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August 25, 2020

Abstract

We study distributional ("social") 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 that attend the same school. The relation between types is almost completely driven by inequality-loving and spiteful types. Further analyses suggest that preference peer networks are mainly formed by selection into the network and, to a smaller degree, by preference transmission. 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 distributions of economic resources. These preferences are often synonymously called social preferences, other-regarding preferences, or distributional preferences (Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000; Charness & 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 & Richerson, 2005; Fischbacher & Gachter, 2010), productivity (Carpenter & Seki, 2011; Bandiera *et al.*, 2005; Dohmen & Falk, 2011), political preferences (Fisman *et al.*, 2017; Kerschbamer & 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 age 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 much fewer studies on the effects of the social environment and peers on distributional preferences (Charness & 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 distributional preference networks in adolescence exist at all. To fully understand how distributional preferences are shaped in adolescence, it seems relevant to take the close social environment and its potential influence into account. Adolescent peer networks could be crucial in explaining adult inter-individual heterogeneity in distributional preferences, selection into friendship/professional networks, and political views later in life, on top of potential biological determinants (Balafoutas *et al.*, 2012; Fisman *et al.*, 2017).

Preference networks exist if preferences are 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 (peer effects). 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 evolu-

[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 & Müller (2020), using the same experimental measure of distributional preferences as our study, show that individuals in Germany classified as selfish preference types tend to vote more likely for the extreme right, while inequality-averse subjects tend to favor more left-wing oriented parties. Other relations 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 by averse to lying. Carpenter & 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 creedence good markets.

tion of these preferences. If children are surrounded by like-minded peers, cognitive and noncognitive abilities could also develop on different trajectories as a result of differences in cooperation and support within the network (Cunha *et al.*, 2010; Thöni & 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 (artefactual) 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 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 relation of these types in peer networks, we ask children to name and rank their three best friends. Background characteristics from a survey and school grades from administrative data sources provide additional information.

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. If two children at the same school report a friendship link, they are 7.9% more likely to exhibit the same preference type than otherwise. This peer correlation in types is mainly driven by inequality-loving (+52%) and spiteful types (+11.9%). In other words, we show that, conditional on reporting a friendship link, distributional preference types of children are strongly related. Even after controlling for a range of observable characteristics, having one additional friend of the inequality-loving or spiteful type increases the likelihood of a child being of the same type by 4.5% (0.1 SD) and 5.2% (0.2 SD), respectively.

Similarity in distributional preference types in peer networks differs by gender, with boys showing stronger correlation coefficients for spitefulness and girls for inequality-loving preferences. Using several empirical strategies that exploit the direction (degree centrality) of friendships, differences in exposure to peers, and best-friend pair fixed effects, we provide tentative evidence for the causal mechanism behind our main results: both selection into networks and preference transmission through peers contribute to the observed effects, with the former seemingly being more important for the compound effects.

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 prefence 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.

The are at least three contributions in this paper. First, we investigate the role peer networks play in shaping children's distributional preferences. Thus, our results contribute to a better understanding of the evolution of preferences with age, as well as their impact on (economic) outcomes. If they exist, *social preference networks* might reinforce individual predispositions for distributional preferences and, subsequently, affect later-life outcomes, for instance, in the labor market (Balafoutas *et al.*, 2012; Kocher *et al.*, 2013).[2] Also with children, educational and social outcomes may be affected by the composition of distributional preferences in their peer groups. Leider *et al.* (2009) show that altruism of university students is correlated with that of their peers.[3] Although we cannot conclusively answer the question regarding the relative impact of ex ante ("selection effects") versus ex post ("transmission effects") similarity in social preferences of groups in our experimental setup, we provide solid evidence for the presence of both transmission of and selection according to preferences within social networks. This is in line with the findings of Girard *et al.* (2015), who document that risk and time preferences, as well as cooperativeness, are robust predictors of network formation and network structure for newly admitted undergraduate students in Germany. It also matches the findings of Leider *et al.* (2010), who show that peer correlations in preferences cannot be explained by individuals' actual awareness of their friends' attitudes in college.

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; Falk *et al.*, 2019) 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 low-income context complements a series of studies that examine distributional preferences of children in high-income contexts (Fehr *et al.*, 2013; Almås *et al.*, 2010; Martinsson *et al.*, 2011; Sutter *et al.*, 2018). By adopting the design pro-

[2] Balafoutas *et al.* (2014) show in an experiment with adult participants that individuals and small unitary teams that are assembled randomly exhibit different distributional attitudes and that the composition of groups in terms of individual preference types determines the group type.

