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Cooperativeness and competitiveness in children*

Juan-Camilo Cárdenas[a], Anna Dreber[b], Emma von Essen[c] & Eva Ranehill[d]

Abstract

Cooperation and competition are both essential elements of economic life. Here we explore how cooperativeness in a prisoner's dilemma is correlated with competitiveness in a sample of 9-12 year old children in Colombia and Sweden. Using two different measures and four different tasks for competitiveness, we find no consistent relationship between cooperativeness and competitiveness. However, we find evidence of a negative relationship between willingness to compete in a math task and cooperativeness in the overall sample. Competitiveness in math has previously been related to educational choices, and may therefore be the most economically relevant relationship.

Keywords: cooperation, competitiveness, experiment, children

JEL Codes: C91, D03, J13

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Cooperación y Competitividad en Niños*

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Resumen

La cooperación y la competencia son dos elementos esenciales de la vida económica. Aquí exploramos cómo la cooperación en el dilema del prisionero se correlaciona con la competitividad en una muestra de 9-12 años de edad los niños en Colombia y Suecia. A través de dos medidas diferentes y cuatro tareas diferentes para la competitividad, no encontramos ninguna relación consistente entre cooperación y competición. Sin embargo, encontramos evidencia de una relación negativa entre la voluntad de competir en una tarea de matemáticas y la disposición a cooperar en la muestra global. Competitividad en matemáticas previamente se ha relacionado con las elecciones educativas, y por lo tanto puede ser la relación económica más relevante.

Keywords: cooperación, competitividad, experimentos, niños

JEL Codes: C91, D03, J13

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1. Introduction

In this study we investigate how two central individual economic behaviors, competitiveness and cooperativeness, correlate. In society today, organizations including companies and universities select and promote employees mainly through competitive mechanisms. However, in situations, related to for example education and work, individual and collective success is most likely related to a broader set of behaviors than just competitiveness. Most challenges faced by organizations require collaboration between individuals or groups with different fields of expertise. While competitive processes may single out the highest performing individuals, a narrow focus on performance and competitiveness may ignore other individual characteristics that are beneficial for an organization as a whole.

Due to the prevalence of competitive selection processes in economically relevant settings, competitiveness has received a lot of attention in recent experimental research. In these studies, competitiveness is often measured together with other preferences that potentially correlate positively with competitiveness, such as risk preferences and overconfidence. Social preferences are often ruled out either in the experimental design, such as, for example, inequality aversion in the widely used design by Niederle and Vesterlund (2007), or measured directly, such as altruism in Dreber et al. (2014a). However, another much explored behavior in economics, cooperativeness, has not previously been directly related to competitiveness. In everyday life, cooperation and competition are often described as opposites. If this holds and competitiveness is negatively correlated with cooperativeness, organizations face a tradeoff between attracting those that perform best in competitive situations on the one hand, and forming the most cohesive and cooperative group on the other. Further, in economics, competitiveness is mainly described as a zero sum game, while cooperativeness involves a social multiplier. Whether individuals who prefer to compete and individuals who perform best under competition also are less cooperative and less prone to exploit social multipliers in cooperative settings, and thus to what extent organizations really

face the above-mentioned tradeoff are, however, rather unexplored questions.[1] It is thus important to shed light on the relationship of individuals' competitiveness and cooperativeness in order to understand how incentives can best be developed when group performance depends on both individual performance and group collaboration.

In this paper, we test whether competitive young individuals are also less cooperative, varying both the measure and the domain of competition. Our sample is a large group of children aged 9-12 in Colombia and Sweden, and we look at the pooled sample as well as each gender and country separately. We believe that this type of sample is interesting to study since if there are correlations between cooperativeness and competitiveness already among children, this suggests that the relationship emerges early in life. Using a sample of school children as compared to the standard sample of university students also has the advantage of diminishing self-selection, which may be particularly important when investigating behavioral traits like cooperativeness and competitiveness. In this study, all children present in school on the day of the experiment participated.

As a measure of cooperativeness we use a simple incentivized prisoner's dilemma game with simple visual aids (colored balls) and physical effort (running), where cooperation entails incurring a cost for someone else to receive a larger benefit and maximize social welfare, whereas defection implies doing nothing for the other person and receiving a larger private gain. Cooperativeness in a one-shot interaction, or more generally when there are no cooperative equilibria in the game, can be considered to be due to social preferences (see for example Dreber et al. 2014b). We chose to focus on cooperativeness because it measures the ability of individuals to forego private gains, and work for the team to create a social surplus by cooperating. We use the prisoner's dilemma to measure cooperation, as this is the standard

