Distributional Preferences in Adolescent Peer Networks

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Abstract

We study distributional preferences in adolescent peer networks. Using incentivized choices between allocations for themselves and a passive agent, children are classified into efficiency-loving, inequality-loving, inequality-averse, and spiteful types. We find that pairs of students who report a friendship link are more likely to exhibit the same preference type than other students who attend the same school. The relation between types is almost completely driven by inequality-loving and spiteful types. The role of peer networks in explaining distributional preferences goes beyond network composition effects. A low rank in academic performance and a central position within the network relate positively to a higher likelihood of being classified as spiteful. Hence, social hierarchies seem to be correlated with distributional preference types.

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1. Introduction

Many people have non-selfish preferences over the distribution of economic resources. These preferences are often synonymously called social preferences, other-regarding preferences, or distributional preferences (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002; Camerer, 2003; Almås et al., 2010). Their existence and their specific nature are very important for economic behavior and outcomes, such as, among many others, cooperation (Boyd and Richerson, 2005; Fischbacher and Gachter, 2010), productivity (Carpenter and Seki, 2011; Bandiera et al., 2005; Dohmen and Falk, 2011), political preferences (Fisman et al., 2017; Kerschbamer and Müller, 2020), and well-being (Becker et al., 2012).[1] Recent studies have documented the evolution of these distributional attitudes in adolescence, from more malevolent at young ages to more benevolent when growing older. They have also stressed the large degree of individual heterogeneity of distributional preferences (Fehr et al., 2013; Almås et al., 2010; Martinsson et al., 2011; Sutter et al., 2018).

There are far fewer studies on the effects of the social environment and peers on distributional preferences (Charness and Kuhn, 2007; Gächter et al., 2013; Fatas et al., 2018; Bicchieri et al., 2019). In particular, we know little about the early-life-peer influence on the emergence of distributional preferences and whether network members share distributional preferences (Hugh-Jones and Ooi, 2017). To fully understand how distributional preferences are shaped in adolescence, it is important to take the close social environment and its potential influence into account. Adolescent peer networks could be important in explaining adult inter-individual heterogeneity in distributional preferences, selection into friendship/professional networks, labor market status and political views later in life, on top of potential biological determinants (Balafoutas et al., 2012; Fisman et al., 2017; Kocher et al., 2013).

Preferences could be correlated between members of social units, such as a child's school or group of friends, beyond what is expected by the population preference distribution. Peer correlation in preferences can arise from selection into social networks whose members have similar preferences as one's own, and through preference transmission. Besides composition, an adolescent's position within the social network could itself be related to specific distributional preferences transmitted through various mechanisms. The potential impact of peer networks that are based on other-regarding attitudes goes beyond differential evolution of these preferences. If children

[1] In particular, Fisman et al. (2017) find that individuals' position along the efficiency-equality trade-off corresponds to their political attitude along the right- and left-wing dimension in the 2012 US presidential election. Similarly, Kerschbamer and Müller (2020), using the same experimental measure of distributional preferences as our study, show that individuals in Germany classified as selfish preference types vote more likely for the extreme right, while inequality-averse subjects tend to favor more left-wing oriented parties. Other relationships between social preferences and real-life outcomes have more normative implications: Kerschbamer et al. (2019) document that altruistic (efficiency-maximizing) types in their lab experiment in Austria are more likely to be averse to lying. Carpenter and Seki (2011) find that cooperative and efficiency-maximizing fishermen in Japan are more productive when their production requires cooperation. Finally, Kerschbamer et al. (2016) show that sellers with partially or fully selfish preferences can lead to inefficient outcomes in credence good markets.

are surrounded by like-minded peers, cognitive and non-cognitive abilities could also develop on different trajectories as a result of differences in cooperation and support within the network (Cunha et al., 2010; Thöni and Gächter, 2015).

This paper investigates the distributional ("social") preferences of children at primary schools in urban Tanzania and the role of peers in shaping these distributional preferences. We conduct a lab-in-the-field experiment and analyze to what extent distributional preferences of children are related to those of their peers at school, and what roles peer networks, school performance, and popularity play in explaining distributional preferences. The experiment involves choices between pairs of allocations that vary as to how much to allocate to oneself and to an anonymous passive agent (Kerschbamer, 2015). The variation in inequality in agents' payoffs across allocations in the choice sets allows us to classify children into four broad distributional preference types: efficiency-loving, inequality-loving, inequality-averse, and spiteful. To study the prevalence and relationships of these types in peer networks, we ask children to name and rank their three best friends. We also use survey data on background characteristics and administrative data on school grades to investigate their relationship with distributional preferences and peers.

The four distributional preference types that are used here capture a large set of potential distributional preferences under very mild assumptions (see Kerschbamer, 2015). Efficiency-loving preferences pertain to utility functions that put emphasis on the maximum of the sum of payoffs (also called "surplus maximizing motives"). Inequality-averse preferences put disutility on inequality, whereas inequality-loving preferences put positive utility on inequality. Finally, spiteful preferences capture a disutility that is increasing in the payoffs of others (also called "competitive preferences").

Our findings show that the majority of children exhibit choices consistent with inequality-averse (30.6%) and spiteful (42.5%) preferences. This pattern stems from a reluctance to accept disadvantageous allocations for oneself, even if they are Pareto improving. Peers' preference types are also correlated. Even after controlling for a range of observable characteristics, we find that, if two children at the same school report a friendship link, they are 1.7 percentage points (0.05 SD, mean=0.33) more likely to exhibit the same preference type than if they do not. Thus, conditional on reporting a friendship link, distributional preference types of children are strongly related. This peer correlation in types is mainly driven by inequality-loving and spiteful types. Having a friend of the inequality-loving or spiteful type increases the likelihood of a child being of the same type by 6.8 percentage points (0.2 SD) and 3.7 percentage points (0.1 SD), respectively.

The similarity in distributional preference types in peer networks differs by gender as well, with boys driving the overall peer correlations and showing stronger correlation coefficients for spitefulness and girls sharing inequality-loving preferences.

Finally, our analysis shows that, besides network composition, the importance of the role of peers in explaining distributional preferences is linked to the position within the network. Worse relative performance in school relates positively to spiteful attitudes. The spiteful preference type is also more common when a child is central or popular within their peer networks. This suggests an importance of both social

hierarchies and relative *economic* (human capital) position.

Our contribution in this paper is threefold. First, we investigate the role peer networks play in shaping children's distributional preferences. Hugh-Jones and Ooi (2017) study transmission of fairness preferences in teen friendship networks and show that observing others' choices affects adolescents' fairness norms. We build on Hugh-Jones and Ooi (2017) and contribute to a better understanding of the evolution of preferences with age, as well as their impact on (economic) outcomes.

Second, we investigate the relationship between social hierarchies in networks and social preferences at a young age. An individual's relative position within the social network may itself be related to distributional attitudes. We complement the view that parents' socioeconomic status relates to the child's social preferences (Benenson et al., 2007; Deckers et al., 2021) by exploring the structure of the child's own social network and its relationship to distributional preferences. If children who are disadvantaged in terms of school performance or who are less popular among peers adopt antisocial attitudes toward peers, such attitudes could be reinforced and persistently shape outcomes of future interactions. Alternatively, in line with Girard et al. (2015), social structure and centrality in the social network can originate from individual preferences of children.

Third, the documentation of nuanced measures of distributional preferences at a young age in a developing country context complements a series of studies that examine distributional preferences of children in high-income contexts (Martinsson et al., 2011; Fehr et al., 2013; Almås et al., 2010; Hugh-Jones and Ooi, 2017; Sutter et al., 2018). Distributional preferences in a setting with scarce financial resources, ethnic and religious diversity, and the absence of a welfare state, like urban Tanzania, may be of particular interest. Additionally, in an environment with high overall gender inequality, gender-specific preference formation at a young age may play an important role in explaining persistent outcome differences between males and females.[2] We therefore complement previous studies on overall and gender-specific distributional preferences of children (Benenson et al., 2007; Almås et al., 2010; Martinsson et al., 2011; Fehr et al., 2013; Sutter et al., 2018; Deckers et al., 2021).[3]

Combining distributional preferences and social networks might ultimately provide a workable theory of reference groups. Standard models of distributional pref-

[2]Tanzania ranks 125 out of 155 countries in the United Nations Development Programme's Gender Inequality Index. At the primary school level, the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) stated that, in Tanzania, girls tend to underachieve compared to boys, especially in reading and mathematics (SACMEQ, 2011).

[3]Fehr et al. (2013) elicit egalitarian, altruistic, and spiteful attitudes in 8- to 17-year-old pupils in Austria and find strong concerns for equity (39%) and towards others (40%) in the age group of our study. They further show that, particularly at a young age, girls favor equality, while boys show an overproportional tendency towards spitefulness. In their studies among students in Austria from a similar age group as the one in this paper, using a series of allocation games, Martinsson et al. (2011) and Sutter et al. (2018) also find higher equality concerns in girls and efficiency-orientation in boys. Finally, Almås et al. (2010) show that efficiency concerns and inequality acceptance develop in adolescence. Studying children at an even younger age, Fehr et al. (2013) provide evidence for the emergence of equality preferences from selfishness in early life, and Benenson et al. (2007) document lower levels of altruism for children with low socioeconomic status in the UK, a finding confirmed by Deckers et al. (2021) for Germany.

erences remain silent on how reference groups are formed. Our results are a first step, and they show that empirical inference on reference group (network) formation is not easy, but that it can be achieved in an environment in which there is enough control. Schools are almost perfect laboratories in this sense, allowing us not only to study the emergence of distributional preferences, but also to learn more about general aspects of network formation along distributional preferences.