[3] Both Fehr *et al.* (2013) and Leider *et al.* (2009) document the existence and emergence of parochialism — that is, benevolent attitudes toward members of one's social group. In the present study, we do not distinguish between directed and undirected other-regarding concerns.

posed by Kerschbamer (2015), we elicit and nonparametrically identify all previously discussed archetypes of other-regarding preferences, using a single allocation experiment. Distributional preferences in a setting of scarce financial resources, ethnic and religious diversity, and in absence of a welfare state 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.[4] 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; Falk *et al.*, 2019).[5]

Combining distributional preferences and social networks might ultimately provide a workable theory of reference groups. Standard models of distributional preferences 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 our paper is structured as follows. In Section 2 we present our theoretical framework. Section 3 discusses the sample that we use, 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 & 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,

[4] 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 for Tanzania that girls tend to underachieve compared to boys, especially in reading and mathematics (SACMEQ, 2011).

[5] 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 Falk *et al.* (2019) for Germany.

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, 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 $t_k \neq t_d$.

Different mechanisms may explain a positive probability $p \neq 0$. 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 form friendships with other students that have similar distributional attitudes. 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, which contribute with distinct weights w and $1 - w$ to the overall probability.

$$p = ws + (1 - w)r \tag{2}$$

Our main interest here is to first 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 $q(t)$.[6] 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. Notice that the correlation is likely to vary by preference type: $p(t) \neq p$ for all t. This means that peer correlation may be preference type specific.

3. Sample and Data

We elicited distributional preferences of students through a lab-in-the-field experiment at public primary schools in Ilala District, Dar es Salaam, Tanzania, 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

[6] 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.

[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.

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.

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 to collect background characteristics and elicit 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 experimental 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 short survey, students were asked to list and rank their three best friends

[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 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.

[11]Exchange rate: US$1 = TZS 2,230 (December 2017).

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 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 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.

4. Experimental Design and Definitions

The experimental design to elicit distributional preferences is based on Kerschbamer (2015).[12] The exact design of the experiments and the empirical strategy were registered as a preanalysis plan prior to the fieldwork.[13] 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).[14] 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 vice-versa in the other half (disadvantageous block). The symmetric allocation remains constant 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 chosen ten-item choice list design. The translated version used in the experiment is found in Appendix C. 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

[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]Available online at www.socialscienceregistry.org/trials/2682. Any changes from the registered preanalysis plan are discussed in Appendix E.

[14]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 C). 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

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 switch only 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, choosing *left* already 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 own payoff to *decrease* the passive agent's payoff. Switching to the *left* in the DIB at row 4 or 5 reveals malevolence. For example, never switching implies a willingness to pay at least TZS 500 to decrease the passive agent's payoff by TZS 1,500. In the AIB, switching to left at row 6, 7, or 8 also implies malevolence.

More precisely, 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. Since the choice list structure of the experiment only allows us to identify WTP intervals, the midpoint is used as a proxy. The signs of the WTP in the AIF and DIB classify

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 proxy	WTP sign	Revealed attitude
1	$0.33 \leq w < \infty$	0.33	>0	Benevolent
2	$0.06 \leq w < 0.33$	0.2	>0	Benevolent
3	$0 \leq w < 0.06$	0.03	>0	Benevolent
4	$-0.06 \leq w < 0$	-0.03	<0	Malevolent
5	$-0.33 \leq w < -0.06$	-0.2	<0	Malevolent
Never	$-\infty < w < -0.33$	-0.33	<0	Malevolent
Advantageous Inequality Block (AIB)				
Subject chooses *left* for first time in row	WTP	WTP proxy	WTP sign	Revealed attitude
6	$-\infty < w < -0.33$	-0.33	>0	Malevolent
7	$-0.33 \leq w < -0.06$	-0.2	>0	Malevolent
8	$-0.06 \leq w < 0$	-0.03	>0	Malevolent
9	$0 \leq w < 0.06$	0.03	<0	Benevolent
10	$0.06 \leq w < 0.33$	0.2	<0	Benevolent
Never	$0.33 \leq w < \infty$	0.33	<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.

an individual's choices in these domains as benevolent or malevolent. 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 individuals 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.[15] In particular, students were informed that the passive person was a randomly chosen participant in the same session. Subsequently, student's remaining questions were answered 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

[15]The experimental instructions were translated into Swahili and tested prior to the experiment. The English version of the instructions can be found in Appendix D.

