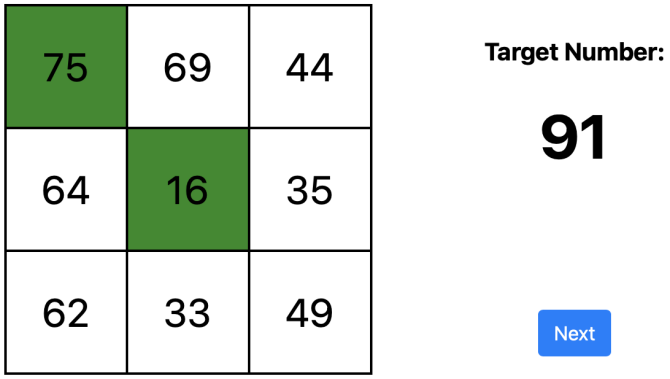
Instructions

Thank you for filling out the questionnaire.

You are now ready to start the main part of the study. You will be paid for your performance in a game. Every game consists of a board with nine different numbers. Your task is to find the two numbers (out of the nine) that jointly add up to a "target number". You can select a number by clicking it. Once clicked, the number will turn green. To deselect a number, you can simply click it again.

After you have selected your two numbers, you can press the "Next" button to continue.

Here is an example of a game. The two selected numbers (75 and 16) add up to the target number of 91.



Before we explain how you can earn money in this part of the study, we will give you 3 practice games for you to familiarize yourself with the game.

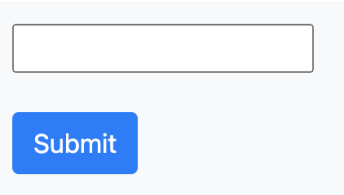
Please press the "Next" button to proceed to the practice games.

Payment Registration

Before continuing with the study, we need to ask you to provide your IBAN, which we will use to send you your earnings for the study.

Please double-check to make sure that the IBAN you provide is the correct one. You will not be able to change this at a later point. If you fail to provide the correct IBAN, we will not be able to send you your payment. If you provide the correct IBAN, we will transfer your earnings to you within 5 business days. We will delete this number after making the payment.

Please enter your IBAN number here:



Instructions

You are now almost ready to start playing the game. You will play the game for 5 rounds.

Each round consists of 10 games and you need to solve each game within a certain time limit. The time limit will change from game to game.

The amount of time you have to find the solution to each game will be either 15, 25, or 60 seconds or no time limit.

Your earnings will be determined as follows: In each round, you start with a budget of €10. €1 will be deducted for each game for which you give an incorrect answer, or fail to provide an answer within the time limit. Your earnings for a given round will be equal to the amount left when you finish the 10 games in that round.

At the end of the study, 1 of the 5 rounds will be randomly selected for payment. You will receive the final earnings for that round.

Please press the "Next" button to continue.

Round 1-4

[Before the start of each round, participants were shown an instruction page indicating the round number. Before the start of each game, participants were shown an instruction page showing the exact time limit (15 seconds, 25 seconds, 60 seconds, or no time limit) for the upcoming game for 5 seconds. The game started automatically after the 5-second timer ran out. After the participants pressed the "Next" button or the time ran out, they were shown a result page with information on the time limit for the game, the result of the game, and the remaining payoff for the current round. There were three potential results of the game: "You chose the correct answer for this game", "You did not provide an answer for this game", and "You chose an incorrect answer for this game". The result page was also shown for 5 seconds. The result page for the last game in each round also indicated the final payoff for the current round. The following screenshots show what participants see in the experiment.]

Instructions

You are now in Round 1.

Next

Instructions

The time limit for Game 1 is **60** seconds.

Seconds left on this page: **2**

Game 1 of 10

0:52

48	34	35
36	41	64
53	13	67

Payoff:

€10.00

Target Number:

