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# Prosociality in variants of the dictator game: evidence from children in El Salvador

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**Abstract**

We study prosocial behavior among primary school students in El Salvador. In a within-subject lab-in-the-field experiment, we examine the relationship between individual traits, i.e., cognitive skills, non-cognitive skills and violence exposure, and how sensitive children are to the changes in the setting of the dictator game. We propose two different variants of the dictator game: allowing the option to take and starting off with relatively unequal initial endowments. We find that prosocial behavior positively correlates with cognitive skills, while no significant correlation with non-cognitive skills and violence exposure arises. Our results show that children are sensitive to the widening of the choice set, with a significant drop in the amount given when the take option becomes available. Children with lower cognitive skills mainly drive the effect. Lastly, we find that children show a stable willingness to redistribute the final resources despite initial disparities, which is unaffected by the level of cognitive skills, non-cognitive skills, and violence exposure. We conclude that cognitive abilities are not only positively related to prosociality, but also to consistency in prosocial behavior across changes in the choice-set of the dictator game.

**JEL Codes:** D91, C91

**Keywords:** dictator game, choice-set, cognitive skills, inequality aversion, El Salvador

## 1 Introduction

Social preferences are important traits affecting a wide range of economic and social outcomes (Fehr and Schmidt, 1999; Andreoni and Miller, 2002; List, 2006). There has been a growing interest in recent years in understanding whether social preferences are stable traits or if they develop with age. The existing evidence point towards the latter, with children behaving more selfishly in the

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early years while transitioning towards more egalitarian distributions of resources as they enter school, and more sophisticated motifs later on during adolescence (Fehr et al., 2008; Sutter et al., 2019; List et al., 2021). In addition to gender, age, and socioeconomic background (Harbaugh et al., 2003; Bettinger and Slonim, 2006; Bauer et al., 2014b; Deckers et al., 2015; Angerer et al., 2015; Sutter et al., 2019; Kosse et al., 2020), social preferences seem to correlate with cognitive skills and non-cognitive skills (Millet and Dewitte, 2007; Chen et al., 2013; Blake et al., 2015; Sutter et al., 2018) - other key traits developing during childhood (Borghans et al., 2008; Heckman et al., 2010; Kautz et al., 2014). Finally, social preferences can be shaped by external factors or interventions (Cappelen et al., 2019; Kosse et al., 2020; Alan et al., 2021).

The dictator game is the most widely used task to measure social preferences during childhood (Kahneman et al., 1986; Forsythe et al., 1994; Camerer, 2011). Since Harbaugh et al. (2003), numerous papers have used the dictator game as a tool to study social preferences in children and adolescents.[1] However, in the adult population, questions have been raised regarding the interpretation of behavior in the dictator game (Chlaß and Moffatt, 2017). Small changes in the dictator's action set lead to reactions that are not consistent with standard models of distributional preferences proposed by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). When dictators are presented with the option to take from the recipient's endowment, the propensity to contribute positive amounts decreases (Eichenberger and Oberholzer-Gee, 1998; List, 2007; Bardsley, 2008). List (2007) and Bardsley (2008) speculate that choices in the game are not only driven by preferences but also by perceived context-specific social norms, by experimental demand effects or by range effects, implying that choices in the game may not easily translate to behaviors in the field. These results have been confirmed in several adult populations and contexts and do not appear to vary significantly by gender, age, and education of dictators (Cappelen et al., 2013). To our knowledge, no study has explored whether similar responses occur in children.

Other variations of the standard dictator game investigate the effects of inequalities in the distribution of the initial endowment. Studies with adults show that the distribution of the final payoff responds to the inequality in the distribution of the initial endowments. This helps to shed light on the motivation underlying dictators' behavior. Higher levels of redistribution reveal dictators' inequality aversion, while low levels of redistribution reveal dictators' "asset legitimacy" (Bolton and Katok, 1998a; Eckel et al., 2005; Korenok et al., 2012). Guala and Mittone (2010) suggest that even little variations in the game setting might trigger different normative cues, and the individual behavior will reflect a trade-off between norms pushing in different directions. Again, to our knowledge, studies have yet to investigate how children respond to different variations in the game settings and how consistently they respond to them.

This paper extends the analysis of social preferences during childhood as studied through choices in the dictator game to a sample of primary school children in a developing country. In particular, we take advantage of a particular context, El Salvador, where low socio-economic

[1] See Sutter et al. (2019) and Martin and Olson (2015) for an overview

conditions are combined with high levels of violent crimes.[2] Our study is developed at the beginning of a larger intervention conducted in schools and local communities by an international NGO aimed at developing children's social skills and community support to prevent violence and improve schooling outcomes. We explore the relationship between children's traits and prosocial behavior and the reaction to changes in the setup of the dictator game. We expand the usual set of correlates explored in the literature (i.e. age, gender and SES) and focus on cognitive skills, non-cognitive skills, and violence exposure. We do this by studying children's behavior in variants of the dictator game, in a within-subject lab-in-the-field experiment. Changes in the dictator game setting are expressed in two ways. First, we vary the action set, allowing the dictator to take from the recipient's endowment. Second, we vary the initial endowment of the dictator who randomly starts in advantage or disadvantage compared to the recipient. In the standard set-up, the outcome of interest is the amount passed by the dictator, which also determines the final split of the total payoff. When initial endowments vary between the dictator and recipient, the outcome of interest is the final distribution of resources.

We find that 91% of pupils have a positive contribution in the standard dictator game which amounts, on average, to about 40% of their endowment. Behaviors change significantly when players are allowed to take from the initial endowment of the recipient. The amount passed to the recipient drops to about 34%. Furthermore, only 79% still choose to have a positive contribution, 15% of pupils choose to take tokens from the initial endowment of the other recipient, and another 6% give nothing, leading to a large reduction in the recipient's relative wealth. Our result confirms the findings in between-subject experiments on adults by List (2007) and Bardsley (2008).

As for the change in the initial endowment, children show a stable willingness to sacrifice money and redistribute resources. The final payoff distribution appears mostly unaffected by the distribution of the initial endowment. Hence, children, regardless of their initial status (advantage vs. disadvantage), compensate for the initial inequalities. Other studies on adults find that the extent of prosocial behavior, as measured through similar tasks, is positively related to the difference in the initial condition between the dictator and the recipient (Bolton and Katok, 1998b; Korenok et al., 2012).

In the standard dictator game (played first) and when pooling all tasks, we find a strong positive association between prosociality and cognitive skills. In contrast, we do not observe a significant correlation with gender, age, SES, non-cognitive skills, or violence exposure.[3]

In addition to predicting prosocial choices, cognitive skills are also correlated with responses to the change in the choice set (i.e., the option of taking). Pupils with higher cognitive skills are less sensitive to such change: their average contribution to the recipient is not signif-

[2] In El Salvador, following the civil war, violence decreased gradually until the rise of the gang culture in the beginning of the 2000s. Since then, the country has been experiencing massive fluctuations in homicides and kidnappings and has had one of the highest homicide rates in the world (Sviatschi, 2018).

[3] The effect of age, which is commonly found in the literature, is fully absorbed by cognitive skills, in line with what is highlighted in List et al. (2021).

icantly different under the "give" and "take" tasks. Conversely, low-skilled students contribute significantly less in the "take" task compared to the standard dictator task. This drives a relevant part of the observed choice-set effect. No differential reaction is found by non-cognitive skills, violence exposure or other individual characteristics (gender, age, and SES).

While cognitive skills predict larger payoff distribution to the recipient in all tasks, we find that cognitive skills do not affect students' responses to different initial endowments. Pupils' distribution of the final payoff is stable in "take" tasks regardless of the level of cognitive skills. Again, we do not find any heterogeneous effect along non-cognitive skills, violence exposure, and other individual characteristics.