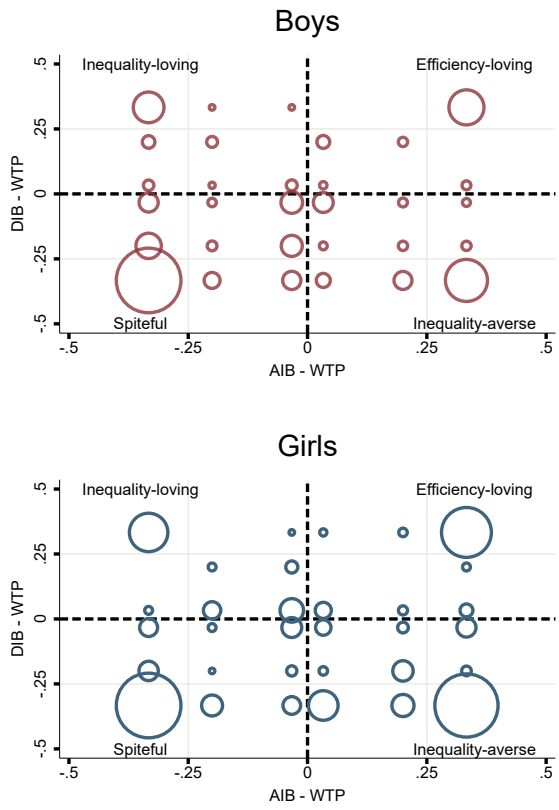


Figure 1: Distribution of distributional preferences by gender

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. Left: boys (293 observations); right: girls (321 observations)

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

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 willingness to pay of a subject to increase (decrease) the payoff of the passive agent in the disadvantageous (advantageous) inequality block.

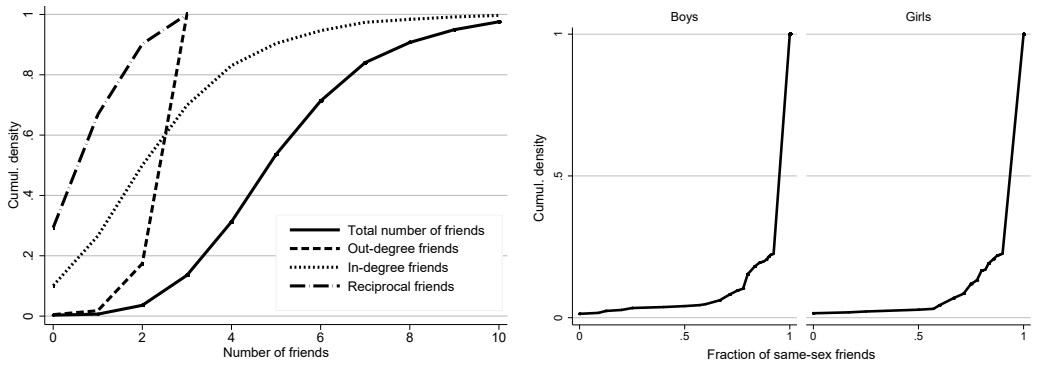
are skewed toward malevolence.

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.[16] 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.[17] 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.

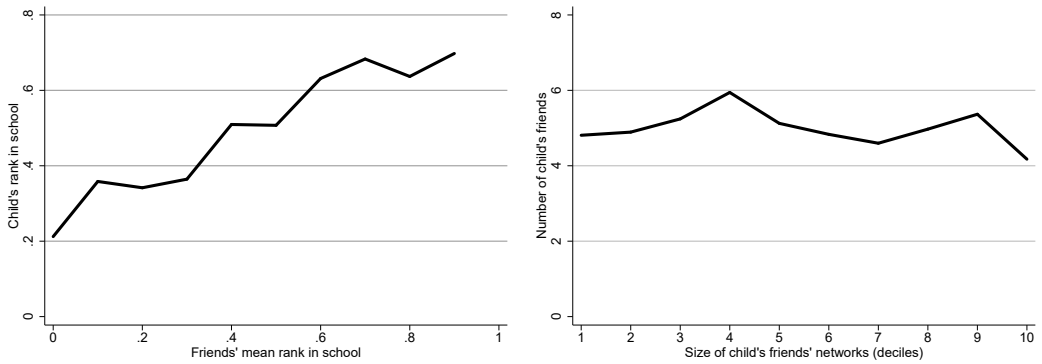
Distributional preferences vary significantly by gender. Girls are substantially more likely to be inequality-averse (35.8% to 24.9%) and less likely than boys to exhibit spiteful preferences (34.6 to 51.2%). This gender difference at a young age is the result of more benevolent choices of girls for 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