82

Next

Game 4 of 10

No Time Limit

72	75	21
12	25	28
48	82	11

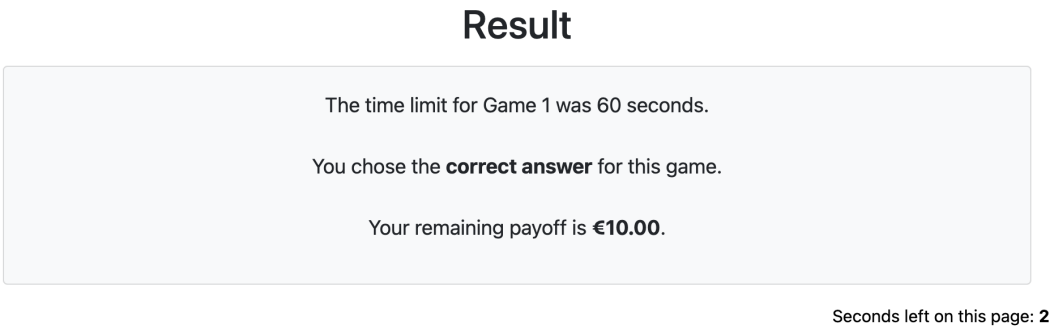
Payoff:

€7.00

Target Number:

94

Next



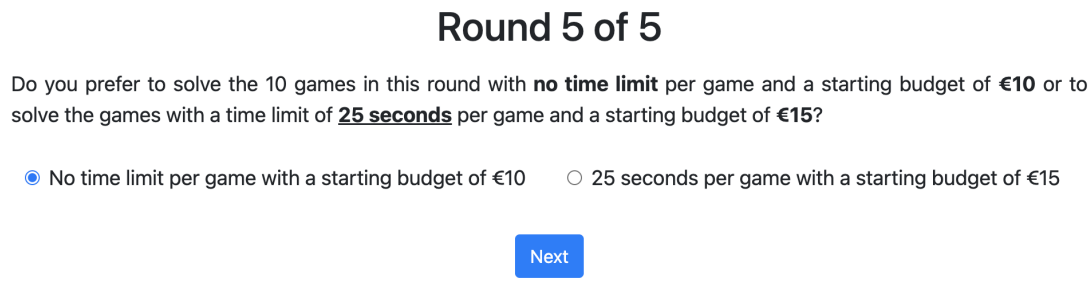
Round 5

You have now arrived at the final round (Round 5). In this round, you will still play the game 10 times. The difference compared to previous rounds is that this time you will be able to choose the time limit that will be applied to the 10 games.

In particular, you will be asked to make several decisions between two payment options. The first option in each decision is always to start the round with a budget of €10 and solve each game with no time limit. The second option varies across the various decisions and will always have an equal or larger starting budget, but you will also have to solve each game under a tighter time limit.

After you have made all decisions, one decision will be randomly selected. As before, €1 will still be deducted for each game for which you give an incorrect answer, or fail to provide an answer within the time limit. Your payment in round 5 will then be determined according to the payment option you chose in this decision.

Please press the "Next" button to proceed to making the decisions.



Round 5 of 5

On the previous page, you chose between "25 seconds per game with a starting budget of €15" and "No time limit per game with a starting budget of €10". We will now ask you to make the same choice for different starting budgets.

You will note that some of the choices have already been filled out for you. This is because on the previous page you chose "No time limit per game with a starting budget of €10" over "25 seconds per game with a starting budget of €15". We therefore assume that you would still prefer no time limit with a starting budget of £10 over the shorter time limit if you received an even smaller starting budget for the shorter time limit.