[1] Further, in the current biology literature, there is a revival of the debate on group selection, or multilevel selection, which investigates the importance of competitive and cooperative traits in group members. This literature has generated a growing set of theoretical models and experimental tests that suggest that there may be a relationship of complementarity (see for example Bowles and Gintis 2011, Burton-Chellew and West 2012, Hausken 2000, Puurtinen and Mappes 2009). One of the arguments in favor of this complementarity is that inter-group competition decreases the intra-group conflicts associated with cooperation dilemmas (Rapoport and Bornstein 1987, Bornstein 1992, Erev et al.,1993, Bornstein and Ben-Yossef, 1994). Assuming preferences for competition between individuals and between groups are positively correlated, this would predict a positive correlation between cooperativeness and competitiveness in our study.

cooperation measure in the literature. We thus do not address other social preferences that may or that may or may not correlate with cooperativeness.

Competitiveness, on the other hand, is in the literature and here measured in different ways: by an individual's reaction to incentives through either willingness to compete by self-selection into environments with competitive or piece-rate payment schemes, or through the performance change as a response to a competitive payment scheme in comparison to a piece-rate payment scheme. Competitiveness could explain why certain individuals are attracted to specific educational tracks and job environments, and also why certain individuals are more likely to be promoted – because they apply more for competitive promotions (see for example Bertrand, 2010, for a discussion on this and Zhang 2012 and Buser et al. 2014 for direct evidence). Since it has previously been shown that competitiveness, and in particular gender differences in competitiveness, may depend on the task, we explore competitiveness in four different tasks. Competitiveness is thus measured as performance change in running, skipping rope, math and a verbal task. In math and the verbal task we also measure competitiveness from subjects' willingness to compete, after they have experienced both payment settings. The two physical tasks are performed in a physical education class with only intrinsic motivation, whereas the two other tasks are performed in a classroom with extrinsic incentives.

To our knowledge, this is the first paper to study the correlation between cooperative and competitive individual preferences.[2] There are, however, some related studies investigating competitiveness and other social preferences. Bartling et al. (2009) study willingness to compete in a simple math task among a sample of mothers of preschool children and find that more egalitarian individuals are less willing to compete, while altruistic individuals are more competitive. Balafoutas et al. (2012) also find that inequality averse individuals, as well as spiteful individuals, are less willing to compete in math than efficiency minded individuals. However, spiteful individuals are more competitive than inequality averse and efficiency minded individuals in terms of performance change when forced to

[2] Charness and Villeval (2009) experimentally elicit measures of cooperativeness and competitiveness in their study. However, their focus is on the behavioral differences between senior and junior employees, as well as on the impact of group age composition on these behaviors, and not on the intra-individual correlation between the two behaviors.

compete. In a similar vein, Teyssier (2008) finds that inequity averse individuals are less likely to self-select into competitive schemes compared to revenue-sharing schemes. In another experimental study, Dohmen and Falk (2011) find that neither trusting nor reciprocal individuals (measured in a sequential trust game) are more or less willing to compete than other individuals.[3] Previous literature thus motivates different hypotheses depending on what relationship we focus on. Since cooperativeness is likely to be positively related to altruism and efficiency, these previous studies should lead us to expect a positive relationship between cooperativeness and competitiveness as measured by willingness to compete. However, the results on inequity aversion might make us expect the opposite relationship: if an individual is averse to inequalities, at least some cooperation may be a solution. Further, predictions based on previous findings with respect to spitefulness vary with the measurement of competitiveness used. Thus, expectations on the relation between willingness to compete in math and cooperation can therefore be formed in both directions. For the correlation between cooperation and the other competitiveness measures there is no previous literature to guide our expectations.

We find no consistent relationship between cooperativeness and competitiveness across tasks and measures. However there is one robust relationship: *willingness* to compete in a math task is negatively correlated with cooperativeness. This relationship appears among both boys and girls, and in both Colombia and Sweden. Competitiveness in math, as measured by *performance change*, highlights how inconsistent and complex this relationship can be: in Colombia there is a marginally significant negative relationship between performance change in math and cooperativeness, whereas in Sweden we find a positive relationship. In both countries these correlations are, however, only present among girls. For the other three competitive tasks, there are largely no significant relationships between competitiveness and cooperativeness.

As said before, we find that the only robust (negative) correlation is between cooperativeness and willingness to compete in *math*. This negative correlation is significant for both boys and girls. Competitiveness measured as willingness to compete in math may

[3] There are also examples of studies that study both competitiveness and cooperativeness but do not explore their correlation: see, for example, Ahlgren (1983) and Bigoni et al. (2011).

be particularly interesting compared to the other tasks given that math test scores is a good predictor of educational and labor market outcomes and willingness to compete in math has previously been associated with educational choices (see discussion in Bertrand 2010, and Niederle and Vesterlund 2010, and the results of Zhang 2012, and Buser et al. 2014). The result from this study thus suggests that organizations may face the aforementioned tradeoff where individuals who prefer to compete also appear to be less cooperative, but this depends on the context.