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

[17] 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 A). 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

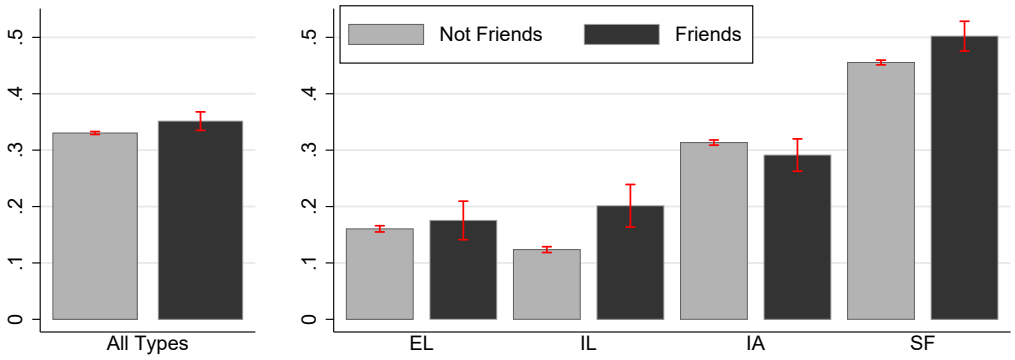


(b) Within-network correlation of school performance (rank within school of grade point some over all 10 subjects) and network size (deciles of total size of a child's network)

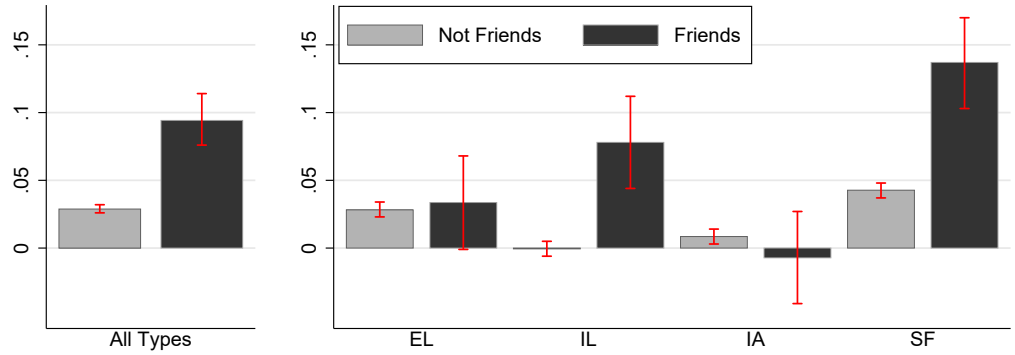
Figure 2: Characteristics of peer networks

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%.

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 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



(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 between preference types by non-friends and friends (zoom in on probability p).

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

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 taking into account the segregation by gender. However, as we analyze and discuss further in Section D, 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 also in other characteristics. Graph (b) of Figure 2 shows that students with high test scores also have high-performing friends (corr. 0.34^{***}). Preference-based peer networks could reinforce peer correlations in school performance through cooperation and social interaction based on distributional attitudes. However, popular children 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 that reported a friendship link and those that simply attend the same school, we can separate the probabilities $p(t)$ and $q(t)$ from our theoretical framework. q_t 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, $p(t)$ 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 at the school is the major factor of explaining dyads of same-type children. However, there are significant differences in the distribution of these frequencies for dyads between friends and non-friends, particularly for inequality-loving and spiteful preference types. Panel A of Table 5 quantifies these differences in a probit regression framework. 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 increases by 7.9%. Inequality-loving and spiteful types account for a large share of this relationship, with increases of 52% and 11.9%.