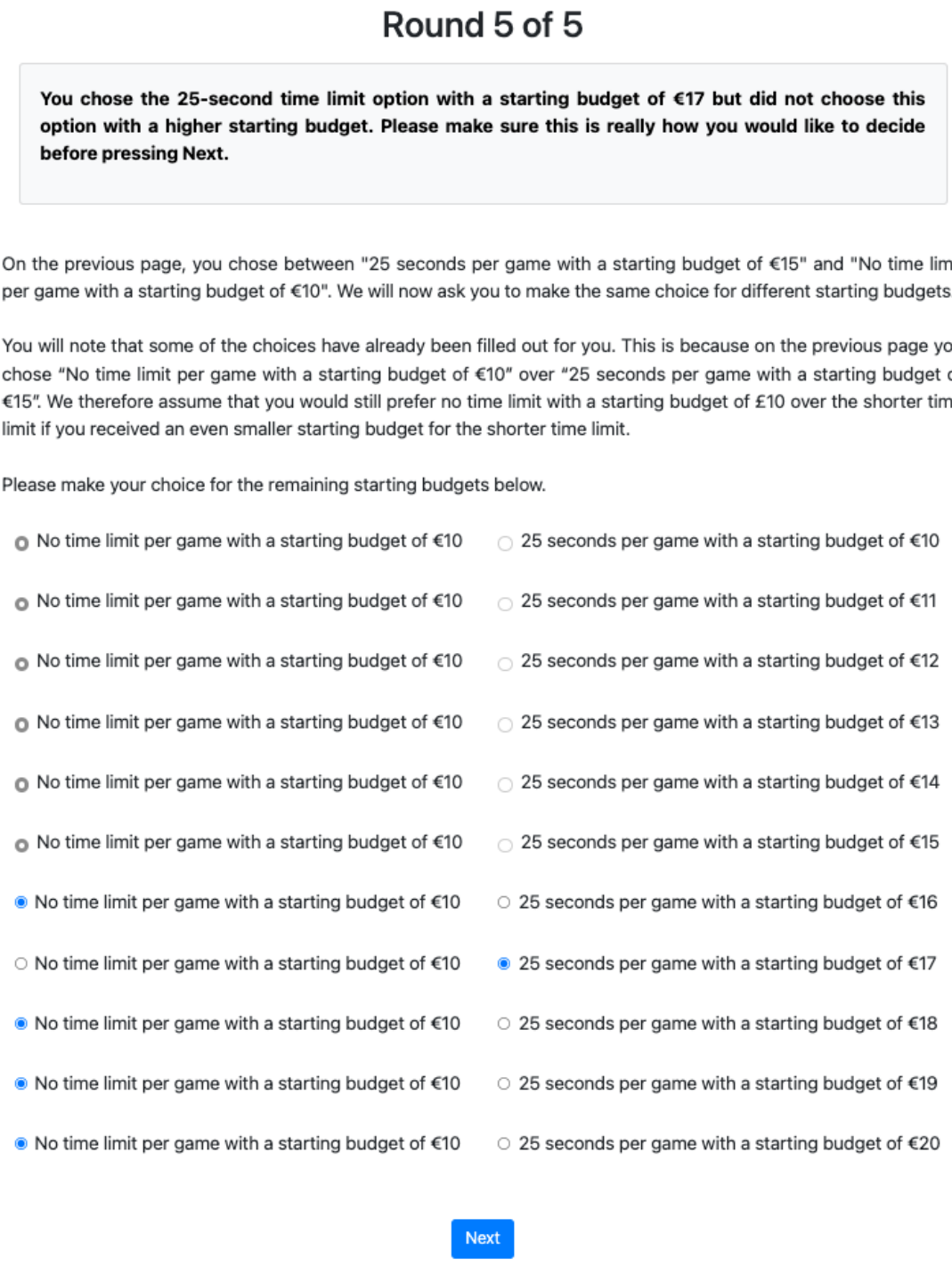
Please make your choice for the remaining starting budgets below.

◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €10
◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €11
◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €12
◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €13
◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €14
◉ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €15
○ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €16
○ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €17
○ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €18
○ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €19
○ No time limit per game with a starting budget of €10	○ 25 seconds per game with a starting budget of €20

Next

[*Above is a screenshot of the price list after the no time limit option is chosen over 25 seconds per game with a starting budget of €15. The starting budget was €16 for a time limit of 15 seconds per game and €14 for a time limit of 60 seconds per game. Given the decision in the binary choice, we assume that participants would also like to choose the no time limit option when the starting budget for solving each game under a time limit of 25 second is lower than €15. If participants switched between*

no time limit and time limit for more than once, they would see the following screen. If they still switched between the two options for more than once, their entries were removed from the sample.]



Round 5 of 5

In the three final decisions, you are asked to choose between two **competition** schemes. If one of these three decisions is implemented, the total number of games you solve within the time limit will be compared to the performance of **a randomly selected other participant** who participated in a previous session of this study and who encountered **the same set of games with the same time limit.** If you solve more games within the time limit than the other participant did, you will receive a payoff of €10 for this round. If you solve fewer games, you will not receive anything for this round. This means that there will be no deductions for late or incorrect answers submitted. In case of a tie, the competition outcome will be randomly determined.