Our paper makes the following contributions to the literature. First, there is evidence showing that subtle changes in the settings of dictator games can lead to decisions that cannot be reconciled with standard social preferences models (Dana et al., 2007; List, 2007; Bardsley, 2008). This has questioned the extent to which the results from dictator games played in the lab can extend to the real world (Levitt and List, 2007). Some studies do not exclude that the behavior in the dictator game is an artifact or is mainly driven by experimenter demand effects (Bardsley, 2008; Zizzo, 2010; Chlaß and Moffatt, 2017). Other studies rationalize dictator's reaction to changes in the choice set by appealing to the role of social norms (Krupka and Weber, 2013; Kimbrough and Vostroknutov, 2016), signalling and social image concerns (Andreoni and Bernheim, 2009; Alevy et al., 2014), and impure altruism (Korenok et al., 2014). We contribute to this literature by confirming the general finding on the choice-set effects when the "take" option becomes available on a sample of children. We also identify a critical personal characteristic, cognitive skills, which identifies a subgroup – those with lower cognitive skills – mostly responsible for driving the choice-set effect. Other papers have looked at the heterogeneous choice-set effects. Cappelen et al. (2013) find that the choice-set effect does not significantly vary by gender, age, and education among the general (Danish) population. Alevy et al. (2014) find that the choice-set effects vary by the degree of observability and gender, pointing to the importance of gender-specific self-signalling concerns. Finally, Zhao et al. (2018) find significant correlations of choice-set effects with personality traits, while Hauge et al. (2016) find that taking (vs. giving) is not affected by cognitive load. Interestingly, when facing a task where the game setting changes relate more closely to distributional concerns, the low-cognitive skills group responds similarly to the high-skills one.

Second, we contribute to the vast literature looking at the correlates of prosocial behaviors, as measured through dictator games, by focusing on cognitive function, non-cognitive skills, and violence exposure in a context where violence may play an important role in the development of children.[4] Cognitive skills have been shown to predict higher prosocial behaviors in correlational studies on both children and adults (Han et al., 2012; Chen et al., 2013; Angerer et al., 2015;

[4]Note that El Salvador is one of the most violent countries in the world, with vast territories being controlled by rivalling gangs. Even though the department where the study was conducted, Chalatenango, has lower homicide rates than the national average, it exceeds by far the homicide rates in most countries worldwide.

Falk et al., 2018).[5] Non-cognitive skills, which appear to be more malleable throughout life than cognitive skills (Borghans et al., 2008; Kautz et al., 2014), have been shown in recent studies, focusing on specific domains, to have a positive causal impact on prosocial behaviors (Blake et al., 2015; Blattman et al., 2017; Heller et al., 2017; Alan et al., 2021). Finally, there is overwhelming evidence of the positive causal relationship between violence exposure and prosociality in adults (see Bauer et al., 2016 for a review focused on war violence, conflict, and crime victimization.).[6] Scholars have shown that other relevant determinants of prosociality in children are age, gender, time and risk preferences, in-group favoritism, the socio-economic conditions, and the social environment of the family (Van Vugt and Van Lange, 2006; Blake et al., 2015; Angerer et al., 2015, 2016; Almås et al., 2017; Sutter et al., 2019; Kosse et al., 2020). We find that, across the different tasks of the dictator game, higher cognitive skills predict higher prosocial behaviors: larger transfers to the recipient and higher relative wealth of the recipient. We note, however, that due to the within-subject design, the correlation between cognitive skills in the "Take" tasks may be influenced by the behavior of pupils in the task played first, i.e., the standard dictator game. In contrast to cognitive skills, we find no significant correlation between prosocial behavior and neither non-cognitive skills or violence exposure. In addition, we do not find gender, age, or SES to correlate with prosocial behavior, especially after conditioning on cognitive skills.

Our paper has some limitations. First, the analysis is based on a within-subject experimental design. While some features, such as the randomization of the order of tasks following the standard dictator game, should limit learning and anchoring effects, the design may suffer from experimenter demand effects.[7] On the other hand, within-subject designs provide more statistical power (Charness et al., 2012) given the contextual constraints of the experiment. Second, the dimensions of heterogeneity assessed have been chosen in order to fill gaps in the literature but have not been pre-specified. To mitigate this limitation, we apply multiple hypothesis corrections. The key results hold. Third, we can only speculate on the underlying mechanisms behind the observed behaviors. Due to limited literacy skills and logistical constraints, it was impossible to measure participants' beliefs (e.g., perceived social norm, perception of fairness in the distribution of the initial endowment).

The remainder of this paper is organized as follows: Section 2 presents the experimental design, data, and descriptive statistics. Section 3 describes in detail the variables used in the analysis. Section 4 discusses the main results, potential mechanisms, and robustness checks. Finally, Section 5 concludes.

[5] Castillo et al. (2020) is an exception, finding no correlation between social preferences and cognitive skills or executive function among children 3 to 5 years old, suggesting that the relationship is likely to build up with age.

[6] We also highlight two recent studies on adolescents and young adults. Bogliacino et al. (2019) find that recalling crime-related violence exposure in urban Colombia increases prosocial behavior; the effect is driven by trauma and wealth shock. Cavatorta et al. (2023) find that adolescents that are more exposed to conflict context, measured as the obligation to cross military checkpoints to go to school, engage in more reciprocal behavior.

[7] However, this has been argued to be a relevant factor also in between subject studies (Bardsley, 2008).

## 2 Study Design

In this section, we document the sampling strategy for selecting children, the survey instrument, and the experimental protocol.

### 2.1 Sampling and Survey

We carried out fieldwork activities between March and April 2019 in 8 schools in the department of Chalatenango, randomly drawn from a pool of 12 schools participating in an international project. The project lasted 3 years, starting from February 2019, and aimed to enhance social inclusion, reduce violence and prevent dropouts through workshops, school activities, and training with students and teachers.[8] We selected a random sample of classes (totalling 468 students). Only the first two cycles, which correspond to grades 1-6, were targeted for the study.[9]

Local facilitators introduced the project and the data collection to parents or legal guardians during school meetings and home visits.[10] We obtained written consent for 350 students. We stratified by school, cycle, and student gender and sampled 300 students.[11] In case of a student's absence at the time of the survey administration, we sampled a substitute from the list of excluded students within the same stratum. We administered a survey that consisted of several sections: individual and household socio-demographic characteristics, cognitive and non-cognitive measures, aspirations, and violence exposure. The survey was revised and pre-approved by the implementing organization, which is highly experienced in working on social inclusion projects with children in disadvantaged communities. The violence exposure section was used to monitor one of the key project performance indicators.

The data collection took place at school and was conducted by local enumerators, mainly students or graduates in social work at the local university, who completed a two-day training with a strong focus on ethics. During the training, enumerators practiced responding to challenging situations through role-playing games[12] and piloted the survey with several pupils not in the sample. The instructions and questions were read out loud by the enumerators and further explained if needed (e.g., questions regarding the education or jobs of their parents). Given the sensitive

[8] The project involved several international organizations and research institutions: Soleterre, Fondazione puntosud, EducAid Onlus, the University of Bologna, the Italian Network of Disability and Development (RIDS). The study activities were concentrated in the first months of the project.

[9] Grades 1-6 cover the first two cycles of the *Basic Education* level (grades 1-9). The third cycle (grades 7-9) represents a transition period to secondary education.

[10] Four schools involved in the intervention had long-term collaborations with the implementing organizations, which facilitated the process of getting parents acquainted with the project and obtaining consent for their children's participation.

[11] We excluded from the analysis one student where the enumerator had problems with the mobile device and could not administer some sections of the survey properly.

[12] One played the role of the enumerator while the other was instructed to be a challenging pupil. The other enumerators could observe the interaction, ask questions, or provide feedback.

nature of some survey sections, enumerators (i) ensured the survey took place in a private place at school, (ii) allowed breaks between survey sections in which play materials were offered, and (iii) whenever necessary, encouraged pupils to use visual cues instead of verbal ones to respond to several sections of the survey. More information on the survey protocol is provided in Appendix B while the list of survey variables is discussed in Section 3.

### 2.2 The experiment

The same pool of children participated in a lab-in-the-field experimental session in July 2019, about two months after the baseline survey data collection and before the implementation of most project activities. We could successfully track 278 students, out of the 299 survey pool (93%).

In each experimental session, children were asked to make decisions in two separate games; in the first session, children played several variants of the dictator game, while in the second, we proposed a series of lotteries, though the latter is not the focus of this paper. The dictator games were run first and lasted for about fifteen minutes.