Panel (b) of Figure 3 zooms in on the probability p, which explains why observing a randomly selected pair of children at a school is more likely to exhibit the same preference type if they are friends. It presents the raw correlations between types over all possible friendship dyads. For the overall relation between the categorical types variable, the Cramer's V measure of association is used. 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 non-friends and friends 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 friendship dyad-level specification with child i's and peer d's types.

$$\mathbf{1}[\text{type} = t]_{i,d} = \alpha_0 + \alpha_1 \mathbf{1}[\text{friend type} = t]_d + X_i'\delta + \epsilon_{i,d} \tag{3}$$

where $\mathbf{1}[\text{type} = t]$ is a dummy variable for preference types $t = \{EL, IL, IA, SF\}$ for individual i in friendship d and $\mathbf{1}[\text{friend type}]$ the corresponding peer type in dyad d.

Table 5: Correlation in distributional preference types

		by preference type			
Outcome: "Same Preference Type"	All Types	EL	IL	IA	SF
(at dyad level)	(1)	(2)	(3)	(4)	(5)
Panel A: *Probability of Same-type Dyad (p)*					
Friendship link	0.026**	0.0017	0.066***	-0.021	0.050**
(128,943 dyads)	(0.010)	(0.021)	(0.016)	(0.018)	(0.002)
Outcome Mean	0.331	0.161	0.126	0.313	0.457
Panel B: *Correlation in Types between Friends*					
Peer is same type		0.0001	0.056**	-0.028	0.046*
(2,600 dyads)		(0.020)	(0.017)	(0.019)	(0.020)
Outcome Mean		0.148	0.130	0.297	0.424
Panel C: *Correlation in Types by Degree of Friendship*					
Out-degree		0.00003	0.056**	-0.035	0.046^{+}
(1,630 dyads)		(0.023)	(0.021)	(0.024)	(0.025)
In-degree		0.002	0.064*	-0.038	0.037
(1,631 dyads)		(0.028)	(0.028)	(0.024)	(0.025)
Reciprocal		-0.004	0.085**	-0.076*	0.011
(1,322 dyads)		(0.039)	(0.032)	(0.035)	(0.038)
Panel D: *Correlation in Types by Gender of Child*					
Friend of same type × Boy		0.021	0.026	-0.031	0.055^{+}
(2,600 dyads)		(0.026)	(0.024)	(0.027)	(0.029)
Friend of same type × Girl		-0.017	0.070*	-0.044^{+}	0.033
(2,600 dyads)		(0.031)	(0.031)	(0.027)	(0.028)
Controls	Yes	Yes	Yes	Yes	Yes

Notes: This table reports marginal effects from a probit regression of a friendship link (Panel A) or of a friend's type (Panels B-D). In Panel A 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). In Panels B-D the outcome variable is a binary variable indicating whether a student is of a specific distributional preference type. Panel B reports overall correlations per type. Panel C reports correlations by type for subsamples by degree centrality. Panel D reports correlations by type interacted with the subject's gender. In all panels standard errors are clustered at the child level, and controls include student's school grade, household size, religion, age, gender, and school fixed effects. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Controls X include school fixed effects, total number of friends, school grade, age, gender, religion, and household size. Standard errors are clustered at the child level. Panel B of Table 5 displays correlations in preference type between a child and her or his close friends, i.e. for the subsample of dyads between friends. Each cell corresponds to the marginal effect of the variable of interest from a probit model estimation.[18]

[18]Notice that although we estimate separate specifications for all preference types, the simultaneous change of both outcome and explanatory variables does not warrant adjustments for multiple hypotheses testing. Furthermore, because of the exhaustive nature of the outcome variable (one regression for each possible preference type) and the clustering at child level, a joint estimation (SUR) does not yield significant efficiency gains. In Table A.2 in Appendix A, we present results from an alternative specification that regresses a child's preference type on all four types of friends

We find that being an inequality-loving or spiteful preference type is systematically related to the number of friends of these same types. An additional friend of either of these two types significantly increases the likelihood of the child being either inequality-loving (+4.6%) or spiteful (+4.6%). Overall, the evidence suggests that peer effects are large for malevolent but not for benevolent choices, and thus preference types, in both domains of our experiment. Additionally, 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), and positive estimates for probability p suggest that the coefficients in Table 5 can be interpreted as a lower bound. Notice also that, as unrecorded friendships are by design lower ranked than the recorded links, any downward bias in our estimates is likely to be small.

Panel C of Table 5 shows that the peer correlations across distributional preference types remain fairly constant when the directed nature of the network is taken into account. Whether a child names a friend (out-degree), is named by another child (in-degree), or both (reciprocal) makes little difference for preference type relations. Girls are slightly more likely to share reciprocal friendships, and therefore the correlations are slightly higher for the inequality-loving type, which is more prevalent in female students.