The outline of the paper is the following: we start by describing the experimental design in section 2, and then present the results in section 3. Finally, we discuss our results and conclude in section 4.

2. Experimental design

The experiment took place during two sessions conducted within the same week in each school. The first session took place during a physical education (PE) class and the second session took place in the class room. The PE class always took place before the normal class. Thereafter, depending on the class schedule, the second session took place at varying times, either on the same day or on any of the remaining week days. For some participants, the classroom sessions were therefore conducted earlier during the day than the PE session, and for some later. The sessions lasted between 40 minutes and one hour, and both parts of the study were overseen by at least one teacher.

In the PE part, the children first participated in a cooperation task resembling a continuous prisoner's dilemma, and then in two competitive tasks: running and skipping rope. Due to time constraints, however, not all children participated in all tasks during the PE classes.

In the cooperation task, two children were randomly matched when the task was about to start[4] and allocated ten balls each (white or green). These balls were placed in a pool, with two separate baskets placed seven meters in opposite directions from the pool. Each basket contained a public bin and a private bin, representing cooperation and defection. A ball placed in the private bin gave three private points to the child, whereas a ball placed in the public bin gave two points to both children. Both bins were concealed within the basket and only observed by the participating child. The children were given two minutes to fetch the 10 balls, one at a time, and for each ball decide whether to place it in the public or the private bin. The points were in the end of the PE class converted to pens and erasers. Our measure of cooperation is the number of balls placed in the public bin. See Cárdenas et al. (2014) for a more detailed description of the cooperative task.

During the same class as the cooperative task took place, the children participated in the first stage out of two in either a running or a skipping rope task (or both). In this first stage of both tasks, the children performed the task individually. In running, this consisted of running 4*13 meters while being timed.[5] In skipping rope, this consisted of jumping with a long rope where one teacher or experimenter and one child turned the rope, while the number of continuous jumps was being counted. In the second stage of each task, two children performed the task simultaneously, and competed against each other. Matching was made such that children in a competing pair had performed about similarly in stage one. This enables us to measure competitiveness as the performance change between stage two and stage one (reaction to competition). No compensation was awarded for the physical competitiveness tasks. The cooperative task was always finished before the competitive stage in the other two tasks was initiated, and the children were unaware of the competitive part when performing the cooperative task. See Cárdenas et al. (2012) for a more detailed description of competitiveness in the PE class.

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4 The children knew the identity of their counterpart when the game started. Cooperation can thus here be connected with reciprocity – one of the main mechanisms behind cooperation (e.g. Olson and Spelke, 2008; Greiner & Levate, 2005; Wedekind & Milinski, 2000; Trivers, 1971; Nowak 2006).

5 This design was necessary since the Swedish weather conditions did not allow the study to be performed outdoors. Otherwise the experimental design of the running part is similar in spirit to that of Gneezy and Rustichini (2004).

In the classroom, the children were first randomly assigned to one of two competitiveness tasks: math or verbal task. They then participated in a risk task (which is not the focus of this study; see Cárdenas et al. 2012) and answered a survey. The competitiveness tasks consisted of three stages and was inspired by the design in Niederle and Vesterlund (2007). In stage one, a piece-rate incentive scheme, the children were given two minutes to solve exercises. Three points were given for each correctly solved exercise. In stage two, a tournament incentive scheme, the children again solved exercises for two minutes, but were now randomly paired with another anonymous child against whom they were competing. If they performed at least as well as the other child, they got six points per exercise correctly solved. If they performed worse, they got zero points. The difference in stage two and stage one performance enables us to explore competitiveness as the reaction to competition. In stage three, the children were given the choice between being paid according to the setup of stage one or of stage two. If they chose competition, the children were once again randomly assigned an opponent (from the second stage), whose result was compared to theirs. At no time during the experiments did the children receive information about their competitor. The third stage enables us to study competitiveness as their self-selection into a competitive environment, i.e. as willingness to compete. After the third stage, we asked the children about their relative performance beliefs (not incentivized), allowing us to create a measure of overconfidence when comparing actual and predicted performance. Finally, the risk task consisted of six different choices were the children could choose between a certain amount of points (varying from 2 to 7.5) and a gamble that gave 0 or 10 points with equal probability. We use the number of times a child chose the gamble as our risk measure (varying from 0 to 6 where 6 indicates more risk taking). We control for beliefs and risk preferences in the regression analysis in the results section.