The rest of the paper is structured as follows. In Section 2 we present our theoretical framework. Section 3 discusses the sample and data, Section 4 describes the experimental design in more detail, Sections 5–6 present our results, and Section 7 concludes the paper.

2. Theoretical Framework

In this section, we provide a theoretical mapping for our experimental design to motivate why we might observe that pairs of children who report a friendship link have a higher probability of exhibiting the same preference type than other children who attend the same school. We lay out a simple extension of the workhorse model for intergenerational transmission of preferences by Bisin and Verdier (2001), where horizontal preference adoption may differ between the general population and the close social environment. Consider a child i with distributional preference type t_i, where $t = \{1...K\}$, and a friend d with type t_d. With some probability $q(t_d)$, the two children reveal the same preference type due to the distribution of types in the reference population. This likelihood depends on the fraction of that specific type in the reference population of the child, in our case, the school. With an additional probability $p(t_d)$, the child exhibits the same type as the friend due to reasons unrelated to the overall type distribution at the school:

$$t_i = (p + q(t_d)) \cdot t_d + (1 - p - q(t_d)) \cdot t_k \tag{1}$$

with $t_k \neq t_d$.

Our interest here is to estimate p, the correlation coefficient between the preference types of children and their friends jointly with and independently from the share of types in the reference population $q(t)$.[4] Empirically this is achieved by sampling the peer networks of the entire reference population at the friendship dyad level. A positive p suggests that correlation in preferences between friends goes beyond $q(t)$. Notice that it is possible that the correlation varies by preference type: $p(t) \neq p$ for all t. This means that peer correlation may be preference type specific.[5] Different mechanisms may explain a peer correlation ($p > 0$). Children may select their friends by matching on observable and unobservable characteristics, in particular their distributional preferences (*ex ante* similarity, s), i.e., they choose to

[4]For simplicity, we do not endogenize the distribution of types in the reference population, which theoretically can depend on the strength of the horizontal transmission mechanism between children.

[5]Note that distributional preferences also very likely transmit from parents to children, which we do not study in this paper due to the limited scope and lack of detailed parental data.

form friendships with other students who have similar distributional attitudes. In a school environment, children do interact frequently and are thus able to learn about the attitudes of others. Children might also be influenced by the attitudes of their peers, such that distributional preferences could be transmitted through friends (*ex post* similarity, r). Preference transmission refers to any influence on the preference *ex post* to the formation of a friendship link and comprises unconscious assimilation, conscious imitation and directed socialization efforts by friends. Peer correlation in distributional preferences can therefore be decomposed into selection and preference transmission. However, disentangling transmission from selection in a sample of adolescents is empirically very difficult. At the time participants are old enough to elicit their preferences, they are likely to have grown up within the same local social and economic context, including sharing pre- or primary school classes, where transmission could take place. Generally, at this young age, it is unlikely to be able to exploit or generate random variation in peer networks, and thus excluding selection.[6]

3. Sample and Data

We elicited distributional preferences of students through a lab-in-the-field experiment at public primary schools in Dar es Salaam city, the commercial capital of Tanzania. The experiment was conducted in schools in the Ilala District at the beginning of the new school year in early 2018. In collaboration with the District Educational Office, we randomly chose 3 out of 112 schools for participation.[7] The experimental sessions took place on a single day per school during lecture hours. All present standard 6 (out of 7) students (age 12–13) participated.[8] The total sample contains 650 students, representing more than 90% of eligible students. In contrast to experiments in previous studies conducted with children after school hours, we had very little to no attrition and no selection effects into the experiment.

At the beginning of each session, students were randomly allocated to classrooms by drawing numbers. After a short survey on background characteristics and the students' friend networks, pen-and-paper choice list experiments for distributional preferences and a money-earlier-or-later experiment were conducted.[9] The preference experiments took place in random chronological order and were accompanied by randomly rotating teams of enumerators.[10] Students could earn money from ex-

[6] We discuss this issue further and illustrate potential empirical approaches using our study sample in section 5 of the appendix.

[7] The sample schools are average sized in terms of the number of classrooms and students. The sample contained participants from Kibaga (177 standard-6 students), Mtakuja (271), and Maarifa (264) primary schools.

[8] Primary school education in Tanzania is mandatory and free of tuition. Students attend for seven years (standards 1–7) at ages 7–14.

[9] The child survey and experimental session were embedded in a larger study that included a family survey and decision-making experiments conducted with parents of some of the children in the sample.

[10] The team of enumerators consisted of graduate students from the University of Dar es Salaam who are experienced in conducting surveys in the area and are native Swahili speakers. All survey and experiments were conducted in Swahili.

Table 1: Summary statistics

Background Characteristics	Mean	SD
Age of child	12.67	(1.078)
Female	0.523	(0.500)
Household size	5.346	(1.999)
Number of children in hh	2.616	(1.304)
Muslim	0.596	(0.491)
School grade	458.6	(123.3)
Rank in school	0.496	(0.288)
Peer Networks		
Number of total friends	5.614	(2.128)
Number of out-degree friends	2.803	(0.463)
Number of in-degree friends	2.811	(2.016)
Number of reciprocal friends	1.137	(0.949)
Observations	650	

Notes: This table reports summary statistics of the experimental sample. School grade and rank come from the results of the national exam for grade 5, taken one month before the study. The school grade represents the grade point sum for all ten subjects: Swahili, English, mathematics, science, geography, civic education, history, art/handicraft, communication/informatics/ICT, and physical education. Rank in school is the ranking of a student of grade 6 at a given school divided by the number of grade 6 students at that school. Out-degree denotes the number of friendships reported by a student. In-degree denotes the number of friendship ties directed toward a student (i.e., reported by peers). Reciprocal friends imply that two students independently listed each other as friends.

perimental payoffs. At the end of the session, either the distributional or the time preference experiment was randomly chosen for payout, which led to guaranteed earnings between TZS 3,000 (US$1.35) and 8,000 (US$3.59), a significant amount of pocket money for these students, particularly given the low opportunity costs.[11]

In the survey, students were asked to list and rank their three best friends within their cohort at the school. Using this information, we can construct the self-reported social networks of students. Within this network structure, various centrality measures, such as degree or eigenvector centrality, can be defined according to standard measures.

Table 1 presents descriptive statistics of student and network characteristics for the experimental sample. Approximately half of the participants are female, and a large proportion are Muslim, with the remaining 40.4% mostly of the Christian faith. Reassuringly, the mean normalized student rank based on the overall grade by school is 0.5, which suggests we did not oversample students with good or bad grades. Social networks in the sample consist of on average of 5.6 peers, and an average student is named 2.8 times by friends. The friendship measures are bounded by the fact that only three friends per student were elicited. High standard deviations in these variables suggest that there is large heterogeneity in popularity across students.

[11]Exchange rate at the time of the experiment: US$1 = TZS 2,230.

4. Experimental Design and Definitions

The experimental design to elicit distributional preferences is based on Kerschbamer (2015).[12],[13] The exact design of the experiments and the empirical strategy were registered as a preanalysis plan prior to the fieldwork.[14] Students were asked to make ten binary choices between two payoff allocations. Each allocation consists of a payoff for the decision-maker (the active agent) and a randomly matched anonymous person (the passive agent).[15] One of the two allocations in each choice situation always gives equal payoffs to both agents (symmetric allocation). The other allocation is asymmetric, with higher payoffs for the active agent in half of the choices (advantageous block) and lower in the other half (disadvantageous block). The symmetric allocation is the same in all ten choices, while the asymmetric allocation in both blocks increases in the payoff for the decision-maker (the active agent). The changes in the asymmetric payoffs represent a change in the cost of giving to (taking from) the passive agent.

Table 2 shows the ten-item choice list design. The constant symmetric (egalitarian) allocation (right) is fixed at TZS 2,500 for both agents for the ten choices. In the five rows of the disadvantageous inequality block (DIB), the decision-maker faces lower payoffs than the passive agent (TZS 4,000) in the asymmetric allocation (left). Over the five choices, the payoff to the active agent increases monotonically from TZS 2,000 to 3,000. In the five rows of the advantageous inequality block (AIB), the decision-maker faces greater payoffs than the passive agent (TZS 1,000) in the asymmetric allocation (left). Over the five choices, the payoff to the active agent increases monotonically from TZS 2,000 to 3,000, as in the DIB.

Since the payoff to the decision-maker on the left side increases from row to row, a rational participant should only switch from *right to left* and only once per block. A rational participant can also always choose left or right. The pattern of choices in the blocks determines the classification of distributional preferences. In particular, the choices reveal benevolence or malevolence toward the passive agent in the disadvantageous and advantageous domains.