The experimental sessions were conducted by four local enumerators and supervised by one researcher. Children were gathered in groups, ranging from 5 to 16 (the mean group size is 11) depending on the size of the available room, the number of students participating, and the schedule of classes. They entered the room one by one, drawing a ball with their designated desk number. Besides impeding self-selection of students who were close friends in neighboring desks, it also familiarized them with the idea of a random draw. Each desk had a cardboard divider to ensure decisions were taken in private. One enumerator presented the instructions to the children, while the other three helped with demonstrations. Children could observe the consequence of a wide range of choices, from sharing a small or a large share of the endowment with the recipient to a more fair split. The demonstrations were highly visual and engaging and included comprehension questions.[13] In addition, children were instructed that if they had any questions, they could raise their hands and one enumerator would provide assistance in private.

Four tasks of a dictator game were played sequentially, where each participant chose how to allocate some tokens between herself and a recipient. Specifically, the tasks were as follows:

1. Dictator (5), hereafter D5: the baseline dictator game where both dictator and recipient players start with 5 tokens as an initial endowment, and the dictator can decide how to allocate 10 extra tokens.

2. Take (5), hereafter T5: players start with 5 tokens as initial endowment. The dictator can decide how to allocate 10 extra tokens, including the option to take (all or part of) the tokens from the recipient.

[13] One example went as follows: Enumerator: "If I put two beans from the basket in the "Other" bag, how many beans do I have for myself?"; after pupils answered correctly, "how many beans will the other student receive?"

3. Take (2), hereafter T2: the dictator has 2 tokens whereas the recipient has 5 tokens as an endowment. The dictator can decide how to allocate 10 extra tokens, including the option to take 5 tokens from the recipient.

4. Take (8), hereafter T8: the dictator has 8 tokens whereas the recipient has 5 tokens as an endowment. The dictator can decide how to allocate 10 extra tokens, including the option to take 5 tokens from the recipient.[14]

The task sequence always started with D5. The order of the following tasks was randomized. The within-subject design represented the only feasible alternative, given the context and the limited resources.[15]

At the beginning of each round, children received two transparent zip-lock bags, which contained the initial endowment of tokens (beans) and a bowl with 10 extra tokens. The bags have "You" or "Other" written on them.[16] Next, the children made their decisions using the bags and the tokens.[17] At the end of the round, the bags were collected by enumerators and counted in private.

All participants were instructed that a final lottery would determine the role of the player (either dictator or recipient) and that the matched player would be a student from the same school or from another school in the local area but not from the same session.[18] This design choice allows us to observe the dictator's choice for all students (higher statistical power) while avoiding deception and maintaining incentive compatibility. In addition, it was more logistically feasible to have all students in the same class in the same session, playing the same role, i.e., the dictator.[19] Enumerators emphasized that their choice would not affect what they would receive from the matched student, in case they were drawn as recipients.

At the end of the experiment, the round selected for payment was randomly drawn publicly. Children then proceeded one by one, according to their desk number, and drew a ball with

[14] Note that the total number of tokens available in each task is not constant: 20 in D5 and T5, 17 and 23 in T2 and T8, respectively.

[15] Dealing with children with low literacy skills prevented us from randomizing tasks at the individual level within sessions. Sessions were conducted almost entirely verbally. Randomizing tasks at the session level was deemed risky in terms of statistical power.

[16] Given their age, we aimed to reduce to a minimum the need for reading or writing skills. We tested that children in the first and second grades could read the two words. No child had any difficulties reading the two words. In addition, the words were written in large letters on the whiteboard.

[17] The large number of enumerators reduced to a significant extent communication among students.

[18] If a student draws the role of the recipient, they would be matched randomly with a pupil from a previous session. Pupils in the first session were matched with pupils from a pilot session. When the class size differed, some pupils were matched twice, i.e., one dictator from a previous session was matched with two recipients in the current session.

[19] We employ a variant of the strategy vector method, SVM (Di Cagno et al., 2016). While SVM is rather common in studies employing the dictator game (Cochard et al., 2021), we cannot exclude that this design choice may affect the external validity of the results more for children than for adults. It is possible that the SVM nudges pupils to put themselves in the shoes of the recipient – to become more empathetic and, as a result, more generous in their choice as dictators.

their role in the task, received their payment, and "purchased" their desired prizes in the experimental shop. The values of the prizes were different, and children were aware that possessing more tokens would allow them to access items from higher categories. Appendix Figure A.1 depicts the prize counter. Prizes included candies, erasers, pencils, notebooks, legos, games requiring motor coordination, and puzzles. The whole experimental protocol is reported in Appendix B.[20]

Overall, the quality of the data shows that the game's rules in different tasks were well understood and respected. This did not occur only in a handful of cases (about 0.6% of all tasks, which means 6 out of 1105). We detail such irregularities and our decisions on the use of such data in Appendix C. Ultimately, the study sample we use in the analysis includes 278 children and 1,105 total task observations.

# 3 Data and variables

## 3.1 Dictator game outcomes

Our experimental protocol proposes a modified version of the traditional dictator game where both recipient and dictators are endowed with a positive amount: the initial endowment of tokens provided to the recipient ($e_r$) is kept constant across all tasks, whereas the endowment given to the dictator varies across tasks ($e_d = e_d^L, e_d^M, e_d^H$) such that each level is lower, equal or higher than the recipient's endowment, respectively. The dictator distributes an amount $X$ between himself and the recipient: $x_r$ is the amount passed to the recipient while $x_d = X - x_r$ is the amount held by the dictator, with $x_d, x_r \geq 0$. When the dictator is allowed to take from the recipient, i.e., in tasks T2, T5, and T8, the tokens $x_r$ passed to recipients range in the interval $[-e_r, X]$.[21] The total payoff of the game is $Y = e_r + e_d + X$, the sum of the dictator's and recipient's final payoff. Due to the different levels of the dictator's endowment, we have three levels of total payoff ($Y = Y^L, Y^M, Y^H$). The main features of the different experimental tasks are depicted in Table 1.

We specifically focus on the following three dimensions as outcomes in the analysis, corresponding to different dictators' distributional concerns. These measures represent our main dependent variables: we address the extensive ($P(x_r > 0)$) and intensive margin of prosociality ($x_r$), and the final distributional concerns ($y_r$).

1. The extensive margin, i.e., the probability of giving a positive amount, $P(x_r > 0)$, is constructed through a dichotomous variable taking value one when the money transferred to the recipient is positive and zero otherwise.

2. The intensive margin, i.e., the tokens transferred ($x_r$). The intensity of prosociality is the

[20] Having a store with prizes is the most common incentive approach adopted in experiments with children: see List et al. (2021) for a recent review of the best practices for experimental procedures with children.

[21] The choice set is held constant across T2, T5 and T8 tasks.

Table 1: Experimental setting

| Description | Variable | Task | | | |
|---|---|---|---|---|---|
| | | D5 | T5 | T2 | T8 |
| Dictator's endowment | $e_d$ | 5 | 5 | 2 | 8 |
| Recipient's endowment | $e_r$ | 5 | | | |
| Extra tokens | $X$ | 10 | | | |
| Tokens transferred | $x_r$ | $[0, X]$ | $[-e_r, X]$ | | |
| Total payoff | $Y$ | 20 | 20 | 17 | 23 |
| Taking | | No | Yes | | |
| Random order | | No | Yes | | |

number of extra resources transferred to recipients regardless of the distribution of the initial endowment. It is a measure of unconditional prosociality.

3. The recipient's wealth share ($y_r = \frac{e_r + x_r}{Y}$); differently from the first measures, it indicates how children distribute the total resources and take into account the initial endowment disparities. It is a measure of taste for equality/ inequality aversion in the final payoff.

### 3.2 Key covariates

The key covariates we consider are students' cognitive skills, non-cognitive skills, and violence exposure. In what follows, we describe how these variables are elicited and operationalized. At the time of the survey data collection (i.e., a few months before the experiment), we administer students two tasks to measure two sub-components of cognitive functions: inhibitory control and fluid intelligence.