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 D of Table 5, we therefore introduce heterogeneity by gender of children. Overall, the patterns in peer correlations in distributional preferences are similar for boys and girls. However, network results for spiteful types are strongly driven by boys, with a marginal effect of 5.5%, while girls show higher correlations in inequality-loving types (7%), although these gender-specific coefficients are not statistically different from each other.

The correlations with same-type friends differentiated for the gender of friends are similar to the overall results (see Table A.3 in Appendix A). On the one hand, they suggest that peer correlation for spitefulness is larger for boys than girls, while it is lower for inequality-loving types. On the other hand, it is noteworthy that social networks in general are extremely segregated by gender, which is a main driver of these results.

C. Ex Ante versus Ex Post Similarity

After isolating the probability p that a child exhibits the same preference type as a friend, we turn to the underlying reasons for these peer correlations. Our measures of correlations of types between friends suggest that social attitudes such as distributional preferences already shape interactions between individuals at a young age. Children may choose their close friends by, among other characteristics, matching on distributional preferences (ex ante similarity). In this case, the networks that we

simultaneously. Wald-tests confirm the main result that inequality-loving and spiteful types are correlated significantly with their friends' types.

Table 6: Ex ante versus ex post similarity

Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
Panel A: *Exposure in Class*				
Same type friends in class	0.018	0.049^{+}	-0.032	0.038
	(0.024)	(0.026)	(0.023)	(0.024)
Same type friends not in class	-0.040	0.051	-0.020	0.062^{+}
	(0.034)	(0.034)	(0.034)	(0.035)
Panel B: *Friendship Fixed Effects (569 best-friend pairs)*				
Friend of same type	-0.006	0.023*	-0.016^{+}	0.017^{+}
	(0.013)	(0.011)	(0.011)	(0.009)
FE logit p-values	0.659	0.088^{+}	0.15	0.034*
Panel C: *Ordinary Least Squares*				
Friend of same type	-0.004	0.052*	-0.029	0.046*
	(0.023)	(0.022)	(0.020)	(0.020)
Logit p-values	0.921	0.007**	0.149	0.026*
Controls	Yes	Yes	Yes	Yes
Observations	2,600	2,600	2,600	2,600

Notes: Columns 1–4 of this table present alternative regression results for the likelihood of having the same-type friend. Panel A reports results from a linear probability model estimated with friendship fixed effects. Each pair of best friends represents a fixed effect and each pair is used only once in the estimation sample. *P*-values for the alternative fixed effects logit estimation are added. Coefficients of the linear specification without fixed effects are shown for comparison in panel B. 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). Standard errors are clustered at best-friend pair and child levels. Controls include total size of social network, student's school grade, household size, religion, age, gender, and school fixed effects. Panel C 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. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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, the elicited networks are likely to be endogenous, as pupils have attended the same school for the previous five years. Therefore, the peer correlations represent the joint effect of selection and preference transmission, and further attempts to distinguish between the two channels seem warranted. In line with our theoretical framework, we attempt to decompose p to selection s and transmission r.

First, using the network structure of the data in more detail, we find suggestive evidence that both selection into networks and transmission play a significant role. If correlations were driven by preference transmission, one should expect differential correlations across the various dimensions of degree centrality. In particular, the out-degree friends should show higher correlation in types than in-degree peers if there is transmission, and actively naming a peer signals higher importance to or influence on the child than being nominated passively. Selection based on distribu-

tional preferences would lead to constant margins across degree centrality measures. In our case, correlation coefficients of peers for different degree centrality subsamples are not significantly different from each other, suggesting that selection plays a large role in explaining (see Panel C of Table 5) *social preference peer networks*.

Second, 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 than friends who simply go to the same school (see panel A of Table 6). The idea behind this 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.[19]

Third, the most relevant evidence to distinguish selection from transmission comes from an 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 equation 3. This means that we construct best-friend pairs (b) and leverage the information on the types of their unshared friends by controlling for best-friend dyad fixed effects ϕ_b. If two students named each other as best friends reciprocally, the pair is kept only once in the estimation sample.

$$\mathbf{1}[\text{type} = t]_{i,d} = \beta_0 + \beta_1 \mathbf{1}[\text{friend type} = t]_d + X_i'\delta + \phi_b + \epsilon_{i,d,b} \tag{4}$$

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 confounds and one can identify the ex post peer effect from the pair's unshared friends. The regression results reported in panels B and C of Table 6 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 55.8% and 62.3% (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. 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.[20]

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

[20] As can be seen in Table 6, the results of the fixed effects and OLS estimation are robust to using (conditional) logit specifications. Since marginal effects cannot be consistently estimated for the logit fixed effects model, p-values are reported.