Benevolence means that the decision-maker is giving up his or her own payoff to *increase* the passive agent's payoff. For example, already choosing *left* at row 1 in the DIB reveals that the decision-maker is willing to pay at least TZS 500 to increase the passive agent's payoff by 1,500 compared with the symmetric allocation. In the AIB, switching from right to left at row 9, 10, or never also implies benevolence.

Malevolence means that the decision-maker is willing to give up his or her own payoff to *decrease* the passive agent's payoff. For example, never switching implies

[12]The design allows for the identification of nine nuanced preference types. For simplicity, we focus on four broader types, as in Balafoutas et al. (2014).

[13]See Murphy and Ackermann (2011) for a survey of the literature on the alternative methods to measure social preferences.

[14]Available online at www.socialscienceregistry.org/trials/2682. Any changes from the registered preanalysis plan are discussed in section 6 of the appendix.

[15]No information on the identity or characteristics of the passive agent (such as gender) were revealed to the active agent. However, the matching was within the sample of participating students at a given school, and this was common knowledge.

Table 2: Choice list

Disadvantageous Inequality Block (DIB)						
	Left		Choice		Right	
	You get	Passive agent gets			You get	Passive agent gets
1	2,000	4,000	◯	◯	2,500	2,500
2	2,400	4,000	◯	◯	2,500	2,500
3	2,500	4,000	◯	◯	2,500	2,500
4	2,600	4,000	◯	◯	2,500	2,500
5	3,000	4,000	◯	◯	2,500	2,500
Advantageous Inequality Block (AIB)						
	Left		Choice		Right	
	You get	Passive agent gets			You get	Passive agent gets
6	2,000	1,000	◯	◯	2,500	2,500
7	2,400	1,000	◯	◯	2,500	2,500
8	2,500	1,000	◯	◯	2,500	2,500
9	2,600	1,000	◯	◯	2,500	2,500
10	3,000	1,000	◯	◯	2,500	2,500

Notes: This table presents the choice list provided to subjects (for the actual version used in the experiment, see Figure C.1 in Appendix 3). In each of 10 rows, subjects are asked to choose between two pairs of allocations (left or right). These pairs denote payoffs to the subject and to an anonymous passive agent from the same school. Payoffs are in Tanzanian shillings (TZS), US$1=TZS 2230

a willingness to pay at least TZS 500 to decrease the passive agent's payoff by TZS 1,500. Switching to the *left* in the DIB at row 4 or 5 reveals malevolence. In the AIB, switching to the left at row 6, 7, or 8 also implies malevolence.

The definitions of benevolence and malevolence in the two domains lump together strict and weak forms. A weakly benevolent decision-maker increases the passive agent's payoff by choosing *left* at row 3 at no cost, while a weakly malevolent individual renounces doing so by choosing *left* at row 8.

Table 3 clarifies how a choice sequence translates into the active agent's willingness to pay (WTP) to increase/decrease the passive agent's payoff by TZS 1. The choice list structure of the experiment only allows us to identify WTP intervals, which is sufficient to determine the signs of the WTP. Benevolence and malevolence are used to categorize subjects into four major distributional preference types. An individual who makes benevolent choices in both domains is labeled as "efficiency-loving" (EL) — that is, the decision-maker maximizes total payoffs. A subject who chooses to switch to the asymmetric allocation early in both domains reveals a preference for inequality; thus the label "inequality-loving" is used (IL). In contrast, switching to the asymmetric allocation late or never in both domains means that we classify the individual as "inequality-averse" (IA). A subject with malevolent choices in both domains is assigned to the "spiteful" preference type (SF).

At the beginning of the experiment, the instructions of the experiment and an example choice list to illustrate the choices were read to all participants.[16] In particular, subjects were informed that the passive person was a randomly chosen participant in the same session. Subsequently, students' remaining questions were answered

[16]The experimental instructions were translated into Swahili and tested prior to the experiment. The English version of the instructions can be found in section 4 of the appendix.

Table 3: Revealed willingness-to-pay and distributional preference types

Disadvantageous Inequality Block (DIB)			
Subject chooses *left* for first time in row	WTP w	WTP sign	Revealed attitude
1	$0.33 \leq w < \infty$	>0	Benevolent
2	$0.06 \leq w < 0.33$	>0	Benevolent
3	$0 \leq w < 0.06$	>0	Benevolent
4	$-0.06 \leq w < 0$	<0	Malevolent
5	$-0.33 \leq w < -0.06$	<0	Malevolent
Never	$-\infty < w < -0.33$	<0	Malevolent
Advantageous Inequality Block (AIB)			
Subject chooses *left* for first time in row	WTP	WTP sign	Revealed attitude
6	$-\infty < w < -0.33$	>0	Malevolent
7	$-0.33 \leq w < -0.06$	>0	Malevolent
8	$-0.06 \leq w < 0$	>0	Malevolent
9	$0 \leq w < 0.06$	<0	Benevolent
10	$0.06 \leq w < 0.33$	<0	Benevolent
Never	$0.33 \leq w < \infty$	<0	Benevolent
Preference types			
DIB	AIB		Revealed preference type
Benevolent	Benevolent		Efficiency-loving (EL)
Benevolent	Malevolent		Inequality-loving (IL)
Malevolent	Benevolent		Inequality-averse (IA)
Malevolent	Malevolent		Spiteful (SF)

Note: This table shows how a choice sequence translates into the active agent's willingness to pay (WTP) to increase/decrease the passive agent's payoff by TZS 1.

personally by the team of enumerators.

It was made clear that, if a student drew the distributional preference experiment for payout at the end of the session, one of the ten items on the choice list would be randomly chosen and realized. Due to random matching of active and passive agents, apart from actively choosing allocations, each child was guaranteed to be a passive agent for some other student. The passive payoff from the randomly matched participant was added to the active payoff of the decision-maker, and this was made clear in the instructions.

5. Results

A. Preference Distribution and Peer Network Characteristics

The first step of the analysis is to document the prevalence of distributional preference types in the sample. Figure 1 plots the metric willingness-to-pay measure to increase the passive agent's payoff in the DIB (y-axis) and AIB (x-axis) and assigns preference types per quadrant. For most children, their choices can be clearly attributed to one of the four broad preference types, defined by the graphs' quadrants. Only in the range between spiteful and inequality-averse types do some subjects show more nuanced preferences, as they reveal neutrality if advantaged and neutrality or malevolence if disadvantaged. These types are consistent with *kick-down* or *selfish* preferences (Kerschbamer, 2015). The visualization also highlights that, while fairly balanced across the advantageous domain, choices in the disadvantageous domain

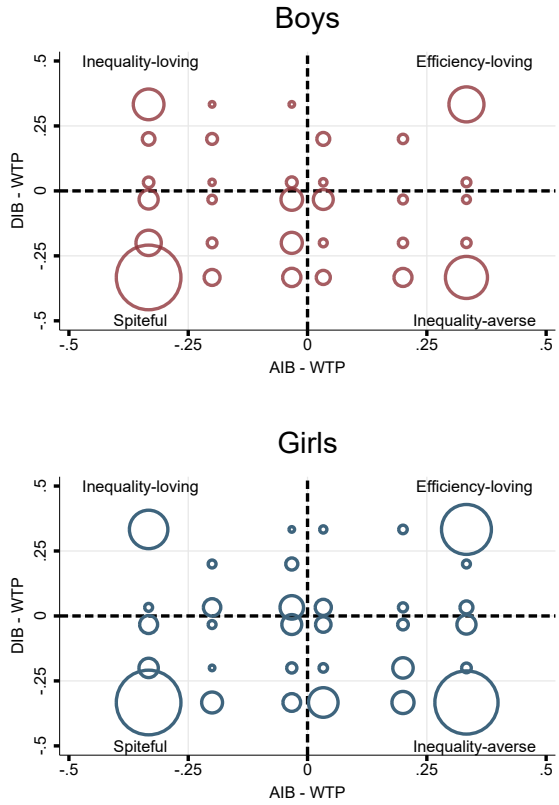


Figure 1: Distribution of distributional preferences by gender

Note: Distributional preferences based on willingness to pay (WTP) to increase the passive agent's payoff in disadvantageous (DIB, y-axis) and advantageous (AIB, x-axis) domains. Upper: boys (293 observations). Lower: girls (321 observations).

Table 4: Distribution of distributional preferences

	(1) Children	(2) Boys	(3) Girls	t-test
Efficiency-loving (EL)	14.5%	13.0%	15.9%	
Inequality-loving (IL)	12.4%	10.9%	13.7%	
Inequality-averse (IA)	30.6%	24.9%	35.8%	**
Spiteful (SF)	42.5%	51.2%	34.6%	***
WTP (DIB) > 0 (benevolence)	26.9%	23.9%	37.9%	
WTP (AIB) > 0 (benevolence)	45.9%	29.6%	51.7%	***
Observations	614	293	321	

Notes: Columns 1, 2 and 3 of this table show summary statistics of distributional preferences of the whole sample of children and the subsample of boys and girls. WTP denotes a subject's willingness to pay to increase (decrease) the payoff of the passive agent in the disadvantageous (advantageous) inequality block.

are skewed toward malevolence.