Inhibitory control or self-control refers to one's ability to override impulses and ignore distractions (Rothbart and Posner, 1985). We use the *Spatial Stroop Task*, a version of the Classic Stroop Teask (Stroop, 1935). Incorrect trials receive a score of 0. Each correct trial is weighted by the reaction time as follows: (i) if the reaction time is 400ms (milliseconds) or below (only a handful of trials), the trial receives the maximum score of 1, (ii) if the response time is 2500ms (the 93rd percentile of reaction time) the trials receives a score of 0, (iii) if the response time is in the interval (400ms, 2500ms) the score is normalized, thus varying between 1 and 0.[22] Then the score is standardized.

Fluid intelligence is a higher-order cognitive function and measures one's ability to solve new tasks and adapt to new situations (Dean et al., 2017). We administer a shortened version of *Raven's Matrices* (Raven and Court, 1998), a widely used tool for assessing fluid intelligence. The final score is the sum of correct trials out of 10 and is then standardized.

Following Mani et al. (2013), we decided to adopt shortened versions of these widely

[22] We apply the following formula: $Score_i = (2500 - RT_i)/(2500 - 400)$, where $Score_i$ is the score of a correct trial $i$ with reaction time $RT$.

used tasks for cognitive abilities, due to the limited time and children's attention. This may lead to higher noise in the measures. Even though the two measures capture different dimensions of cognitive function, they are moderately correlated (the correlation coefficient is 0.224). We assume they relate to the same latent variable of cognitive skills, as it is generally done in the literature on human capital formation (Cunha et al., 2010). Thus, the scores from the two cognitive tasks are combined in an index which is constructed following Anderson (2008).[23] Then, the index is standardized. Panel (a) of Appendix Figure A.2 depicts the density function of the two standardized scores and of the cognitive skills index.[24] The score on the Raven Matrices follows a bell-shaped distribution, with a mean and median of roughly four correct trials out of 10. The score on the Stroop task has a distribution slightly skewed towards the right, with a mean of 7.37 and a median of 7.46.

Second, we consider multiple dimensions of non-cognitive skills, such as self-efficacy, social skills, emotional and conduct problems, adapting items from the *Generalized Self-Efficacy Scale* (Luszczynska et al., 2005), the Young Lives Study (Boyden, 2012), the German Socio-Economic Panel (Wagner et al., 2007), and two questions measuring shyness from Hopko et al. (2005). Panel (b) of Figure A.2 shows the density function of the standardized non-cognitive skills index, which is constructed aggregating the items following Anderson (2008). The index seems to follow a normal distribution. Appendix Table D.1 reports the various items used to construct the index and their basic statistics.

Third, we look at violence exposure. We combine items adapted from international and validated survey instruments such as the *Young Lives Study* (Boyden, 2012), the *Reduced Aggression/Victimization Scale* (Orpinas and Horne, 2006), the *School Relationships Questionnaire* (Wolke et al., 2000), the *Exposure to Neighborhood Violence Scale* (Attar et al., 1994), and the *Survey of Children Exposure to Community Violence Scale* (Richters and Saltzman, 1990). The items are translated and adapted to the local context and capture the incidence and fear of violence and bullying at school and in the community. Items related to domestic violence and gang violence (local "pandillas") are excluded.[25] The survey items are gathered into a general index of violence exposure. Appendix Table D.2 reports the various items used to construct the index and their basic statistics.

Besides these, we look at variables for children's gender, age and socio-economic status (SES).[26] In order to better characterize the context, we consider a set of individual and household

[23] The method uses an inverse covariance weighting procedure which maximizes the amount of information extracted from the items, hence weighting more new information as opposed to shared information.

[24] Figure A.3 displays histograms of the standardized scores for the two cognitive tasks.

[25] Both researchers and the implementing organization decided to implement a protocol minimizing sensitive questions, in particular those on local gangs and on family violence.

[26] For SES we aggregate in an index using the method proposed by Anderson (2008) the following dimensions: household size, number of children, whether the child lives with the mother/father, employment status and educational attainment of both parents, dwelling characteristics (number of bedrooms, whether the kitchen is used for sleeping, whether there is electricity, pipe water or a bathroom in the house).

level variables which we use as controls in the analysis: students' subjective health, sleeping hours, subjective school performance, aspirations, household size, parents' education, and job type.[27] Table 2 presents summary statistics of student and household characteristics in Panel A and B, respectively. The average age is 9.4 years, and around 57% are girls. The average household size is 5 members (including children). Between 45 and 50% of parents did not go to high school, and the majority of fathers is employed in low-skill jobs.

Table 2: Students and housholds characteristics

| | Panel A: Student characteristics | | | | |
|---|---|---|---|---|---|
| Variable | Categories | Mean | Std. Dev. | Min | Max |
| Female | | 0.572 | 0.496 | 0 | 1 |
| Age | | 9.446 | 1.813 | 6 | 16 |
| Health | | | | | |
| | Worse than others | 0.072 | 0.259 | 0 | 1 |
| | Equal to others | 0.662 | 0.474 | 0 | 1 |
| | Better than others | 0.263 | 0.441 | 0 | 1 |
| | DNK-PNA | 0.004 | 0.060 | 0 | 1 |
| Sleeping hours | | 8.989 | 1.242 | 5 | 18 |
| Better than classmates: | | | | | |
| | No | 0.770 | 0.422 | 0 | 1 |
| | Yes | 0.219 | 0.415 | 0 | 1 |
| | DNK-PNA | 0.011 | 0.104 | 0 | 1 |
| Aspires to go to university | | | | | |
| | No | 0.108 | 0.311 | 0 | 1 |
| | Yes | 0.871 | 0.336 | 0 | 1 |
| | DNK-PNA | 0.022 | 0.146 | 0 | 1 |
| | Panel B: Household characteristics | | | | |
| Variable | Categories | Mean | Std. Dev. | Min | Max |
| Household size: | | 5.144 | 2.045 | 2 | 16 |
| Father low education | | | | | |
| | No | 0.453 | 0.499 | 0 | 1 |
| | Yes | 0.435 | 0.497 | 0 | 1 |
| | DNK-PNA | 0.112 | 0.315 | 0 | 1 |
| Mother low education | | | | | |
| | No | 0.493 | 0.501 | 0 | 1 |
| | Yes | 0.496 | 0.501 | 0 | 1 |
| | DNK-PNA | 0.011 | 0.104 | 0 | 1 |
| Father low skill work | | | | | |
| | No | 0.284 | 0.452 | 0 | 1 |
| | Yes | 0.604 | 0.490 | 0 | 1 |
| | DNK-PNA | 0.112 | 0.315 | 0 | 1 |
| Mother low skill work | | | | | |
| | No | 0.543 | 0.499 | 0 | 1 |
| | Yes | 0.446 | 0.498 | 0 | 1 |
| | DNK-PNA | 0.011 | 0.104 | 0 | 1 |

**Notes**: Statistics are obtained from the sample of 278 students participating in the experiment. The age range of our sample is 6-13, but we have a single outlier, a student that is 16yo. "Better than classmates" indicates whether the student perceived being better at school than its peers. Low education refers to completed primary school or lower education level. Low skill jobs include informal work and low skill jobs (farm hand, food seller,...). DNK-PNA= do not know - prefer not to answer.

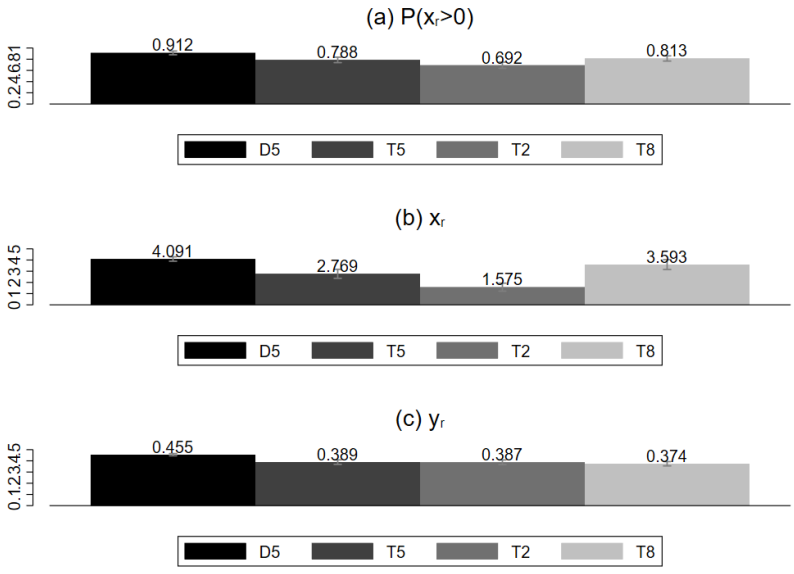
[27] For these latter dimensions related to parents' education and occupation we do not exclude the missing values but we record them in separate categories.