Next

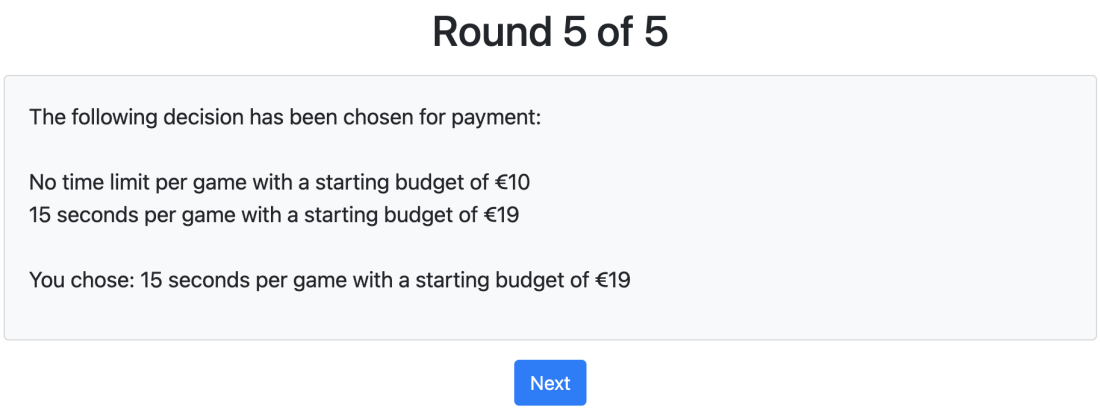
Round 5 of 5

You are asked to **choose the time limit** for your competition. The first decision is to choose between a time limit of 15 seconds and a time limit of 25 seconds. If you choose a time limit of **15 seconds** per game, you will compete against the performance of a randomly selected other participant who also performed with a time limit of 15 seconds per game. If you choose a time limit of **25 seconds** per game, you will compete against the performance of a randomly selected other participant who also performed with a time limit of 25 seconds per game.

○ Compete with a time limit of 15 seconds per game ◉ Compete with a time limit of 25 seconds per game

Next

[*Two more decisions were made: "Compete with a time limit of 15 seconds per game" or "Compete with a time limit of 60 seconds per game" and "Compete with a time limit of 25 seconds per game" or "Compete with a time limit of 60 seconds per game". After all 33 decisions were made, one decision was randomly selected for implementation. Participants saw the following screen.*]



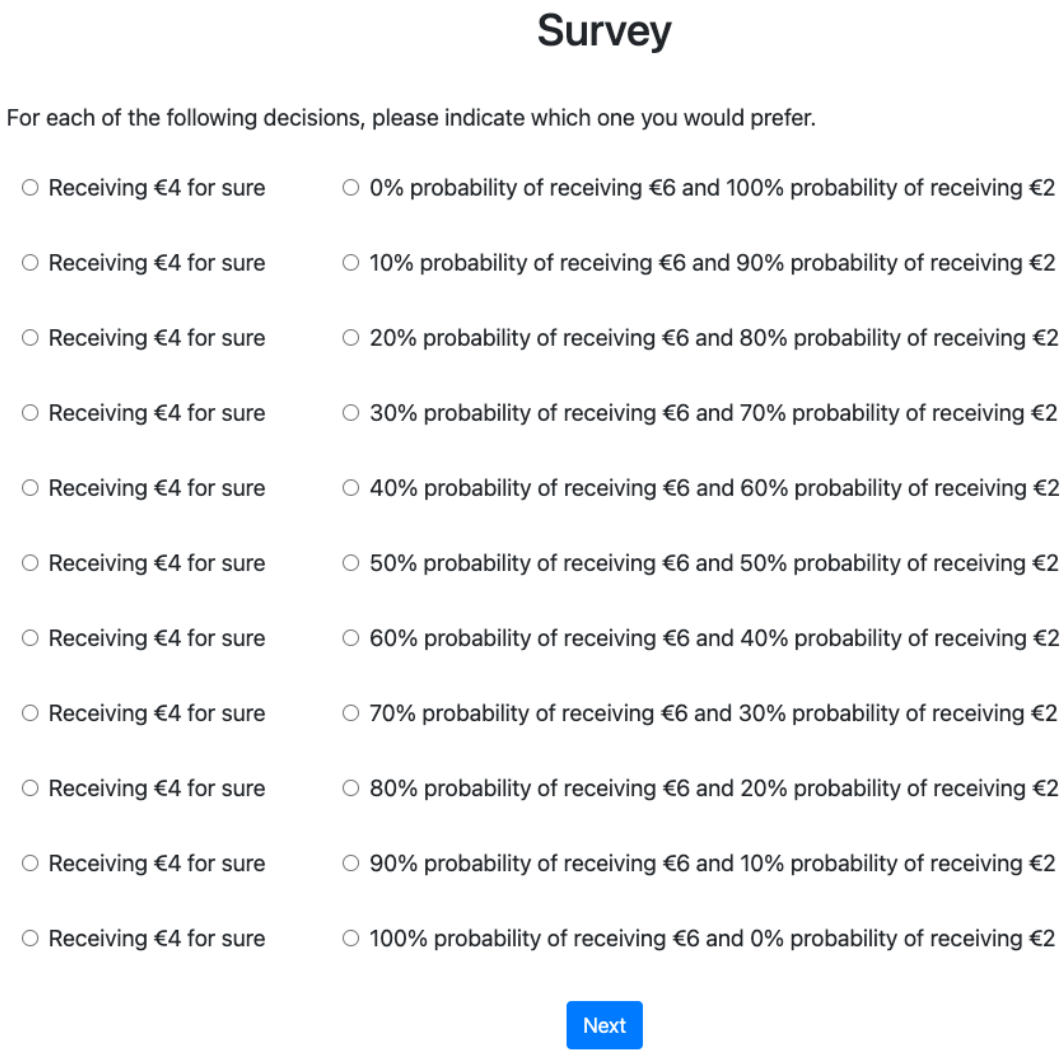
[Above is an example of a selected decision. Round 5 would be implemented in a way that participant would have a starting budget of €19 and have to solve each game under a time limit of 15 seconds. Except the starting budget and the time limit, everything else was the same as in round 1-4. After round 5, participants would fill in the following final survey.]