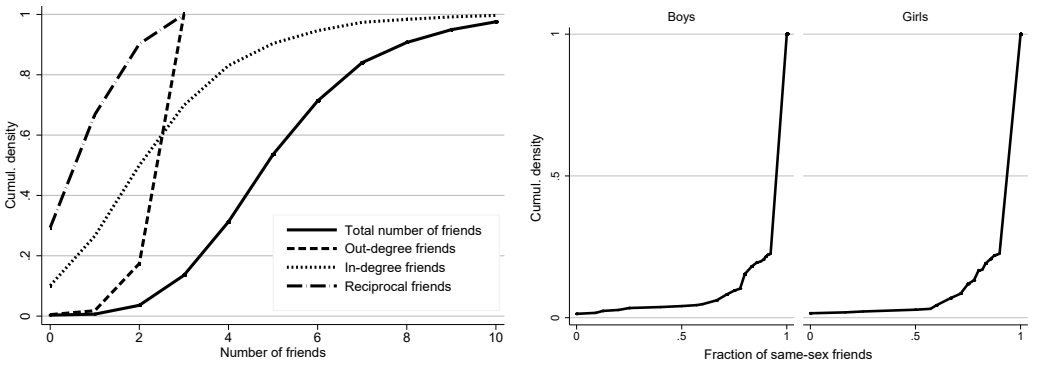
Table 4 shows that a high percentage (42.5%) of children reveal spiteful behavior in the experiment. Less than half of the subjects show either efficiency-loving (14.5%) or inequality-averse (30.6%) preferences.[17] A large share of students exhibit malevolent behavior in either the DIB (73.1%) or the AIB (54.1%), meaning that they sacrifice resources to improve their relative position. If advantaged, they choose to preserve the inequality, and, even more strongly, if disadvantaged, they decide to equalize payoffs.[18] Although Fehr et al. (2013) use a somewhat different experimental design, the shares of revealed preference types from our experiment mirror almost one-to-one the distribution of 8- to 9-year-olds in their study of Austrian students. Compared with 12- to 13-year-old children in their sample, we document approximately three times higher frequencies of spitefulness and three times lower frequencies of efficiency-loving or altruistic types.

Distributional preferences vary significantly by gender. Girls are substantially more likely to be inequality-averse (35.8% to 24.9%) and less likely than boys to exhibit spiteful preferences (34.6 to 51.2%). This gender difference at a young age is the result of more benevolent choices of girls for both disadvantageous and advantageous allocations. In particular, when the allocation is in their favor (AIB), female students are statistically significantly more willing to sacrifice resources in order to increase the passive agent's payoff. In fact, 13.8% more girls do so in the advantageous than in the disadvantageous domain, while for boys this difference amounts to only 5.1%. Additionally, we check if distributional preferences vary depending on whether a child lives with both biological parents, with a single parent or with none. This proxy for orphanhood, a common characteristic of children in the study context, does not correlate with the preference type; see Table A.4 in the Appendix for details.

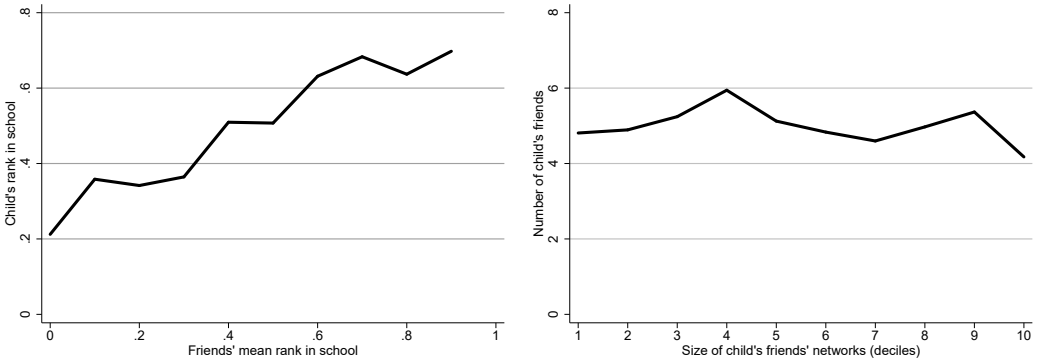
The peer network constructed from the three best friends of each child provides information on the quantity and the types of peers. We define "friendship" as a unilateral or bilateral link in the network. Figure 2 summarizes some of the main characteristics of these networks. By design, our network measure limits out-degree (naming a friend) to a maximum of three, which corresponds to the number of friends that we elicited via the survey. Within the observable range, the distribution does not have large tails of very unpopular or popular students (i.e., in-degree, being named as a friend). The median number of peers is only slightly lower (5) than the mean (5.6), and the standard deviation (2) is moderate. Almost every third friendship is

[17] We dropped 36 observations from the sample because of inconsistent (double switching) or erroneous (incomplete or ambiguous) choices.

[18] Children's distributional preferences differ significantly from those of a comparable sample of adults (362 parent couples recruited from eight randomly chosen primary schools in Dar es Salaam), who participated in a related study conducted by one of the coauthors (see Table A.1 in Appendix 1). In particular, the efficiency-loving type is about 2.5 times less prevalent in the sample of children (14.5% to 38.6%). Instead, adolescents show a high frequency of spiteful preference types (42.5%), about 2.5 times the percentage of adults. Similar shares of the samples revealed inequality-loving (12.4% to 13.7%) or inequality-averse (30.6% to 31.2%) preferences. This suggests that, with age, individuals adopt more efficiency-oriented preferences, rather than prioritizing their own absolute and relative payoffs. These findings are consistent with the age trends in other-regarding preferences documented by, among others, Almås et al. (2010) and Sutter et al. (2018).



(a) Distribution of size and network segregation by gender



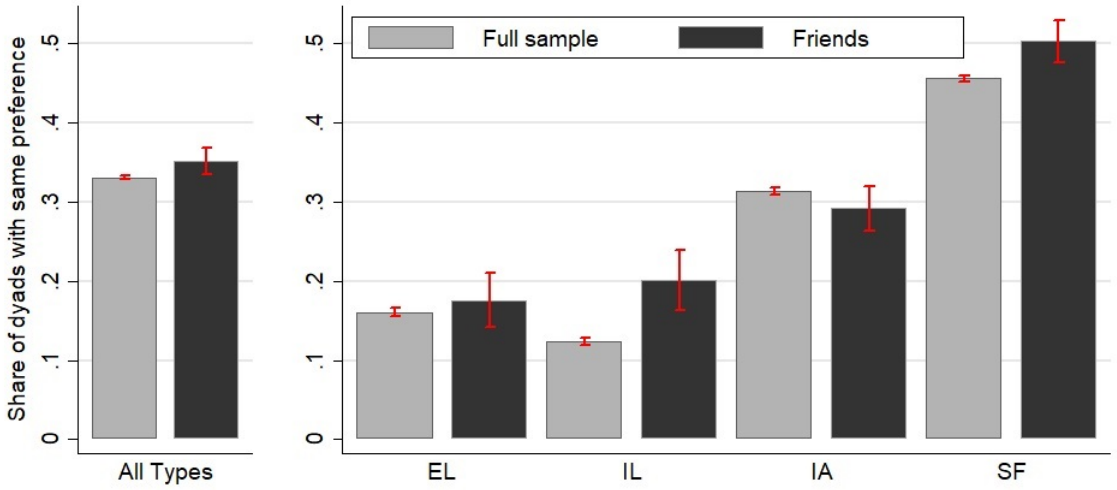
(b) Within-network correlation of school performance (rank within school of grade point summed over all 10 subjects) and network size (deciles of total size of a child's network)

Figure 2: Characteristics of peer networks

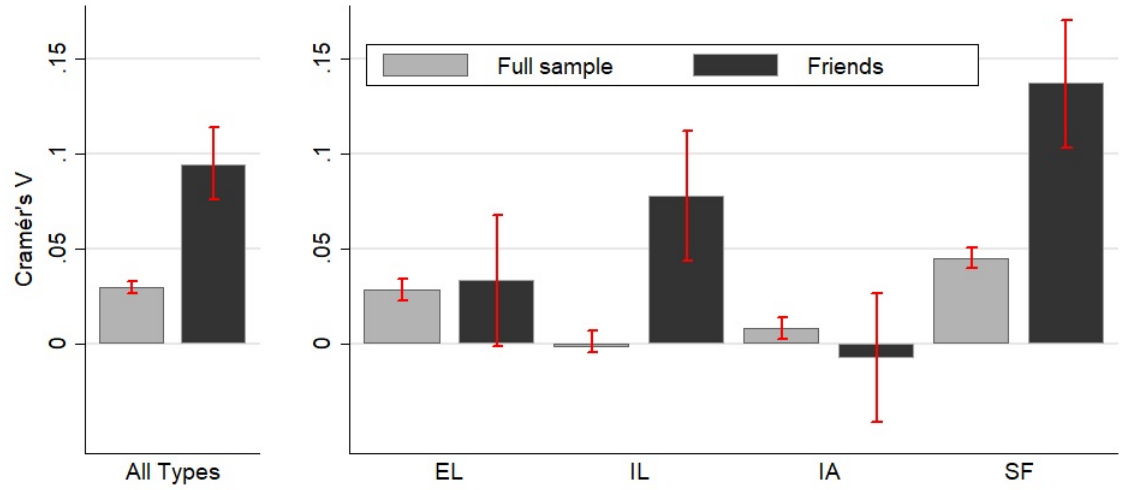
reciprocated. Not surprisingly for this age group, friendship networks are extremely segregated by the gender of students. In our sample, 77.5% of children have only same-gender friends, and only 9% have more than one peer from the opposite sex in their peer networks.