# 4 Experimental findings

## 4.1 Does behavior change with variations in the game setting?

First, we look at children's reactions to changes in the choice set. Following List (2007) and Bardsley (2008), we test if children hold more resources for themselves when the action set includes the possibility of taking from the recipient. We compare the differences in behavior in the dictator game, measured in terms of the probability of giving a positive amount, $P(x_r > 0)$, the net amount given by the dictator to the recipient, $x_r$, and the recipient's final share of wealth, $y_r$, between D5 and T5.

Figure 1: Averages of the main dependent variables




**Notes**: Bars indicate means, whiskers indicate 95% confidence intervals. Value on bars indicates percentages in panels (a) and (c), and tokens in panel (b).

Figure 1 shows the results for the three main outcomes, while Appendix Table A.1 reports p-values from Wilcoxon rank-sum non-parametric tests. The probability of giving a positive amount under D5 and T5 is 91 and 79%, respectively. The difference is statistically significant (p-value $<$ 0.001). The average number of tokens given to the recipient is 4.09 (SD=1.67) and 2.77 (SD=3.39) in D5 and T5, respectively; the difference is statistically significant (p-value $<$ 0.001).[28] The final

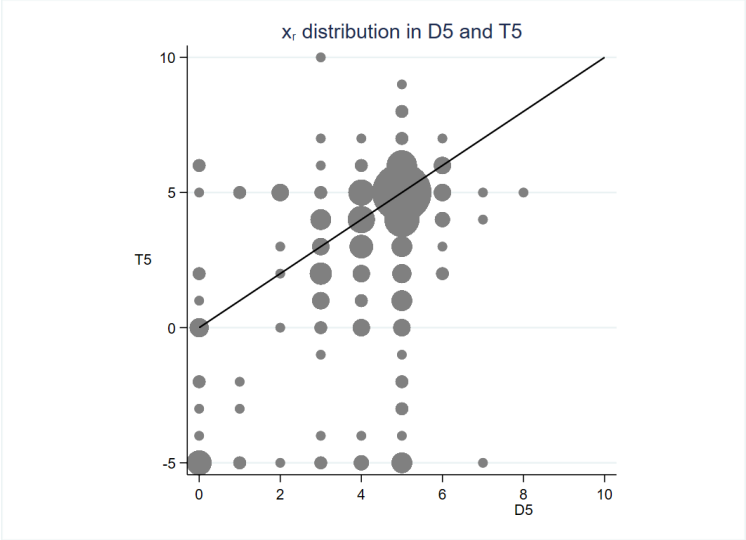
[28] Our results show that dictators in D5 tend to pass more resources than the average amount generally given in other experimental studies involving children and adults in developed countries. There, children seem to increase their contributions with age and can reach up to 35% of the available endowment (Harbaugh et al., 2003; Eckel et al., 2011). Conversely, 30-35% of adults give nothing to the recipient, and the rest tend to offer approximately

share of the total payoff passed to the recipient significantly decreases from 45 to 39% (p-value $<$ 0.001).

To better understand the reaction to the change in the choice set, Appendix Figure A.4 shows the distribution of tokens passed to the recipients across tasks. It depicts the shift to the left when passing from D5 to T5. In Appendix Table A.1, one can notice that a significant share of children, about 15%, decides to "take" from the endowment of the recipient, and approximately 9% of children take the whole recipient's endowment in T5.

Figure 2 shows the individual combinations of tokens passed in D5 and T5. We observe that a large share of dictators has egalitarian preferences: they opt for the equal distribution of the extra tokens both in D5 and T5. Yet, most dictators choose a more favorable combination in D5 than T5 (represented by the observations below the diagonal that represents all cases where $x_r$ is equal in both tasks).

Figure 2: Individual combination of tokens transferred $x_r$ in D5 and T5




**Notes**: The figure plots the tokens passed to recipients in D5 and T5; the size of circles is given by the share of players in each combination.

**Result 1** *The probability of giving a positive amount decreases, the average number of tokens passed to the recipient decreases, and the share of wealth given decreases when the action set is extended, and children can take from the recipient.*

Next, we explore the reactions to differences in the initial endowment, i.e., when the dictator receives a higher (lower) endowment in T8 (T2) than the recipient's, keeping constant the action set, as in T5. Korenok et al. (2012) find that the mean and median amounts passed

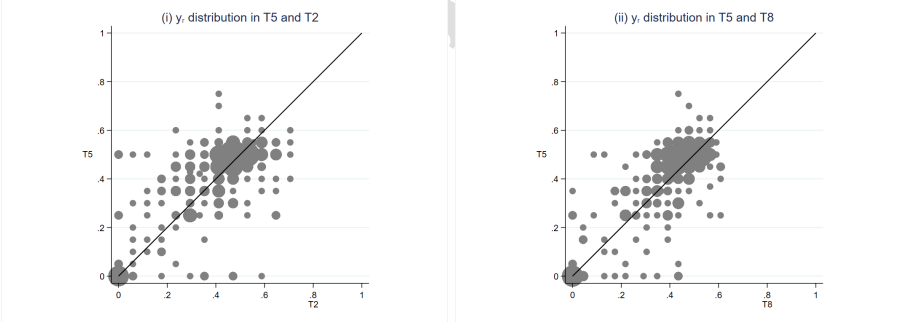
20-30% of their endowment (Camerer, 2011; Engel, 2011).

fall as the recipient's endowment increases. We predict that dictators will transfer more tokens when the recipient's endowment is relatively lower (T8) than the situation when the dictator is disadvantaged (T2). The effects on the final distribution $y_r$ depend on how much $x_r$ is adjusted with respect to initial disparities: that is, if $x_r$ is adjusted less than proportionally, then the initial (dis)advantage is preserved.

As one can see from Figure 1 (and Appendix Table A.1), the probability of giving is higher in T8 (81%) than in T5 (79%) and significantly lower in T2 (69%) (p-value=0.011). Compared to the average amount passed in T5, i.e., 2.77 (SD=3.39), the amount passed in T2 equals 1.58 (SD=3.01), while it is 3.59 (SD=3.70) in T8. The differences are statistically significant (p-value $< 0.001$). The recipient's share of the final payoff narrowly ranges between 37 and 39% in T2, T5, and T8. This indicates a general tendency to reduce the initial inequalities, regardless of the initial starting point. While there is no significant difference between T2 and T5 (p-value=0.740), the difference is statistically significant between T5 and T8 (p-value=0.035), while non-significant between T2 and T8 (p-value=0.242).

Figure 3 shows the individual combination of resources distributed to the recipient in T2 and T8 (with respect to T5). The figure suggests that most dictators opt for the same distribution of resources across tasks, resulting in a large concentration of observations lying on the 45° line and a similar distribution of points across the two panels. Consistency in the final payoff distribution suggests that children have a generally stable willingness to sacrifice money (Krupka and Weber, 2013).

Figure 3: Individual combination of wealth share $y_r$ in (i) T5 and T2 and (ii) T5 and T2




**Notes**: The figure plots the share of resources distributed to the recipients in T2, T5, and T8; the size of circles is given by the share of players in each combination.