D. 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 individuals economic or social position. Bolton & Ockenfels (2000) argue that the aggregate relative position of the decision-maker matters for equity concerns and reciprocity. Charness & Rabin (2002) explore Rawlsian preferences and find that individuals tend to increase the payoffs of worst-off agents, but behave locally competitive. Fisman *et al.* (2017) show that distributional preferences vary across the income distribution. The adolescent individuals in our study do not differ in their economic status, and we lack reliable income data for their parents. Therefore, we investigate whether distributional preference are related to an individual's position in terms of school outcomes and popularity using detailed data on friend networks, as well as administrative information on test scores. In particular, we test the hypothesis that a higher relative position in terms of school outcomes and centrality within the social network is related to more benevolent or more malevolent preferences.

Relative position in school performance is measured by the rank in standard 6 of a specific school.[21] 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 for centrality widely used in network analysis. The simplest one, in-degree centrality, denotes the number of incoming friendships, meaning it counts the number of times that other students have named a child as their friend. Taking it a step further, the Katz-Bonacich centrality additionally captures aspects of popularity that go 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 to degree centrality, treats connections to friends differentially by their respective importance in the network.[22]

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

$$\mathbf{1}[\text{type} = t]_i = \gamma_0 + \gamma_1 \begin{Bmatrix} rel.\ \ rank_i \\ centrality_i \end{Bmatrix} + X_i'\beta + \epsilon_i \tag{5}$$

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 report clustered standard errors and clustered wild bootstrap standard errors with the Webb distribution (Webb, 2014; Cameron & Miller, 2015). The latter corrects for overrejection bias due to the very low number of clusters (three schools). Table 7

[21] 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.

[22] For a detailed description of network summary and centrality statistics, see Jackson (2008)

shows that especially 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 relation relatively locally. Taking the estimates at face values, 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 2.3%. 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 causality. Students may perform worse than their peers because of their distributional preferences or because of observable or unobservable confounds. We rely on survey information to tentatively argue against these alternative explanations (see Table A.4 in Appendix A). 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 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, potential proxies we control for, such as household size, religion and impatience, are not or 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, varied by color, 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 7, which shows that all measures for centrality and popularity are related positively, although not 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. Popular students might feel less intrinsic pressure to show benevolence towards others. In the spirit of reverse causality, an alternative explanation might be that it requires spiteful types to establish and conserve hierarchies at school. Concerning this channel, Girard *et al.* (2015) provide some evidence that preferences, such as risk, trust, and cooperativeness, can predict an individual's centrality in a newly formed social network. 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 to understand why low ranks in outcomes and popularity show different correlations to distributional preference types. Disadvantaged children 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

Table 7: 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	0.935	0.180	0.111	0.092
Rank difference to friend (dyad level)	-0.041	-0.029	0.005	0.065+
(normalized at school level)	(0.027)	(0.026)	(0.034)	(0.037)
Observations	2,744	2,744	2,744	2,744
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

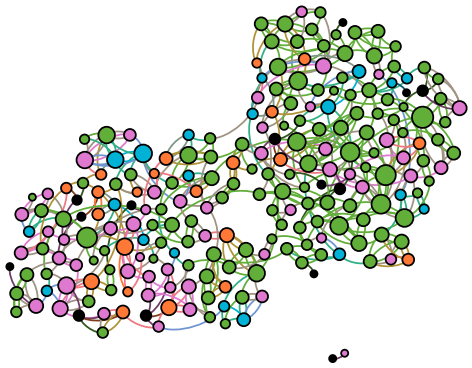
Notes: Columns 1–4 of this table report marginal effects from probit regressions of preference types regressed on a student's relative position (panel A) and social hierarchy (panel B). The outcome variable is a binary variable that determines whether a student is of a specific distributional preference 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. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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 instance of experimentally eliciting these attitudes with the given method in a low-income context. Not surprisingly, we find that the country context also matters for other-regarding preferences in adolescence. As mentioned earlier, although we use a different experimental design, the shares of revealed preferences 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). 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 as if a 2- to 3-year delay exists in the evolution of distributional preferences, though individuals could be on different paths altogether. Interestingly, this delay corre-