The peer networks in the sample are dense and well connected. This implies that each student could reach out to any other student via relatively few friendship connections. There are also virtually no isolated peer networks, even considering the segregation by gender. However, as we analyze and discuss further in Section C, there are differences in popularity and centrality of children within their networks.

Despite the focus on understanding whether and why peer networks are based on distributional preferences, it is worth noticing that members of these networks can exhibit similarities in other characteristics as well. Graph (b) of Figure 2 shows that students with high test scores also have high-performing friends (corr. 0.34^{***}). Peer networks could reinforce peer correlations in school performance through cooperation and social interaction based on distributional attitudes. However, popular children



(a) Percentages of links between children of the same distributional preference type by non-friends and friends (comparing probabilities q and $q + p$).



(b) Association (Cramér's V for all types, correlation coefficient for separate types) between preference types by non-friends and friends.

Figure 3: Correlation of distributional preferences at the school and within peer networks.

do not seem to socialize more with peers who are part of large networks themselves.

B. Peer Correlations in Distributional Preferences

We start by exploring the link between preference types in peer networks by plotting the frequency of observing pairs of children with identical preference types. Each possible pair of children at a sample school is represented by an observation (dyad) in the sample. Distinguishing between dyads of children who reported a friendship link and the full dyad sample, we can separate the probabilities p and q stated in our theoretical framework. q represents the distribution of preference types in the

children's broad social environment. In the absence of peer effects, it represents the probability that two randomly selected children exhibit the same preference type. If we observe a higher frequency of same-type dyads among those children that report a friendship, p is positive and friends are more likely to have similar preferences.

Panel (a) in Figure 3 depicts these frequencies for the entire sample and for subsamples of specific preference types. The distribution of types in the children's population is the major factor that explains dyads of same-type children. However, there are significant differences in the distribution of these frequencies for dyads between friends and the full sample, particularly for inequality-loving and spiteful preference types.

Panel (b) of Figure 3 compares these frequencies to the overall preference distribution by plotting the association/correlation coefficients. For the overall relationship between the categorical types variable, we use the Cramér's V measure of association. A randomly selected pair of children at a school is more likely to exhibit the same preference type if they are friends. First, note that types between non-friends at the same school are weakly correlated (0.029), which means that q at a given school is slightly different than the overall distribution of types in our full sample of all three schools. Second, the correlation between types in dyads between friends and the full sample differs substantially and explains why we observe more same-type dyads among friends. The overall higher correlation (0.094) between types in friend-dyads is driven by significantly higher correlations for inequality-loving (0.078) and spiteful types (0.137).

Next, we take a closer look at these correlations between types for friend-dyads by controlling for observable child characteristics and uncovering some of the heterogeneity in preference peer networks using the following dyad-level specification with child i and dyad link d.

$$sametype_{i,d} = \alpha_0 + \alpha_1 friendship_d + X_i'\delta + \epsilon_{i,d} \tag{2}$$

where *sametype* is a dummy variable equal to one if the two children in a dyad reveal the same preference type. *Friendship* is a dummy equal to one if one child in the dyad unilaterally reported a friendship with the other. Controls X include school fixed effects, total number of friends, school grade, age, gender, religion, same sex dyads and household size. Standard errors are bootstrapped at the child level.[19] We also estimate this specification for preference type $t = \{EL, IL, IA, SF\}$ subsamples.

Panel A of Table 5 shows marginal effects of a probit regression for equation 2. It confirms that the higher correlation between types for friends persists when school fixed effects and individual characteristics of the child are included. If two randomly selected children report a friendship, the likelihood of revealing the same preference type (mean=0.331) increases by 1.7 percentage points. Inequality-loving (mean=0.126) and spiteful types (mean=0.457) account for a large share of this relationship. In a regression run using a subsample of friends with these types,

[19] In Table A.3 in the Appendix we provide a robustness check with bootstrap standard errors stratified at child level to alleviate the concern that reciprocal dyads appear in clusters of two children.

Table 5: Correlation in distributional preference types

Panel A:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.017*	-0.001	0.068***	-0.029	0.037**
	(0.007)	(0.018)	(0.017)	(0.015)	(0.0124)
Panel B:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.0158	0.023	0.045*	-0.016	0.039*
× Unilateral	(0.013)	(0.023)	(0.022)	(0.019)	(0.017)
Friendship link	0.009	-0.003	0.136***	-0.051*	0.025
× Reciprocal	(0.015)	(0.022)	(0.032)	(0.022)	(0.022)
Panel C:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.039**	0.004	0.067*	-0.122***	0.110***
× Boy	(0.015)	(0.026)	(0.032)	(0.021)	(0.023)
Friendship link	-0.002	-0.004	0.090**	0.026	-0.065*
× Girl	(0.015)	(0.034)	(0.029)	(0.018)	(0.028)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	128,943	17,607	15,803	39,770	55,763
Outcome Mean	0.331	0.161	0.126	0.313	0.457

Notes: This table reports marginal effects from a probit regression of a friendship link. The outcome is a binary variable equal to one if two children at a school exhibit the same preference type. Column 1 shows the marginal effect on having the same preference type. Columns 2-5 report the results for subsamples of the child's preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Panels B and C report correlations for unilateral and reciprocal friendship links and by the child's gender. In all panels standard errors are bootstrapped at the child level, and controls include student's school grade, household size, religion, age, gender, a dummy for gender-matched dyads and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

the likelihood increases by 6.8 percentage points and 3.7 percentage points, respectively.[20] Overall, the evidence suggests that peer correlations are large for malevolent but not for benevolent choices, and thus for preference types, in both domains of our experiment. Even though children reported their three best friends, peer networks at the school may in fact be larger. This means that our measure of peer networks is truncated at out-degree three (naming three friends). As unrecorded friendships are by design lower ranked than the recorded links, our reported coefficients could be interpreted as close-friends preference correlations.

Panel B of Table 5 shows that the peer correlations in types among friends remain fairly constant when the directed nature of the network is taken into account. Whether a child names a friend or is named by another child (unilateral link) or both (reciprocal) makes little difference for preference type relations. Looking at the estimates for subsamples by distributional preference types, we observe that girls are slightly more likely to share reciprocal friendships, and therefore the correlations

[20]Note that, although we estimate separate specifications for all preference types, the simultaneous change of both outcome and explanatory variables does not allow for standard adjustments for multiple hypotheses testing.

are slightly higher for the inequality-loving type, which is more prevalent in female students.[21]

With distinct preference distributions for boys and girls, as well as relatively segregated peer networks, one could think that peer correlations are gender specific. In panel C of Table 5, we therefore introduce heterogeneity by gender of children. Overall, the estimates for peer correlations in distributional preferences are entirely driven by boys, with a statistically significant difference at 0.1%. However, when differentiating between preference types, network results for inequality-loving and spiteful types are strongly driven by boys, with marginal effects of 6.7 percentage points (p-*value*=0.056) and 11 percentage points (p-*value*>0.000), while girls show higher correlations in inequality-loving types (9.0 percentage points; p-*value*=0.003). It is noteworthy that we control for same sex dyads, because social networks in general and preference distributions are segregated by gender. We do not want to speculate on the origins of the gender differences, because we had no ex ante expectation, and there is no economic theory that gives guidance for what we observe.

As mentioned in the theoretical section, the correlation p can be due to both transmission and selection effects, and it is very difficult to empirically disentangle the two channels. In section 5 of the appendix, we discuss these issues further, including using our data to illustrate a few possible approaches on how to do this.

Finally, we want to comment on the average effect size of friendship in our preferred specification, 1.7 percentage points on average and significantly higher for certain types. Given the lack of comparable evidence in the experimental literature, there is no benchmark for the size of the effect. What we can do is compare the effect size of friendship regarding distributional preferences with effect sizes from observable characteristics among our control variables. The average effect size of friendship regarding distributional preferences is slightly larger than the effect size of being a Muslim (compared to being a Christian).