**Result 2** *Children tend to reduce the initial levels of inequality and converge to a similar split of the final payoff, regardless of the starting position.*

To confirm the analysis above, we run multivariate regressions where we include individual controls and order fixed effects. We estimate the following model:

$$Y_{it} = \beta_0 + \sum_k \beta_k Task_{it} + \beta^c C_i + \beta^l Z_i + \delta_t + \epsilon_{it} \quad (1)$$

where $Y_{it}$ represents different dependent variables: (i) $x_r$, the tokens passed to the recipient; (ii) $P(x_r > 0)$, the probability of giving a positive amount of tokens; (iii) $y_r$, the final wealth share passed to recipients. All outcomes are measured for student $i$ in round $t$. $Task_{it}$ is a set of three dummy variables taking the value of one when the task belongs to D5, T2, T8, respectively, and zero otherwise, such that the reference category is T5. $C$ is a vector including our covariates of interest, i.e., indexes for cognitive, non-cognitive abilities, and violence exposure. $Z_i$ is a vector of child and household characteristics: gender, age, general health, sleep hours, a dummy capturing the individual perception of being a better student than the others, aspiring to university education, household size, a dummy for low education of each parent and a dummy for low skill work for each parent.[29] $\delta_t$ are round fixed effects, which allow control for the task order. Standard errors are clustered at the individual level. Results are shown in Table 3: the multivariate regression analysis confirms the results presented above.

### 4.2 Are cognitive skills, non-cognitive skills, and violence exposure related to the behavior in the dictator game?

We assess the correlation between behavior in the dictator game and individual characteristics. While controlling for covariates commonly studied in the literature involving children, such as gender, age and SES (Sutter et al., 2019), our focus is on cognitive and non-cognitive skills and violence exposure. The fact that prosocial behavior develops during childhood implies that there may be complementarities with other skills (cognitive and non-cognitive) in the process of human capital formation (Cunha et al., 2010; List et al., 2021). Our focus on violence exposure is motivated by the context in which the study was run and by the vast literature documenting how violence can foster prosociality (Bauer et al., 2016).

Our conjecture is that cognitive and non-cognitive skills are positively associated with prosociality, consistent with Bettinger and Slonim (2007), Han et al. (2012), Angerer et al. (2015), Blake et al. (2015), Chen et al. (2016), among others. The relationship between violence exposure and prosociality has been shown to be positive, even though this may depend on whether the recipient is a member of the in-group or out-group (Keeley, 1996; Bellows and Miguel, 2009; Bowles, 2009; Blattman, 2009; Bauer et al., 2014a, 2016). We assess the correlation between behavior in the dictator game and the three key covariates in estimating the model in Equation 1.

Results are shown in Table 3. We find a robust positive relationship between cognitive abilities and the outcome measures in each specification: a one standard deviation increase in

[29] Results are not sensitive to the choice of covariates, being robust to the exclusion of all covariates or the selective inclusion through post-double Lasso regularization approach of Belloni et al. (2011). Results are available upon request.

Table 3: Relationship between prosocial behaviour, cognitive skills, non-cognitive skills and violence exposure

| | (1) | (2) | (3) |
|---|---|---|---|
| | $P(x_r > 0)$ | $x_r$ | $y_r$ |
| D5 | 0.121*** | 1.287*** | 0.065*** |
| | (0.024) | (0.187) | (0.009) |
| | [0.000] | [0.000] | [0.000] |
| T2 | -0.099*** | -1.238*** | -0.004 |
| | (0.026) | (0.170) | (0.009) |
| | [0.001] | [0.000] | [1.000] |
| T8 | 0.025 | 0.809*** | -0.015** |
| | (0.021) | (0.159) | (0.007) |
| | [0.742] | [0.000] | [0.146] |
| Cognitive skills | 0.078*** | 0.638*** | 0.032*** |
| | (0.021) | (0.165) | (0.008) |
| | [0.001] | [0.000] | [0.001] |
| Non-cognitive skills | 0.015 | 0.142 | 0.007 |
| | (0.017) | (0.141) | (0.007) |
| | [0.745] | [0.630] | [1.000] |
| Violence exposure | 0.006 | 0.078 | 0.004 |
| | (0.018) | (0.164) | (0.008) |
| | [0.745] | [0.636] | [1.000] |
| Constant | 0.823*** | 2.995** | 0.399*** |
| | (0.188) | (1.489) | (0.075) |
| Obs. | 1,093 | 1,093 | 1,093 |
| $R^2$ | 0.115 | 0.185 | 0.140 |
| Pairwise comparisons T2=T8 | | | |
| p-value | 0.000 | 0.000 | 0.171 |

**Notes**: The unit of analysis is the task. OLS estimates with standard errors in parenthesis clustered at the individual level (N=278) and 1093 observations. FWER-adjusted q-values in square brackets (*q-values* are computed using the Stata command *qqvalue* (Newson, 2020), using the Holm option). The specification includes student gender (female), age, HH size, a dummy for low education of each parent, a dummy for low skill work for each parent, general health, sleep hours, a dummy capturing the individual perception of being a better student than the others, aspiring to university education, task order fixed effects. *** significance at the 1% level, ** at the 5% level, * at the 10% level.

cognitive abilities leads to a 7.8 percentage points increase in the propensity to give a positive amount to the recipient, an increase of 0.64 tokens passed to the recipients (+21%), a 3 percentage points increase in the recipients' payoff share (+7%). Conversely, we do not find any statistically significant correlation between the outcomes and either non-cognitive skills or violence exposure.[30]

As for the other correlates, i.e., gender, age, and SES, we find a non-significant correlation with the prosociality measures (see Appendix Table A.2). One should note that, as found in the literature (Ben-Ner et al., 2017; Brocas et al., 2017; Sutter et al., 2019), age is positively correlated with prosociality; however, when jointly estimated with cognitive skills, the latter tends to absorb the effect of age. Moreover, the positive relationship between prosociality and cognitive skills is not affected by the inclusion of either of these factors.

**Result 3** *Prosocial behavior in the dictator game is positively associated with cognitive skills, while no relationship is found between non-cognitive skills and violence exposure.*

### 4.3 Are there heterogeneous effects in the response to changes in the game setting?

We explore the extent to which children with different levels of cognitive skills, non-cognitive skills, and violence exposure react differently to the experimental manipulations of the game setting. On one hand, higher cognitive abilities may be associated with higher awareness that a wider choice set makes selfish decisions more socially acceptable. This means that when the take option becomes available, players with higher cognitive abilities may be more likely to perceive a new social norm that tolerates lower giving. This would lead to negative heterogeneous effects. On the other hand, higher cognitive skills may correlate with preference consistency and social image concerns, leading to positive heterogeneous effects. Cognitive, non-cognitive skills, and violence exposure may also affect pupils' inequality aversion and their propensity to compensate for the gaps in the initial endowment.

We look at the heterogeneous effects in the following model:

$$Y_{it} = \beta_0 + \sum_k \beta_k Task_{kt} + \beta^c C_i + \sum_k \eta_k Task_{kt} \times C_i + \beta^l Z_i + \delta_t + \epsilon_{it} \quad (2)$$

This model adds the interaction between tasks and key covariates with respect to model 1. It is estimated using mutually exclusive task categories and the key (continuous) covariate indexes $C$, with T5 being the reference category. Results are reported in Table 4.

We find that the gap in the amount passed, and the share of the final payoff given between T5 and D5 depends negatively and significantly on cognitive skills (the coefficient $D5 \times C$ is negative

[30] With respect to violence exposure, one limitation is that we cannot establish whether the recipient was perceived as a member of the in-group or out-group by the dictator. This distinction appears important in pinning down the relationship between violence exposure and prosociality (Bauer et al., 2014a).