Survey

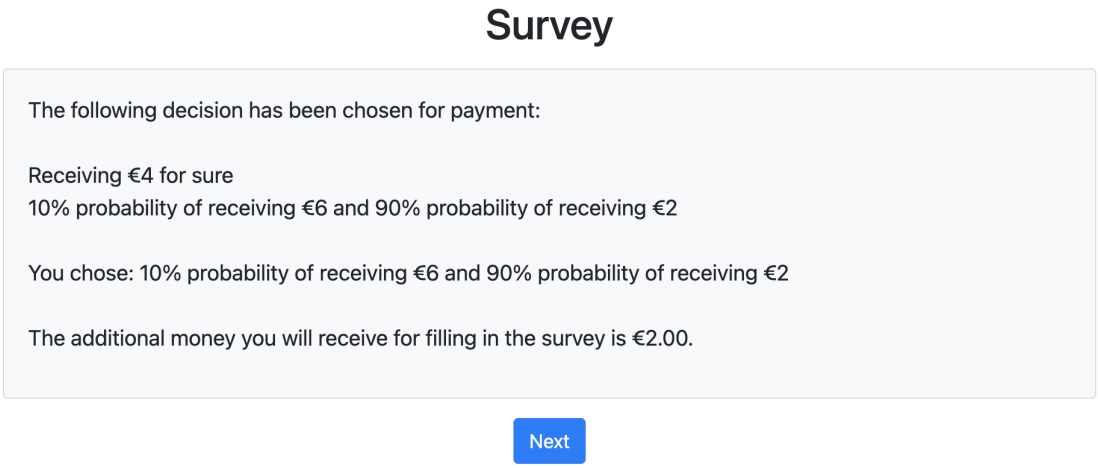
This is almost the end of the study. We now ask you to fill out a short survey in which you have the chance to earn additional money.

On the next page, you will make 11 decisions between a sure amount of €4 and a random lottery between €2 and €6 with changing probabilities.

After you have made all decisions, one decision will be randomly selected. Your additional earnings will then be determined according to the option you chose in this decision.



[*After the lottery choice, a few general demographic questions were asked. These questions include age, gender, nationality, and study program. One random decision out of 11 lottery choices were chosen to determine the amount of additional money participants could earn. This is shown in the following screenshot.*]



End of Study

You have now finished the study. Please click "Next" to see your payment.

End of Study

Thank you for participating in the study.

Your results for each round were the following:

Round	Final Earnings (€)
1	7.00
2	2.00
3	1.00
4	6.00
5	5.00

The computer randomly selected round 4 for payment.

Your final earnings for this round are €6.00.

Your additional payoff from the previous survey is €2.00.

Including your participation fee of €4.00, your total earnings for the study are €12.00.

Your payment will be transferred to your bank account within 5 working days.

Please press "Next" to end the study.

Next