Points were in the end of the P.E. and regular class converted to pens and erasers. The children knew that more points implied more pens and erasers, but were unaware of the exact exchange rate. See Cárdenas et al. (2012) for a more detailed description of the classroom part.

The sample of children we study here is the same as in two previous papers where we explore competitiveness, risk taking and cooperation separately.[6] In Cárdenas et al. (2012) we found no evidence of a gender gap in competitiveness in Colombia, whereas the results in Sweden were mixed, with boys being more competitive in some tasks, and with some measures, and girls with others. We also found that boys in both countries were more risk taking than girls, and that the gender gap in risk taking was larger in Colombia than in Sweden. In Cárdenas et al. (2014) we found Colombian girls to be significantly less cooperative than boys, whereas no significant relationship is found in Sweden. In this paper our focus is on the relationship between competitiveness and cooperativeness, which we have previously not explored, and has not been explored in the literature with this kind of experiments.

A total of about 1200 children participated in the experiments. However, as described above, not all children participated in all tasks, thus our sample sizes when correlating cooperativeness and competitiveness is smaller than this (about 300 subjects per task). While testing for correlations between tasks below we note the sample size for each test, since sample sizes vary with the number of children who participated in the two relevant tasks. Table 1 below gives an overview of the data, presenting the mean of each variable as well as the number of children who participated in each task (See Cárdenas et al. (2012) for more information on the sample.).

[6] The two previous studies focused on gender differences in preferences. Colombia and Sweden where chosen since the two countries have very different ratings on gender equality indices, with Sweden scoring very high on gender equality.

Table 1. Summary statistics

Variable	Obs	Mean	Std Dev	Min	Max
Female	1222	0.48	-	0	1
Age	1120	10.90	0.91	8	15
Sweden	1240	0.49	-	0	1
Cooperation (balls in cooperative bin)	823	4.11	4.16	0	10
Competition					
Running	902	-0,33	1.38	-11.85	7.47
Skipping	886	7.27	38.34	-240	233
Math task, performance change	571	0.44	4.14	-22	25
Verbal task, performance change	575	0.59	3.35	-33	12
Math task, choice	571	0.32	-	0	1
Verbal task, choice	577	0.31	-	0	1
Risk	872	4.0	2.23	1	8.75
Overconfidence	1073	0.07	0.41	-0.96	0.92

*Within each task the sample size includes only those children who participated in all parts of that task.

All students present on the day of the experiment participated, unless unable due to illness or physical disabilities. No formal obligation to participate was expressed - the study was presented as a school activity - but no student expressed the wish not to participate. While we have self-selection at the school level, we thus have little selection at the individual level.

3. Results

We start by studying the sample as a whole and then study each gender and country separately. For the math task and the verbal task, we correlate cooperativeness with the two different measurements of competitiveness; performance change and willingness to compete. For the two physical competitiveness tasks, running and skipping rope, we correlate cooperation with performance change. We report Spearman correlations that measure the existence and the strength of a monotonic relationship. It is calculated based on

the ranks of the two variables in question. When correlating a continuous and a dichotomous variable there will be a lot of ties and Spearman may not be the most appropriate measure. For this reason, and to simplify the interpretation, we complement this type of analysis with a t-test. When exploring each country and gender separately we only discuss the significant results, p-values for all other results can be found in Appendix Tables A2-5.