Table 4: Heterogeneous reactions to changes in game settings

| $C$ = | Cognitive | | | Non-cognitive | | | Violence exposure | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | $P(x_r>0)$ | $x_r$ | $y_r$ | $P(x_r>0)$ | $x_r$ | $y_r$ | $P(x_r>0)$ | $x_r$ | $y_r$ |
| D5 | 0.124*** | 1.331*** | 0.067*** | 0.123*** | 1.303*** | 0.065*** | 0.123*** | 1.304*** | 0.066*** |
| | (0.024) | (0.189) | (0.009) | (0.024) | (0.190) | (0.010) | (0.024) | (0.188) | (0.009) |
| T2 | -0.101*** | -1.242*** | -0.005 | -0.098*** | -1.228*** | -0.003 | -0.097*** | -1.223*** | -0.003 |
| | (0.027) | (0.175) | (0.009) | (0.027) | (0.173) | (0.009) | (0.026) | (0.171) | (0.009) |
| T8 | 0.026 | 0.798*** | -0.015** | 0.026 | 0.810*** | -0.015** | 0.026 | 0.820*** | -0.015** |
| | (0.022) | (0.160) | (0.007) | (0.022) | (0.158) | (0.007) | (0.021) | (0.160) | (0.007) |
| $C$ | 0.081*** | 0.705*** | 0.036*** | 0.003 | 0.039 | 0.002 | 0.011 | 0.024 | 0.002 |
| | (0.028) | (0.214) | (0.011) | (0.024) | (0.200) | (0.010) | (0.026) | (0.255) | (0.013) |
| D5 $\times C$ | -0.022 | -0.396** | -0.020** | 0.005 | 0.003 | -0.000 | -0.001 | 0.078 | 0.004 |
| | (0.024) | (0.184) | (0.009) | (0.026) | (0.203) | (0.010) | (0.024) | (0.248) | (0.012) |
| | [0.628] | [0.098] | [0.090] | [0.859] | [0.987] | [0.998] | [0.963] | [0.754] | [0.773] |
| T2 $\times C$ | 0.023 | 0.029 | 0.007 | 0.019 | 0.065 | 0.005 | -0.024 | -0.088 | -0.005 |
| | -0.628 | (0.196) | (0.011) | (0.029) | (0.175) | (0.009) | (0.030) | (0.242) | (0.013) |
| | [0.370] | [0.882] | [0.726] | [0.784] | [0.987] | [0.910] | [0.641] | [0.754] | [0.773] |
| T8 $\times C$ | -0.011 | 0.095 | -0.000 | 0.019 | 0.258* | 0.011 | -0.014 | 0.055 | 0.002 |
| | (0.023) | (0.165) | (0.008) | (0.020) | (0.144) | (0.007) | (0.016) | (0.130) | (0.006) |
| | [0.649] | [0.846] | [0.950] | [0.784] | [0.219] | [0.364] | [0.641] | [0.754] | [0.773] |
| Constant | 0.860*** | 3.380* | 0.417*** | 0.630*** | 1.436 | 0.319*** | 0.618*** | 1.318 | 0.314*** |
| | (0.217) | (1.803) | (0.091) | (0.185) | (1.448) | (0.073) | (0.187) | (1.464) | (0.074) |
| Obs. | 1093 | 1093 | 1093 | 1093 | 1093 | 1093 | 1093 | 1093 | 1093 |
| $R^2$ | 0.119 | 0.187 | 0.144 | 0.090 | 0.160 | 0.113 | 0.089 | 0.159 | 0.111 |
| Pairwise comparisons between interaction T2 $\times$ $C$=T8 $\times$ $C$ | | | | | | | | | |
| p-value | 0.202 | 0.727 | 0.404 | 0.978 | 0.217 | 0.463 | 0.753 | 0.540 | 0.520 |

**Notes**: Notes: The unit of analysis is the task. OLS estimates with standard errors clustered at the individual level (N=278). Key covariates (C), indicated in the column headings, are expressed as standardized scores. Controls include: female, age, general health, sleep hours, a dummy capturing the individual perception of being a better student that the others, aspiring to university education, HH size, a dummy for low education of each parents (we do not exclude the missing values but we record them in a separate category), and a dummy for low skill work for each parent. We control for task order. P-values for the difference between interaction coefficients are reported at the bottom. FWER-adjusted q-values in square brackets (*q-values* are computed using the Stata command *qqvalue* (Newson, 2020), using the Holm option).
*** significance at the 1% level, ** at the 5% level, * at the 10% level.

and significant in columns 2 and 3), while there is no significant gap between low and high cognitive skills in the probability of giving (the coefficient $D5 \times C$ is not significant in column 1). This means that as cognitive ability increases, the gap in the amount given and in the final payoff between T5 and D5 tends to get closer. This suggests that children with higher cognitive skills are less sensitive to the choice-set effects than those with lower cognitive skills. This can also be seen in Appendix Figure A.5, which represents the individual distribution of tokens $x_r$ by two levels of cognitive skills, either high or low in T5 vs. D5.[31] It shows that children with higher cognitive skills are more likely to distribute around the 45° line (representing the same number of tokens passed in both D5 and T5), whereas children with lower skills are more likely to deviate from D5.

Overall, the first three columns of Table 3 suggest that cognitive abilities lead to a positive heterogeneous effect in the number of tokens passed to the recipient (intensive margin) but no heterogeneous effects in the probability of acting generous (the extensive margin) when the choice set varies. This may imply that cognitive skills do not affect the propensity to give, but only the intensity of the contribution.

We do not find significant heterogeneous effects by other dimensions like age, SES and gen-

[31] We create a dummy variable that takes the value of one if the index for cognitive abilities is above the median and zero otherwise.

der (columns 1-9 of Appendix Table A.3). We also replicate the analysis considering the cognitive tasks separately in columns 10-15; findings are qualitatively aligned to those in Table 4 although estimates appear less precise (the coefficients $D5 \times C$ are not always statistically significant).

**Result 4** *Students with lower cognitive skills tend to be more sensitive to changes in the choice set than those with higher cognitive skills.*

As for the differences in the initial endowment, we focus on the final distribution $y_r$. The response to changes in the initial endowment does not seem to be affected by levels of cognitive skills: the interaction terms $T2 \times C$ and $T8 \times C$ is not significant, and we reject the null that $T2 \times C = T8 \times C$.

For non-cognitive skills and violence exposure, we do not find significant heterogeneous responses to the variation in the choice set and initial endowment distribution. We also explore the extent to which the differences in behavior across tasks vary across different levels of age, gender and SES. Results are shown in Appendix Table A.3. We do not find any significant heterogeneous effect along socio-demographic dimensions.

**Result 5** *Children's sensitivity to the changes in the initial endowment is not affected by levels of cognitive, non-cognitive skills and violence exposure.*

Concluding this subsection, we note that the number of significant results may be inflated by the number of hypotheses we test. Using the Holm correction, we introduce FWER-adjusted q-values for the parameters of interest in our main regressions. The results on the choice-set effect (Result 1) and the positive and significant role of cognitive skills on prosociality (Result 3) are robust to MHT in Table 3. The result on the higher sensitivity of low cognitive skills children to choice-set change (Result 4) is robust to MHT . Overall, the majority of our statistically significant results are robust to the multiple hypothesis correction.

## 4.4 Discussion and additional robustness checks

Our analysis has several limitations that challenge the results' internal and external validity. In this section, we address these potential problems and extend the analysis with some robustness checks that confirm our main results.

*Internal validity.*

The first challenge to the internal validity of the choice-set effect (Result 1) is that the study relies on a within-subject design. Three possible confounders can bias the results: order, anchoring, and experimenter demand effects.

The decline in giving from D5 to T5 could be driven by order effects, as D5 is always played first while the 3 "take" tasks are randomized. In Appendix Table A.4, we explore if average

tokens passed decline across rounds and tasks, which would signal order effects in the same direction as our findings. Results show that from round 2, tokens passed do not consistently decline through periods and never do so from one task to the following one.[32]

Anchoring effects are related to order effects. If anchoring effects play a role, the contribution in D5, always played first, could act as an anchor for the following "Take" tasks. Since the level of contribution in D5 is significantly higher than any other "Take" task, anchoring effects would likely lead to higher contributions in the following tasks, compared to what would have resulted from a between-subject design. This would imply that our estimates are a lower bound of the true effect.