C. Relative School Performance and Popularity

Besides providing a reference unit in which distributional preferences are formed, changed, or reinforced, peer networks may also have an indirect influence by referencing an individual's economic or social position. Bolton and Ockenfels (2000) argue that the aggregate relative position of the decision-maker matters for equity concerns and reciprocity. Charness and Rabin (2002) explore Rawlsian preferences and find that individuals tend to increase the payoffs of worse-off agents, but behave locally in a competitive manner. Fisman et al. (2017) show that distributional preferences vary across the income distribution. In this section, we use detailed data on friend networks, as well as administrative information on test scores, and explore whether distributional preferences are related to an individual's position in terms of school performance and popularity. These two outcomes are presumably important

[21] Table A.5 in the appendix provides robustness test of the main correlation by using only unilateral directed or reciprocal links in separate regressions. The results are qualitatively robust, but lose in significance due to the lower amount of "treated" friendship links.

for the individuals position within the networks.[22]

Relative position in school performance is measured by the rank in standard 6 of a specific school.[23] Within the social network, we use the number of higher-ranked friends, whether friends are on average higher-ranked, and a continuous variable of the mean rank difference to capture the relative standing in performance of the child. Popularity is assessed by measures of centrality widely used in network analysis. The simplest one, in-degree centrality, denotes the number of incoming friendships, meaning that it counts the number of times that other students have named a child as their friend. The Katz-Bonacich centrality additionally captures aspects of popularity that goes beyond the direct friends. It counts all the shortest paths to reach any other friend node in the close and extended social network, while discounting those connections farther away from the child. Finally, the eigenvector centrality, in an extension of degree centrality, treats connections to friends differentially by their respective importance in the network.[24]

Empirically, the relationship between relative position or popularity and distributional preferences is estimated using the following specification at the student/individual level.

$$\mathbf{1}[\text{type} = t]_i = \gamma_0 + \gamma_1 \begin{Bmatrix} rel.\ \ rank_i \\ centrality_i \end{Bmatrix} + X_i'\beta + \epsilon_i \tag{3}$$

where $\mathbf{1}[\text{type} = t]$ is a dummy variable for preference types $t = \{EL, IL, IA, SF\}$ for individual i and γ_1 is the marginal effect of either relative school performance or peer network centrality. To correct the robust standard errors for correlation at the school level, we estimate clustered standard errors and clustered wild bootstrap standard errors with the Webb distribution (Webb, 2014; Cameron and Miller, 2015). The latter corrects for over-rejection bias due to the very low number of clusters (three schools).

Table 6 shows that the large prevalence of spiteful preference types is connected to the relative position of students in terms of educational outcomes. Note that the specification controls for the numeric school grade and therefore identifies the relationship relatively locally. Taking the estimates at face value, this implies that, of two students who ranked one standard deviation apart, the lower-ranked student is about 29% more likely to have spiteful preferences. Ranking one standard deviation lower than a peer increases this likelihood by 3.7%. Inequality- and efficiency-loving types are negatively correlated with our measures of relative position, but this is not statistically significant.

Although intuitive, the estimates do not prove a causal relationship between relative position and spiteful distributional preferences because of potential reverse

[22] The adolescent individuals in our study do not differ in their economic status, and we lack reliable income data for their parents, which means that we cannot look at any relative economic status measures.

[23] The rank is based on the grade point sum over all 10 subjects of the final national exam at the end of standard 5, normalized by the total number of students at the school. The exam took place approximately one month prior to the experimental sessions.

[24] See Jackson (2008) for a detailed description of network summary and centrality statistics.

Table 6: Distributional preference and relative position

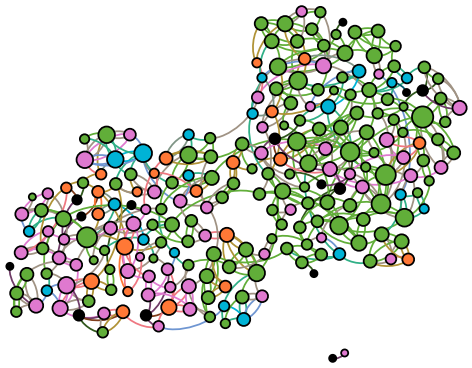
Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
Panel A: *Relative Position in School*				
Rank in school	0.022	-0.307	-0.741*	0.997**
(normalized at school level)	(0.267)	(0.229)	(0.352)	(0.369)
clustered p-values	0.879	0.120	0.110	0.092+
Rank difference to friends	-0.110	-0.046	0.032	0.126+
(normalized at school level)	(0.082)	(0.079)	(0.702)	(0.111)
clustered p-values	0.102	0.620	0.111	0.046*
Panel B: *Social Hierarchy*				
In-degree	0.002	0.011	-0.013	0.0004
	(0.007)	(0.008)	(0.009)	(0.010)
clustered p-values	0.842	0.119	0.323	0.973
Eigenvector centrality	-0.072	0.530	-0.682+	0.224
	(0.418)	(0.481)	(0.361)	(0.594)
clustered p-values	0.843	0.547	0.287	0.704
Katz-Bonacich centrality	-0.177	-0.448	-0.182	0.807+
	(0.492)	(0.343)	(0.463)	(0.479)
clustered p-values	0.362	0.176	0.779	0.038*
Controls	Yes	Yes	Yes	Yes
Observations	611	611	611	611

Notes: Columns 1–4 of this table report marginal effects from probit regressions of preference types regressed on a student's relative position (panel A) and social hierarchy (panel B). The outcome variable is a binary variable that determines whether a student is of a specific distributional preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Standard errors are robust, and clustered p-values reflect standard errors clustered at school level (3), computed via wild bootstrap using the Webb distribution. Controls include total size of social network, student's school grade, household size, religion, age, gender, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

causality. Students may perform worse than their peers because of their distributional preferences or because of observable or unobservable confounders. We rely on survey information to tentatively argue against these alternative explanations (see Table A.2 in appendix). To the extent that malevolent social preferences hinder a student's success at school, we do not find spiteful types to be less popular among other students or to show lower self-reported frequencies of studying or doing homework with their friends. With respect to observable confounders, such as social and financial status of the child's family, the potential proxies we control for, such as household size, religion, and impatience, are not related, or are negatively related, to spitefulness.

Figure 4 depicts the social networks in one of the sample schools. It shows, on the one hand, that preference types appear in clusters, and, on the other hand, that spiteful types (green) are dominant in popularity, represented by size. Zooming in on this malevolent type, a central cluster located around several popular *influencers* emerges. This pattern is supported weakly by panel B in Table 6, which shows that all measures for centrality and popularity are related positively, although not

(a) *All preference types*



(b) *Spiteful type*

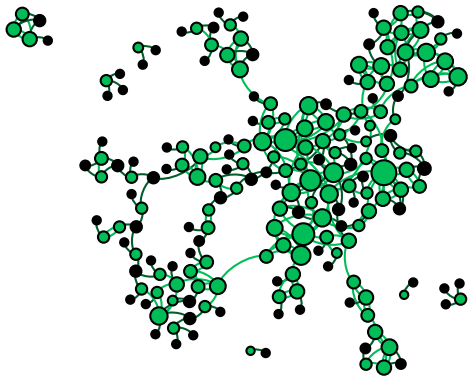


Figure 4: Degree centrality and preference types (Maarifa Primary School)

Notes: Efficiency-loving = blue, inequality-loving = orange, inequality-averse = pink, spiteful = green. Black circles in Figure 4, panel A, denote individuals with missing preference measures; in Figure 4, panel B, they denote all nonspiteful preference types. Figure 4, panel A, depicts all standard-6 students in the school, with colors and size denoting preference types and degree centrality. Figure 4, panel B, displays the network for children of the spiteful type.

significantly, to the likelihood of being a spiteful type. This correlation is robust to controlling for the total number of friends and therefore is not merely a reflection of large numbers of this preference type. A look at the relationship between popularity and choices in the DIB and AIB domains reveals that the correlation operates mainly through malevolence, when the asymmetric allocation is advantageous for the decision-making child. This suggests that these students are likely to prefer establishing hierarchies in the school environment that are favorable to them.

The distinction between benevolence in the DIB and AIB domains can also help explain why low ranks in outcomes and popularity show different correlations to distributional preference types. Children who are disadvantaged in terms of school grades may take the situation as exogenous — that is, not affected by their distributional attitudes towards peers — and tackle the disadvantage through malevolent

choices in the DIB domain. Unpopular children may consider their social position malleable and signal benevolent behavior.

6. Additional Results

While the main focus of this paper is to study the role of the close social environment of peers in understanding distributional preferences of children, our study additionally represents the first attempt to experimentally elicit these attitudes with the given method in a developing country context. Not surprisingly, we find that the country context also matters for other-regarding preferences in adolescence. As mentioned earlier, the shares of revealed preference types in our sample of 12- to 13-year-old Tanzanian children resemble the distribution of 8- to 9-year-olds in the sample of Austrian students studied by Fehr et al. (2013), who also use simple allocation experiments; see footnote 3 for details. The gender gap in children's distributional preferences is identical to the shares of preference types among 8- to 9-year-olds in that study. Thus, it appears that a 2- to 3-year delay exists in the evolution of distributional preferences, though individuals could be on different paths altogether. Interestingly, this delay corresponds to the deficits in human capital formation in Sub-Saharan Africa compared with developed countries. Bold et al. (2018) find that, after 3.5 years of school, primary schoolchildren in Kenya and Mozambique have gathered knowledge of only 1.5 years' effective learning. If economic underdevelopment is related to a low rate and slow formation of benevolent other-regarding preferences, cooperation and growth could be further affected negatively — a hypothesis, which, we believe is important to test in future research.

It is worth mentioning that the broad and close social environment may interact in determining preference formation at a young age. For example, peer networks in low-income, poverty-prone contexts could have stronger influences on economic behavior, given their role for providing crucial insurance and support in the context of a lack of efficient formal institutions, even at a young age.