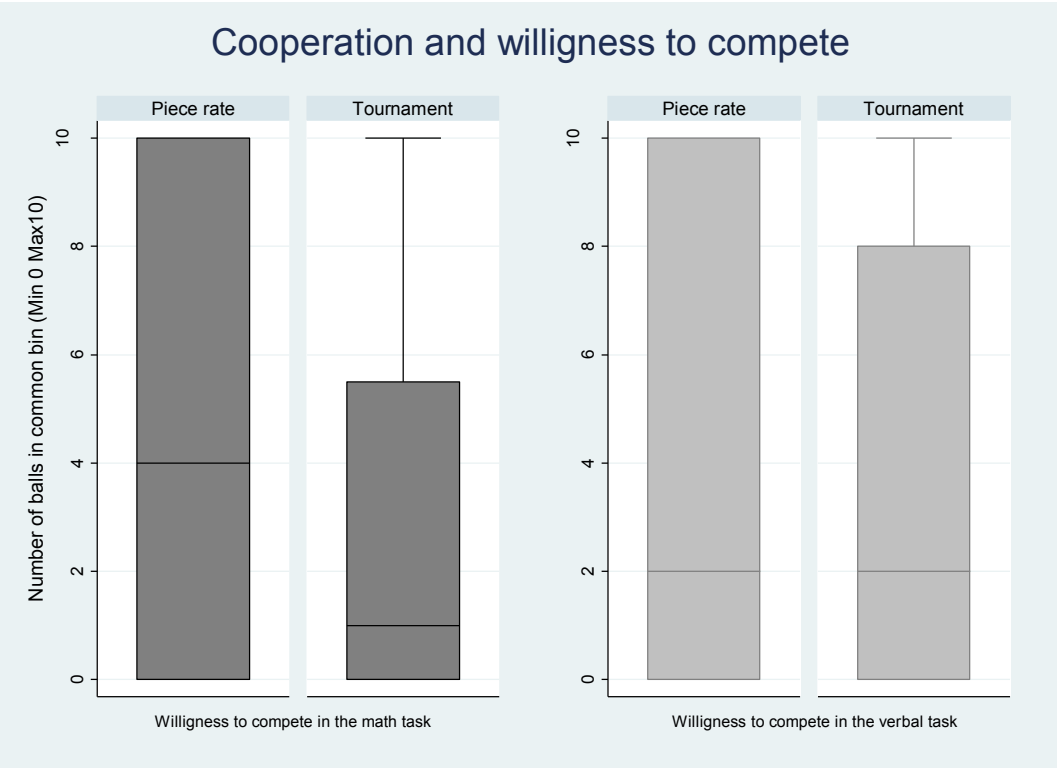

Figure 1. Boxplot for cooperativeness across willingness to compete in the math task and the verbal task.

The four boxplots in Figure 1 illustrate the raw data of cooperativeness across willingness to compete in the two respective tasks. The bottom and the top of the box display the first and third quartiles respectively, and the solid lines in the middle show the medians. The whiskers indicate the maximum value in the data. The distributions of cooperativeness are skewed towards fewer balls in the public bin for those who choose to compete in both tasks. This is however more pronounced in the math task compared to the verbal task.

Starting with willingness to compete in the math task we find that competitive individuals are significantly less cooperative – or vice versa. The estimated correlation coefficient of -0.172 is, however, rather weak. To put this in perspective, a simple t-test shows that individuals who chose to compete contribute on average 16 % less to the public good compared those that chose not to compete (Spearman's rho= -0.172, p<0.001; t-test: mean difference -1.615, p<0.001, N=389). For willingness to compete in the verbal task, on the other hand, there is no significant correlation (Spearman's rho= -0.047, p=0.355; t-test: p=0.389**,** N= 384).[7] For the continuous competitiveness measure of performance change, there is no significant correlation between performance change and cooperativeness in any of the four tasks (math: p=0.504, N=397; word: p=0.262, N=388; running: p=0.448, N=602; skipping rope: p=0.425, N=623).

In previous studies we have reported both gender differences in competitiveness and cooperativeness, as well as country differences in these correlations. Thus we split the sample by both gender and country. Starting with splitting only by gender, we find that among both boys and girls separately, individuals who are willing to compete in math are less cooperative than those that chose the piece rate scheme (boys: Spearman's rho=-0.150, p=0.043; t-test: mean difference=-1.565, p=0.019, N=183; girls: Spearman's rho=-0.195, p=0.006; t-test: mean difference= -1.696, p=007, N=200).

Dividing the sample by country, we find the same negative relationship between willingness to compete in math and cooperation in both countries, though in Sweden it is only marginally significant (Colombia: Spearman's rho=-0.190, p=0.005; t-test: mean difference=-1.863, p=0.003, N=217; Sweden: Spearman's rho=-0.134, p=0.080; t-test: mean difference=-1.212, p=0.074, N=172). In Colombia, there is also a marginally significant negative relationship between performance change in math and cooperativeness (Spearman's rho=-0.119, p=0.076, N=224). However, in Sweden, the correlation between math performance change and cooperativeness is significant and positive (Spearman's rho=0.226, p=0.003, N=173).

[7] We also performed point-biserial correlations. These results are similar to those reported here.

Finally, we split the sample by gender within each country. Among girls in Colombia, as in the overall sample, we find that competitive individuals, as measured by willingness to compete in math, are less cooperative (Spearman's rho=-0.198, p=0.041; t-test: mean difference= -1.771, p=0.034, N=107). The same relationship is found, though only marginally significant, for our measure of performance change in math (Spearman's rho=-0.214, p=0.027, N=108). Among Swedish girls, we find a positive relationship between cooperativeness and competitiveness measured as performance change in math (Spearman's rho= 0.259, p=0.012, N=94).[8] However, among boys in Colombia and in Sweden we find no significant correlations between cooperation and any of our competitiveness measures.