Experimenter demand effects occur when participants infer the experimenter's goals or what represents the appropriate behavior and then act accordingly (Zizzo, 2010). Within-subject designs are typically more prone to experimenter demand effects than between-subject ones because participants can glean more information about experimenters' objectives from the sequence of tasks. We took the following measures to minimize its relevance: (i) limiting interaction between students and the research team was kept at a minimum; (ii) avoiding any specific frame to the game and any potential judgment of children's behavior.[33], (iii) stimulating incentive compatibility by offering salient prizes to participants.[34] and (iv) implementing a "Pay one task only" to make each task as independent as possible in the within-subject design to avoid children "smoothing prosociality" across tasks. Nonetheless, we cannot exclude that the experimenter demand effect plays a role in our results. However, the literature documents that demand effects may have a relatively small magnitude.[35]

*External validity*

Several aspects may challenge the external validity of our results. First, one may be concerned that the study school selection may be affected by previous similar interventions, which, in turn, may have influenced the levels of key variables such as violence exposure, non-cognitive skills and prosociality. If that were the case, our study would not represent the context well. As a robustness check, we control for all time-invariant differences across schools and repeat the analysis,

[32] When we pool all tasks, the average $x_r$ is constant from the second round until the end of the game (first row). Appendix Table A.4 also shows the average tokens passed by tasks and rounds. We find that the average $x_r$ in T5, when played in round 4, is significantly higher than the average $x_r$ in T5 played in rounds 2 and 3. The average contribution played in T2 does not vary significantly across rounds. Finally, the average amount passed under T8 tends to decrease across rounds.

[33] Training examples used the same neutral frame as the experiment and no reference to real-world applications or examples was made.

[34] We informally registered children's interest in the prizes and believe that they were motivated by the toys/games we proposed. This is important because attention is one of the main challenges when designing an experiment with children (Brocas and Carrillo, 2020).

[35] Lambdin and Shaffer (2009) suggest that within-subject designs are not less transparent and do not allow subjects to guess the experimenter's objective more than between-subject designs. de Quidt et al. (2018) show that demand effects in typical experiments are likely to be small.

including school fixed effects. We also exclude the four schools with established past relationships with the implementing agency. Results, available upon request, are qualitatively similar.

Second, the study activities, i.e., the survey and the experimental sessions, occurred a few months after the launch of the project. This may have influenced key study dimensions, threatening the external validity. We exclude this could be the case: only a few activities involving teachers had been implemented at the time of the survey, and the participation was sparse. Some project activities, also involving students, took place between the survey data collection and the lab-in-the-field experiment. This may have affected the levels of prosociality we measured in the experiment as compared to the "average" school in the area, not involved in such a project. While we do not have data on the exact time students participated in project activities, a survey on the same pool of students at the beginning of 2022 reveals that the intensity of students' exposure to the project activities was moderate over the three years and must have been so even in the three months preceding the experiment. Hence, we tend to exclude that this could have affected the external validity of our results.

*Robustness checks*

We perform robustness checks using alternative definitions of our key covariates. For the cognitive skills index, we repeat the analyses using alternative upper bounds (2000ms and 3000ms) in the Stroop index and find consistent results (Appendix Table A.5). We also explore additional methods to compute a Stroop score which combines both the accuracy and reaction time. First, we code as wrong trials with a reaction time above the 80th, 85th or 90th reaction time percentile. Second, we use accuracy in the task as the outcome variable (which does not account for reaction time), while controlling for the median reaction time across tasks. Results, available upon request, confirm those presented in the paper.

To mitigate the concern that some items in the non-cognitive index may be closely related to prosociality, we reconstruct the non-cognitive skills index excluding "Helps other students" or the items related to behavioral problems ("Often accused of lying and deceiving", "Fights often"). Then, we repeat the main analyses. Results, available upon request, confirm the findings.

We also check that the main and heterogeneous effects estimated in regressions are not affected by multicollinearity[36] or the aggregation of the two cognitive tasks into one index.[37] In Appendix Table A.6, we run the estimates for each of our key covariates separately, including the two cognitive tasks (columns 7-15). Results are consistent. For what concerns the two cognitive tasks, we find that performance in the Raven task seems to have a slightly stronger correlation with prosociality than performance in the Stroop task, but both point in the same direction. Furthermore, in Appendix Table A.7, we simultaneously look at the heterogeneous effects of cognitive skills, non-cognitive skills, and violence exposure. Results appear to hold.

[36] In particular, non-cognitive skills and violence exposure are strongly correlated

[37] Given that the two cognitive tasks relate to separate cognitive functions, we also investigate if the positive and significant correlation between cognitive skills and prosocial measures holds when using them separately.

Finally, we control for the possible confounding effects of the survey experiment documented in Bonan et al. (2022). In the survey presented in Section 2.1, participants were randomly assigned to respond to the violence exposure section before or after the cognitive tasks.[38] In Appendix Table A.2, we show that this randomization does not impact prosociality and the positive and significant relationship between cognitive skills and prosociality.

## 5 Conclusion

We find that children react to changes in the choice set. In particular, when the option to take from the recipient's initial endowment becomes available, the probability of giving decreases from 91 to 79%, and the average (unconditional) amount passed decreases by 32%. This appears similar to what has been found in several works on adults (List, 2007; Bardsley, 2008; Cappelen et al., 2013). However, the decrease's magnitude for children appears smaller than for adults. For example, List (2007) finds that positive offers are 71% of the initial endowment in the baseline treatment and decrease to 10% when the option to take becomes available. The results are not fully comparable because the mentioned studies use a between-subject design, while we use a within-subject one. Indeed, while we provided suggestive evidence excluding the presence of significant order effects, we cannot rule out that playing the standard dictator game first may have had an anchoring role in determining relatively higher contributions in the follow-up tasks. We also find that children aim to arrive at similar final distributions of payoffs, even though they start with a relative advantage or disadvantage in the initial endowment. This behavior is consistent with theories of inequality aversion and pure altruism and is similar to what has been found in adult populations (Bolton and Katok, 1998b; Korenok et al., 2012).

We also find that children's behavior in the dictator game is significantly positively related to cognitive skills, in line with several other studies on different populations (Millet and Dewitte, 2007; Han et al., 2012; Chen et al., 2013; Angerer et al., 2015; Blake et al., 2015).

The novelty of our findings lies in the fact that cognitive skills seem to mitigate the effect of changes in the game's setup: the drop in prosocial behavior following the change in the choice set allowing participants to take from recipients is lower as the level of cognitive skills increases. This suggests that cognition plays a role in the sensitivity to changes in the game setting.

The investigation of the underlying mechanisms is beyond the scope of the paper due to a lack of data on critical dimensions such as first-order beliefs, social norms, and additional treatments. We were limited in what we could measure due to the age of participants, level of literacy, and logistical constraints. However, one could derive speculative interpretations of our results. First, children with higher (lower) cognitive skills may care more (less) about social image and reputation or have higher (lower) moral costs from deviating from the prosocial norm under the choice-set change. This would explain the divergent behavior in the "give" vs. "take" task of low-

[38] The scope was to identify short-term impacts of recalling violence incidence on cognitive performance.

cognitive skills students with respect to high-skilled ones. Second, children with higher cognitive skills tend to be more in control: prosocial behavior has been shown to positively correlate with the ability of self-control (Ugur, 2021). As a possible alternative, one could think that children with different cognitive abilities are differently affected by experimenter demand effects. For example, by employing cues about what constitutes behavior that is appropriate to the task, children with higher skills y infer that taking is not appropriate for the new task (Zizzo, 2010).

Future research is needed to identify which channel could relate cognition and the reaction to the change in the choice set for both adult and children populations. This will allow a more thorough understanding of what dictator games are measuring, contributing to better defining their use and external validity.

Finally, as a whole, we do not find any evidence of an association between contributions in the dictator game and inequality aversion, and neither non-cognitive skills nor violence exposure. However, we believe that these aspects remain relevant and should be further explored with more advanced tools which we do not use in this paper, such as incentivized tasks for non-cognitive skills (Eklöf, 2010; Hitt, 2015; Hitt et al., 2016; Borgonovi and Biecek, 2016; Brunello et al., 2021; Zamarro et al., 2019) and violence exposure prime (Callen et al., 2014; Bogliacino et al., 2017; Bonan et al., 2022).

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Highlights

- Students in El Salvador play variants of the dictator game
- We propose two variants: allowing to “take” and unequal endowments
- Significant drop in dictators’ offers when the “take” option becomes available
- Children with lower cognitive skills drive the effect
- Cognitive skills associate to consistency of prosocial behavior across game variants