This potential preference gap between low- and high-income contexts seems to persist over time. Results for comparable adults sampled in our low-income setting also differ significantly from distribution of types in developed countries (see Figure B.1 in the appendix for the distribution of preferences in the adult sample). For example, a study in Austria by Balafoutas et al. (2014), using the same design as our study, shows up to twice as many efficiency-loving types and a significantly lower occurrence of inequality-averse attitudes among adults. In fact, the distribution of adult preference types in our sample is strikingly close to the findings of Fehr et al. (2013) for 14- to 17-year-old high school students in a high-income setting. We believe that this observation warrants future research as well.

7. Conclusion

Previous studies in economics have documented that distributional preferences are important in explaining a number of economic decisions in the context of fostering cooperation, increasing productivity, and improving political outcomes. How does

peer influence in early life shape these obviously important distributional preferences? In this paper, we attempt to shed light on this research question using a lab-in-the-field experiment. We recruited a sample of adolescents (aged 12-13) and let them make ten binary choices between two payoff allocations between the decision-maker (the active agent) and a randomly matched anonymous person from the same sample (the passive agent). We then use these allocation patterns to categorize children into efficiency-loving, inequality-loving, inequality-averse, and spiteful types. We also collect detailed information on friendship networks and investigate the relationship between distributional preferences of children and their peers.

Results suggest that a large percentage of children exhibit spiteful behavior (42.5%) or equality-oriented (30.6%) preferences. This means that a large share of students reveals malevolent behavior in their allocation decisions, i.e., they sacrifice resources to improve their relative position. If advantaged, they choose to maintain the inequality; even more strongly, if disadvantaged, they opt to equalize payoffs. There is also a clear difference between boys and girls in distributional preferences. Girls tend to be more strongly inequality-averse than boys and less likely to reveal spiteful preferences.

The detailed friendship network data we collected allows us to uncover a significant correlation in distributional preferences within the peer networks. In particular, pairs of children linked by self-reported friendship are more likely to reveal the same preference type. Conditional on a friendship link, children are alike with respect to malevolent behavior toward others, especially in disadvantageous situations (inequality-loving and spiteful types). Furthermore, the relative position within a network is related to preference types to a smaller extent than the network composition.

We believe that our study offers several novel and relevant insights on distributional preferences of adolescents and their peers. First, it provides a structured view on the role of social networks in shaping adolescents' distributional preferences. We show that distributional preference types are assorted along friendship ties, at least for some types. Second, our study can be considered as a relevant starting point to study the emergence of reference groups that are at the heart of models of social preferences, but have not been endogenized in these models so far. Third, we show that there is a potential relationship between distributional preferences and one of the most important outcomes at a young age, school performance.

Given the importance of distributional preferences for many aspects of life, we regard it as an interesting task for future research to explore how early social preference networks shape group outcomes later in life. Our findings also speak to the potential importance of exposing children to attitudes that differ from the prevalent views of their close social environment. Children in a weak relative position or in a peer network based on malevolent preferences may not evolve with age, or at least not as quickly as others, towards exhibiting more benevolent other-regarding attitudes. Tracking or reshuffling of classes at school may be a policy that can induce exposure to other attitudes, while simultaneously changing relative positions within the social environment.

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Distributional Preferences in Adolescent Peer Networks
Online Appendix

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Contents

1. Additional Tables

Table A.1: Revealed distributional preferences of adults

	Adults	Men	Women
Efficiency-loving (EL)	38.63%	32.87%	44.41%
Inequality-loving (IL)	13.67%	15.04%	12.29%
Inequality-averse (IA)	31.10%	31.20%	31.01%
Spiteful (SF)	16.60%	20.89%	12.29%
WTP (DIB) > 0	52.31%	47.91%	56.70%
WTP (AIB) > 0	69.75%	64.07%	75.42%
Observations	717	359	358

Notes: WTP denotes a subject's willingness to pay to increase (decrease) the payoff of the passive agent in the DIB (AIB). Nine adults are dropped from the sample because of inconsistent (double switching) or erroneous (incomplete or ambiguous choices) answers.

Table A.2: Child characteristics by preference type

	(1) All Types	(2) EL	(3) IL	(4) IA	(5) SF	ANOVA
Study with friends (days per week)	1.95 (0.991)	2.03 (1.055)	1.99 (0.993)	1.77 (1.053)	2.04 (0.906)	*
Do homework with friends (days per week)	1.56 (1.137)	1.40 (1.120)	1.72 (1.180)	1.49 (1.135)	1.63 (1.127)	
Play with friends (days per week)	2.34 (0.915)	2.32 (0.929)	2.47 (1.251)	2.25 (0.999)	2.38 (0.881)	
Household size	5.35 (1.999)	5.47 (1.913)	5.28 (2.197)	5.28 (1.847)	5.37 (2.080)	
Number of children in hh	2.62 (1.304)	2.89 (1.465)	2.45 (1.251)	2.56 (1.215)	2.61 (1.316)	
Muslim	0.60 (0.491)	0.49 (0.503)	0.74 (0.443)	0.62 (0.487)	0.58 (0.495)	*
Observations	614	89	76	188	261	

Table A3: Correlation in distributional preference types (stratified bootstrap)

Panel A:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.017*	-0.001	0.068***	-0.029+	0.037*
	(0.008)	(0.020)	(0.016)	(0.016)	(0.015)
Panel B:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.013	-0.006	0.130***	-0.048+	0.030
× Reciprocal	(0.014)	(0.025)	(0.027)	(0.025)	(0.018)
Panel C:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.039**	0.004	0.067*	-0.122***	0.110***
× Boy	(0.013)	(0.025)	(0.030)	(0.024)	(0.018)
Friendship link	-0.002	-0.004	0.090***	0.026	-0.065***
× Girl	(0.011)	(0.021)	(0.025)	(0.024)	(0.017)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	128,943	17,607	15,803	39,770	55,763
Outcome Mean	0.331	0.161	0.126	0.313	0.457

Notes: This table reports marginal effects from a probit regression of a friendship link. The outcome is a binary variable equal to one if two children at a school exhibit the same preference type. Column 1 shows the marginal effect on having the same preference type. Columns 2-5 report the results for subsamples of the child's preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Panels B and C report correlations for reciprocal friends only and by the child's gender. In all panels standard errors are bootstrap stratified at child level, and controls include student's school grade, household size, religion, age, gender, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

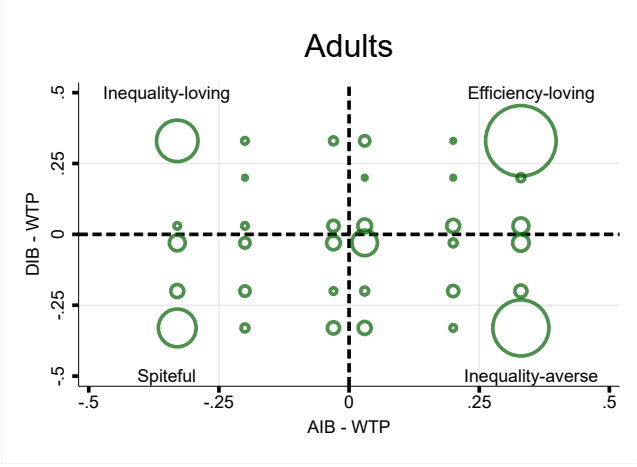
Table A.4: Distributional preference and cohabitation with parents

Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
Panel A: *Binary control*				
Living without biological parents	0.0402	0.00264	0.0235	-0.0573
	(0.0417)	(0.0387)	(0.0578)	(0.0603)
Panel B: *Differentiated control*				
Living without biological parents	0.0382	0.0360	0.0147	-0.0730
	(0.0432)	(0.0403)	(0.0606)	(0.0629)
Lives only with mother	-0.0326	0.0904**	-0.0308	-0.0282
	(0.0370)	(0.0303)	(0.0465)	(0.0480)
Lives only with father	0.0581	0.000497	0.00578	-0.0608
	(0.0467)	(0.0513)	(0.0663)	(0.0696)
Controls	Yes	Yes	Yes	Yes
Observations	611	611	611	611

Notes: Columns 1–4 of this table report marginal effects from probit regressions of preference types regressed on orphanhood. The outcome variable is a binary variable that determines whether a student is of a specific distributional preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Standard errors are robust. Controls include total size of social network, student's school grade, household size, religion, age, gender, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

2. Additional Figure

Figure B.1: Distributional preference of adults



Note: Distribution of social preferences based on willingness to pay (WTP) to increase the passive agent's payoff in disadvantageous (DIB, y-axis) and advantageous (AIB, x-axis) domains (717 observations).