(a) *All preference types*



(b) *Spiteful type*

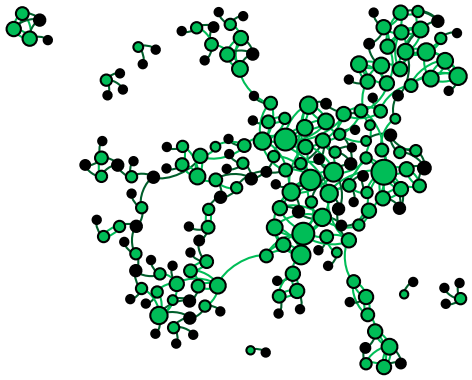


Figure 4: Degree centrality and preference types (Maarifa Primary School)

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.

sponds 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 — a hypothesis to be tested 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 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 Appendix B 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. Again, this observation warrants future research designed to address these aspects directly.

7. Conclusion

Previous literature in economics has documented that distributional preferences — also called social preferences or other-regarding 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 (artefactual) 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, and 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 likely to be 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). A large fraction of this peer effect is driven by selection into networks with the remaining correlation stemming from preference transmission through peers. Furthermore, the relative position within a network is related to preference types to a smaller extent than the network composition.

We think 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 preferences 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 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 2: Peer correlations in distributional preferences (alternative specification)

Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
Friend is type 1 (baseline)				
Friend is type 2	-0.012	0.058*	-0.00004	-0.053
	(0.026)	(0.027)	(0.035)	(0.037)
Friend is type 3	0.014	0.029	-0.048^{+}	0.005
	(0.022)	(0.021)	(0.028)	(0.029)
Friend is type 4	-0.006	0.001	-0.035	0.035
	(0.022)	(0.021)	(0.029)	(0.030)
Wald test: type 2=type 3=type 4	1.53	12.44**	4.56	8.81*
P-value	0.676	0.006	0.207	0.032
Mean	0.148	0.130	0.297	0.424
Controls	Yes	Yes	Yes	Yes

Notes: This table reports marginal effects from a probit regression of a child's preference type on the friend's type. The outcome variable is a binary variable that indicates whether a student is of a specific distributional preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Panel A reports overall correlations per type. Panel B reports correlations by type for subsamples by degree centrality. Panel C reports correlations by type interacted with the subject's gender. Standard errors are clustered 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 3: The role of peers by gender

Preference Type	EL	IL	IA	SF
	(1)	(2)	(3)	(4)
By Gender of Peer:				
Boys				
Friend of same type	0.025	0.053^{+}	-0.046^{+}	0.042
	(0.030)	(0.032)	(0.026)	(0.030)
Girls				
Friend of same type	-0.016	0.069*	-0.044^{+}	0.032
	(0.030)	(0.030)	(0.025)	(0.029)
Mean	0.148	0.130	0.297	0.424
Controls	Yes	Yes	Yes	Yes

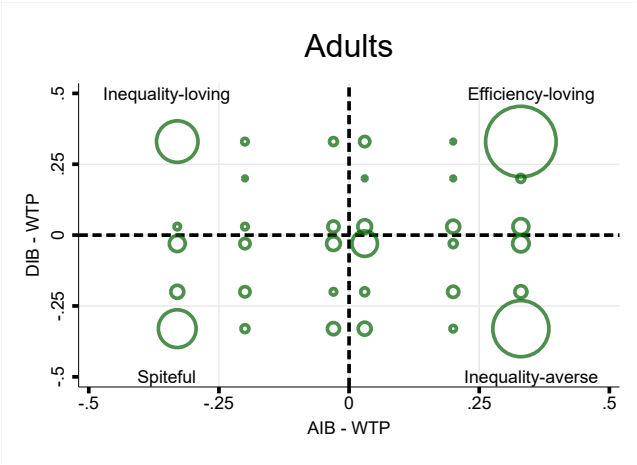
Notes: Each cell shows the marginal effect of having a same-type friend in a probit model estimation. The outcome is a binary variable that determines whether a student is of a specific distributional preference type (EL = efficiency-loving, IL = inequality-loving, IA = inequality-averse, SF = spiteful). Standard errors are clustered at child level, and controls include total size of social network, student's grade, household size, religion, age, gender, and school fixed effects.$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: 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	

2. Additional Figure

Figure 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).

3. Choice List for Distributional Preferences Experiment

Figure 2: 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. 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.