We complement our analysis with a probit regression[9], using willingness to compete in math and verbal tasks as dependent variables. In addition to cooperativeness, we include controls for gender, age, country, confidence, risk preferences, and performance[10]; variables that potentially influence competitiveness (as shown in Cárdenas et al. 2012). Standard errors are clustered by school class. In total, we have 31 school classes in the two countries, but only 28 classes participated in both the competitiveness task and the cooperative task.

[8] We also test to what extent the two measures of competitiveness correlate with each other, within individuals, in the math and the verbal task, as well as whether performance change as a response to a competitive setting correlate between tasks. In line with previous literature, indicating that behavior in the two competitive settings is driven by different motivations (Balafoutas et al. 2012), we find little evidence of a general relationship between the two competitiveness measures. More surprising is that we also find little correlation in the performance change as a response to competition across the different tasks. This suggests that individual competitiveness is closely linked to the task. See Appendix Tables A1-5 for more details.

[9] The results are similar and statistically significant using a standard OLS regression, see Table A6 in the Appendix.

[10] We here use the individual performance in stage 2, the forced competition, as our measure of performance. However, using performance in Stage 1 does not influence the results qualitatively. Although the coefficient is not significant in the regression we find that children who chose to compete perform better compared to those that do not chose to compete (Performance stage 1: mean difference=-1.114, p=0.040; Performance stage 2: mean difference=-1.607, p=0.001).

Table 2. Probit regression analysis competitive choices. Marginal effects

DEPENDENT VARIABLE	(1) Choice Math	(2) Choice Math	(3) Choice Word	(4) Choice Word
Cooperativeness[a]	-0.018*	-0.015*	-0.002	0.000
	(0.010)	(0.008)	(0.006)	(0.005)
Female		0.046		-0.012
		(0.039)		(0.059)
Sweden		0.041		0.195***
		(0.038)		(0.075)
Female*Sweden		-0.227***		-0.096
		(0.026)		(0.081)
Age		-0.028		0.000
		(0.014)		(0.041)
Performance Stage 2		0.009		-0.020**
		(0.003)		(0.009)
Risk taking[b]		0.056***		0.031**
		(0.007)		(0.013)
Overconfidence[c)]		0.116		0.313***
		(0.038)		(0.088)
Observations	312	312	325	325

Clustered robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Cooperativeness is measured as the number of balls the individual placed in the public bin.

b) Risk taking is measured as the number of risky choices selected by the individual.

c) Overconfidence is measured as the difference between self-assessed and actual performance in the tournament.

Table 2 indicates the same correlation as presented in the text above: willingness to compete in the math task, but not the verbal task, is correlated with cooperation. The correlation coefficient for cooperation in specification 2 indicates that individuals who place one more ball (out of 10) in the public bin are 1.8% percent less likely to choose competition in the math task. A fully cooperative individual (10 balls in the public bin) is thus 18% less

likely to compete compared to an individual that does not cooperate at all (0 balls in the public bin). Including control variables such as risk preferences, performance and overconfidence decreases the coefficient for cooperation somewhat, but the results are qualitatively the same.

Compared to the aforementioned raw correlations the standard errors of the coefficients in the regressions are clustered on class. The correlation between competitiveness, measured by willingness to compete in math, and cooperativeness remains the same, but becomes only marginally significant, in the overall sample. This suggests that it is important to adjust the standard errors to control for intra school class dependence.[11]

We also run the same regression using performance change as dependent variable for all our four tasks: math, word search, running and skipping rope. With this dependent variable we find no significant correlations, see regression Tables A7 and A8 in the Appendix.

In sum, we find that competitiveness as measured by the willingness to compete in math is significantly negatively correlated with cooperativeness in the overall sample – however the statistical significance decreases when we test this in a regression analysis, and allow the error term to be correlated within each school class. This correlation is not driven by a particular country or gender. We find no consistent significant correlations between cooperativeness and the other competitiveness measures included in the study.

Robustness

In this section we first check whether the gender pairing in the cooperative task may influence our results. We then look at the subsample of children that performed all tasks in order to investigate whether our results may be driven by differences in the respective sample engaging in each task.

[11] The competitive behavior may be influenced by a class specific norm or average performance. If we, in addition to clustering at class level, add a control variable capturing the average performance in each class the results remain qualitatively the same.

In the cooperative task, children were randomly paired and they could see each other while performing the task. In our sample girls are more cooperative when being paired with a boy compared to being paired with a girl (Cárdenas et al. 2014). The shares of mixed- and same-gender pairs are similar in our sample, but we nevertheless add the gender of the opponent in the cooperative task to the regressions in order to control for any potential bias. This does not change the results qualitatively. Moreover, high and low performing boys and girls may behave differently; we therefore run a regression including an interaction variable between female and performance (in the second stage). This does not change the results qualitatively and the interaction term is small and not significant.