Table A.5: Correlation in distributional preference types

Panel A:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.017*	-0.001	0.068***	-0.029	0.037**
	(0.007)	(0.018)	(0.017)	(0.015)	(0.0124)
Panel B:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.013	-0.006	0.130**	-0.048^{+}	0.030
× Reciprocal	(0.018)	(0.041)	(0.047)	(0.028)	(0.030)
Panel C:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.017	-0.0002	0.089**	-0.036^{+}	0.039*
× Outward link	(0.010)	(0.023)	(0.028)	(0.019)	(0.019)
Panel D:		by type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Friendship link	0.018^{+}	-0.002	0.068**	-0.019	0.034*
× Inward link	(0.010)	(0.025)	(0.027)	(0.021)	(0.015)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	128,943	17,607	15,803	39,770	55,763
Outcome Mean	0.331	0.161	0.126	0.313	0.457

Notes: This table reports marginal effects from a probit regression of a friendship link. The outcome is a binary variable equal to one if two children at a school exhibit the same preference type. Column 1 shows the marginal effect on having the same preference type. Columns 2-5 report the results for subsamples of the child's preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Panels B, C and D report correlations for reciprocal, outward and inward links estimated in separate regressions. In all panels standard errors are bootstrapped at child level, and controls include student's school grade, household size, religion, age, gender, a dummy for gender-matched dyads and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

3. Choice List for Distributional Preferences Experiment

Figure C.1: Choice List for Distributional Preferences Experiment (translated from Swahili)

	LEFT		Decision		RIGHT	
	You get	Passive person gets			You get	Passive person gets
1	2000	4000	O	O	2500	2500
2	2400	4000	O	O	2500	2500
3	2500	4000	O	O	2500	2500
4	2600	4000	O	O	2500	2500
5	3000	4000	O	O	2500	2500

6	2000	1000	O	O	2500	2500
7	2400	1000	O	O	2500	2500
8	2500	1000	O	O	2500	2500
9	2600	1000	O	O	2500	2500
10	3000	1000	O	O	2500	2500

4. Instructions for Distributional Preferences Experiment

Start by reading the following instructions to the participants: We will now proceed with the next part of today's session. It consists of 10 decisions. You are matched with another person of your age in today's study. The identity of this person will remain unknown to you. We will call the person matched with you "your passive person" from now on. We will explain later, why this participant is called "passive person".

Each of your 10 decisions is a choice between the options LEFT and RIGHT. Each option has consequences for how much money you and your passive person can earn (show example choice).

Left		Choice	Right	
You get	Passive agent gets		You get	Passive agent gets
1900	3000	◯ ◯	2000	2000

In this example you are asked whether you prefer the alternative LEFT, in which you get 1900 TZS and your passive person gets 3000 TZS, or the alternative RIGHT, in which you earn 2000 TZS and your passive person gets 2000 TZS as well. You will have to decide for one of the two alternatives by crossing the circle next to the alternative. Are there any questions?

All in all, you will make 10 such decisions. Your earnings from this part will be determined as follows:

If you draw this part for payout, one decision is chosen randomly by drawing a numbered card from 1 to 10. The alternative that was selected in the decision situation will be paid out. For instance, in the decision situation described above, if you chose the alternative RIGHT, you would receive 2000 TZS as active person, whereas your passive person would receive 2000 TZS as passive person.

In the same way your passive person receives earnings from your decision without doing anything for it. At the end of today's session you will be informed about which part of the session and which of your 10 decisions determines your earnings. Importantly, you are also a passive person for one of the other participants. Again, that person does not know your identity. You will get additional payout from your role as passive person according to that participant's choices. Are there any questions?

5. Ex Ante versus Ex Post Similarity

The main result of this paper establishes that there is correlation in the distributional preferences of friends. This suggests that social attitudes such as distributional preferences already shape interactions between individuals at a young age. In fact, children may choose their close friends by, among other characteristics, matching on distributional preferences (ex ante similarity). In this case, the networks that we measure are likely to be endogenous. On the other hand, children might be influenced by the attitudes of their peers, such that distributional preferences could be transmitted through friends (ex post similarity). When measuring social preferences for children old enough to participate in experimental sessions in our study setting, the elicited networks are likely to be endogenous, as pupils have attended the same school for the previous five years. Therefore, it is very likely that peer correlations represent the joint effect of selection and preference transmission.

The decomposition of the correlation into selection and transmission cannot definitively be achieved by our study set-up and is clearly a highly relevant question for further research. Nevertheless, we report the following results as an attempt to offer tentative evidence that correlations operate through both channels.

First, we do not find that friends who were in the same class in the year prior to the preference elicitation have differential correlation to the child's type compared to friends who simply go to the same school, see Table A.6. The idea behind this

Table A.6: Ex ante versus ex post similarity: Exposure in class (sample of friendship dyads)

		by type			
Outcome: "Same Preference Type" (at friendship dyad level)	All Types (1)	EL (2)	IL (3)	IA (4)	SF (5)
Friends in same class	0.005	0.041	-0.078	-0.03	0.006
	(0.021)	(0.044)	(0.058)	(0.032)	(0.039)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	3,266	479	437	968	1,382

Notes: Columns 1–4 of this table present marginal effects of having been in the same class on the likelihood of having the same-type friend in a friendship dyad. Column 1 shows the marginal effect on having the same preference type. Columns 2-5 report the results for subsamples of the child's preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Standard errors are bootstrapped at child level. Controls include total size of social network, student's school grade, household size, religion, age, gender, a dummy for gender-matched dyads, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

exercise is that a higher exposure to these friends in class would create a larger correlation if preferences are transmitted ex post. However, class compositions in the study context change every year, such that the exposure to same-class friends might not be long enough.[1]

Second, we attempt to control for observable and unobservable characteristics that best (first-ranked) friends share with each other. We implement a best-friend fixed effect specification at the friendship dyad level by augmenting the following baseline equation.

$$\mathbf{1}[\text{type} = t]_{i,d} = \beta_0 + \beta_1 \mathbf{1}[\text{friend type} = t]_d + X_i'\delta + \epsilon_{i,d} \tag{1}$$

We regress a dummy equal to one if the index child is of type t on a dummy of the same type for the friend and the standard set of controls. For each of the four preference types a separate equation is estimated. The estimation sample for this exercise is specifically constructed to include only friendship dyads. It includes all friendship dyads of each best friend pair, captured by a best friend indicator variable.

[1]Every year, classes are newly formed by a quasi-random procedure. Specifically, depending on the grade point sum, students are iteratively assigned to class A or class B.

Table A7: Ex ante versus ex post similarity: Best friend fixed effects

Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
Panel A: *Baseline OLS:*				
Friend of same type	0.0009	0.043*	-0.033*	0.037*
	(0.028)	(0.027)	(0.024)	(0.022)
Logit p-values	0.921	0.007**	0.149	0.026*
Panel B: *Best Friend Fixed Effects:*				
Friend of same type	-0.008	0.023*	-0.018^{+}	0.017^{+}
	(0.013)	(0.011)	(0.011)	(0.009)
FE logit p-values	0.659	0.088^{+}	0.15	0.036*
Controls	Yes	Yes	Yes	Yes
Observations	4,265	4,265	4,265	4,265

Notes: Columns 1–4 of this table present marginal effects for the likelihood of having the same-type friend in a friendship dyad. The outcome of all specifications is a binary variable that determines whether a student is of a specific distributional preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Panel A reports marginal effects from a probit estimation for which the preference types of friends are separated between those within the same class and others from the same school but in a different class. Panel B reports results from a linear probability model estimated without best friend fixed effects. Panel C reports results from a linear probability model with best friend fixed effects. Each pair of best friends represents a fixed effect and each pair is used only once in the estimation sample. Standard errors are robust. Controls include total size of social network, student's school grade, household size, religion, age, gender, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

If two students named each other as best friends reciprocally, the pair is kept only once in the estimation sample. This means that we construct best-friend pairs and leverage the information on the types of their unshared friends by controlling for best-friend dyad fixed effects ϕ_i (child i's best friend). If two students named each other as best friends reciprocally, the pair is kept only once in the estimation sample. The augmented equation takes the following form:

$$\mathbf{1}[\text{type} = t]_{i,d} = \beta_0 + \beta_1 \mathbf{1}[\text{friend type} = t]_d + X_i'\delta + \phi_i + \epsilon_{i,d,b} \tag{2}$$

The idea behind such an approach is that, if close friends share characteristics that lead to endogenous network formation, the fixed effects would capture such confounding, and one can identify the ex post peer effect from the pair's unshared friends. The regression results reported in panels A (baseline OLS) and B (fixed effects) of Table A7 show that correlations for the spiteful types, as well as for

inequality-loving and averse children, survive the inclusion of best-friend fixed effects. The reduction in point estimates suggests that 53.5% and 54.1% (ratio of FE to OLS estimates) of the peer correlations between inequality-loving and spiteful types are explained by observable and unobservable characteristics shared with the best friend. Given that preference transmission might be larger between best friends compared with second-best or third-best friends, and that selection could be driven by factors not shared with the best friend, these results have to be interpreted with caution. Additionally, the truncation of the friend networks may lead to identification based on unshared friends, that, when observing the full network, might not be unshared after all. Nevertheless, they suggest the presence of both a high degree of selection and a positive, but smaller, impact of preference transmission in social preference peer networks.

6. Comment on Preanalysis Plan

There are two main departures of this paper from the registered preanalysis plan: (i) The present study focuses purely on distributional preferences, using children's time preferences only as a control variable in some of the specifications. This is mainly due to presentational considerations. Time preferences were collected as planned and may feature in additional studies. (ii) The paper is focuses mainly on peer and network effects. While we attempted to collect preference measures for the parents of all children, this was hindered by high rates of orphans and children who do not live with both biological parents in their current homes in Dar es Salaam. The resulting sample of parents of the sample children is too small for robust inference on intergenerational preference correlations that we wanted to address.