In the class room sessions, the children were randomly assigned to conduct either the math task or the verbal task. To test that the random assignment provided us with similar groups we compare average cooperativeness, as well as the gender and age composition of the two groups. Conducting a t-test test we find no significant differences (cooperativeness: p=0.436, N=794; gender: p=0.723, N=1158[12]; age: p=0.421, N=1114).

To further ensure that our main result of a negative correlation between cooperativeness and willingness to compete in the math task, but not the verbal task, is not driven by the particular group of children conducting each task, we restrict the sample to the children conducting the math task and the sample of children conducting the verbal task. We then study the relationship between cooperativeness and performance change under competition in all tasks for these two subgroups. The analysis corroborates previous results of no significant relationships, independently of which sample we study (Sample conducting the math task: Running: Spearman's rho= 0.096, p=0.101, N=278; Skipping: Spearman's rho= -0.061, p=0.286, N=310; Performance change in math task: Spearman's rho= 0.052, p=0.301; Sample conducting the verbal task: Running: Spearman's rho= -0.014, p=0.801,

[12] Since we have a small sample size there may be a difference between a t-test (comparing means) and a test of proportions. (The difference becomes smaller as the sample size increases). We therefore also conducted a test of proportions for the differences between genders; this yields the same result (prtest: p=0.723).

N=292; Skipping: Spearman's rho= -0.052, p=0.379, N=284; Performance change in verbal task: Spearman's rho= 0.059, p=0.247, N=382).[13]

There may of course be many additional mechanisms that can impact the relationship investigated here. Ability may for example lead to correlation in both behaviors. We do not have access to actual grade points for the children, but we control for performance in the math task, as a proxy for mathematical ability. Given the strategic uncertainty of the Prisoner's Dilemma, risk preferences could also explain both cooperativeness and competitiveness in the sample. We control for risk preferences in the regression, which does not change the result. Moreover, there is no significant raw correlation between cooperativeness and risk preferences (Spearman's rho= 0.365, p=0.038, N=583). Thus risk preferences do not seem to drive the result.

Conducting multiple tests may increase the risk of Type I errors. When designing the study we did not take Bonferroni corrections into account. To avoid an increase of Type II errors we do not include the corrections in the main text. To provide a more cautious interpretation of the results we revisit them correcting for multiple testing. When using the full sample we conduct six tests; studying the correlation between one measure of cooperativeness and six measures of competitiveness. The p-value required for a significant result is then $0.05/6 = 0.008$. If we adjust the size to a similar level the raw negative correlation in the overall sample between cooperativeness and willingness to compete in math remains significant. The correlation coefficients in the regressions, however, become non-significant.

4. Discussion

When organizations aim to attract the best-performing individuals, they often employ selection mechanisms that are inherently competitive. For example, educational performance

[13] Making other restrictions, such as, for example, comparing the behavior of the children conducting all tasks across tasks yields similar results.

is evaluated mainly at the individual level, and often relative to the performance of others..[14] However, economically successful strategies for both individuals and organizations probably imply a mixture of both cooperation and competition. Often, for organizations to be competitive against other, it is necessary to achieve cooperation within the group. Yet, little is known about the relation between cooperativeness and competitiveness within individuals. Here we perform an experiment using one cooperation measure, two competitive measures, and four different competitive tasks to test how the different behaviors correlate. We find no consistent evidence of cooperativeness correlating with competitiveness. However, competitiveness as measured by willingness to compete in a math task is significantly negatively correlated with cooperativeness in the overall sample. The magnitude of the estimated relation indicates that a fully cooperative individual, in comparison to a fully non-cooperative individual, is 18% less likely to choose competition. This relationship can be found for boys and girls separately, and in both Colombia and Sweden. However, the correlation is only marginally significant in a regression framework where we cluster on school class. There are also no robust relationships between cooperativeness and competitiveness when competitiveness is measured as the change in performance comparing a competitive and an individual setting.

The labor market relevance of the potential relationship between cooperativeness and competitiveness may vary depending on competitive domain. Previous research indicates that competitiveness in math tasks seems to be important particularly important for educational choices and labor market outcomes. For example, Zhang (2012) finds that competitive students, measured as willingness to compete in math, are more willing to take a competitive high school entrance exam than students less inclined to compete. Using a similar competitiveness measure, Buser et al. (2014) further find that competitive individuals are more likely to choose more math oriented and prestigious college majors. It is also interesting to note that gender differences in competitiveness are the largest for willingness to compete in math compared to other tasks (see discussion in Niederle and Vesterlund 2010). Willingness to compete in math may thus be the most relevant measure of

[14] Note, however, that the Swedish grading system is mostly based on learning goals, and not relative performance.

competitiveness in order to understand labor market outcomes. In addition, male stereotyped tasks, such as math, seem to be more correlated with labor market outcomes than, for example, verbal tasks. Favara (2012) finds that, independent of ability, stereotypically male choices of educational tracks lead to higher future earnings.

Here we mainly study the statistical relationship between cooperativeness and competitiveness - the causal mechanisms can work in both directions. It is also not excluded that the relationship between competitiveness and cooperativeness is mediated by other mechanisms.

This study contributes to the literature seeking to understand what preferences and characteristics of individuals can help explain sorting into different payment schemes in the labor market. Future work needs to probe into when and how competitiveness affects cooperation and vice versa, and if such patterns change for different ages. For example, Buser and Dreber (2013) find that competitive settings have a negative impact on cooperation among adults, and mainly so among men. More work is however needed; it would for example be interesting to study how cooperative settings influence competitiveness.

References

Ahlgren, Andrew, 1983. "Sex differences in the correlates of cooperative and competitive school attitudes." *Developmental Psychology* 19(6), 881-888.

Balafoutas, Loukas, Rudolf Kerschbamer, and Matthias Sutter, 2012. "Distributional preferences and competitive behavior." *Journal of Economic Behavior & Organization* 83, 125-135.

Bartling, Björn, Ernst Fehr, Michel Maréchal, and Daniel Schunk, 2009. "Egalitarianism and competitiveness." *American Economic Review: Papers & Proceedings* 99, 93-98.

Bertrand, Marianne, 2010. "New perspectives on gender." In Handbook of Labor Economics, 1543-1590.

Bigoni, Maria, Margherita Fort, Mattia Nardotto, and Tommaso Reggiani. 2011. "Teams or tournaments? A field experiment on cooperation and competition among university students." IZA Discussion Paper No. 5844.

Bornstein, Gary, and Meyrav Ben-Yossef, 1994. "Cooperation in intergroup and single-group social dilemmas." *Journal of Experimental Social Psychology* 30, 52–67.

Bornstein, Gary, 1992. "The free-rider problem in intergroup conflict over steplevel and continuous public goods." *Journal of Personality and Social Psychology* 62, 597–606.

Bowles, Samuel, and Herb Gintis, 2011. *A Cooperative Species: Human Reciprocity and its Evolution*. Princeton, NY: Princeton University Press.

Burton-Chellew, Maxwell, and Stuart A. West, 2012. "Pseudocompetition among groups increases human cooperation in a public-goods game." *Animal Behavior* 84, 947–952.

Burton-Chellew, Maxwell, Adin Ross-Gillespie, and Stuart A. West, 2010. "Cooperation in humans: competition between groups and proximate emotions." *Evolution and Human Behavior* 31, 104–108

Buser, Thomas, Muriel Niederle, and Hessel Oosterbeck, 2014. "Gender, competitiveness and career choices." *Quarterly Journal of Economics* forthcoming.

Buser, Thomas, and Anna Dreber, 2013. "The flipside of comparative payment schemes." Mimeo.

Cárdenas, Juan-Camilo, Anna Dreber, Emma von Essen, and Eva Ranehill, 2012. "Gender differences in competitiveness and risk taking: comparing children in Colombia and Sweden." *Journal of Economic Behavior and Organization* 83(1), 11-24.

Cárdenas, Juan-Camilo, Anna Dreber, Emma von Essen, and Eva Ranehill, 2014. "Cooperation among children in Colombia and Sweden." *PLoS ONE* 9(3), e90923.

Charness, Gary, and Marie-Claire Villeval, 2009. "Cooperation and competition in intergenerational experiments in the field and the laboratory." *American Economic Review* 99(3), 956-78.

Dohmen, Thomas, and Armin Falk, 2011. "Performance pay and multidimensional sorting: productivity, preferences and gender." *American Economic Review* 101, 556-590.

Dreber, Anna, Emma von Essen, and Eva Ranehill, 2014a. "Gender and competition in adolescence: Tasks matter." *Experimental Economics* 17(1), 154-172.

Dreber, Anna, Drew Fudenberg, and David G. Rand, 2014b. "Who cooperates in repeated games? The role of altruism, inequity aversion, and demographics." *Journal of Economic Behavior and Organization* 98, 41-55.

Erev, Ido, Gary Bornstein, and Rachely Galili, 1993. "Constructive intergroup competition as a solution to the free rider problem: a field experiment." *Journal of Experimental Social Psychology* 29, 463–478.

Favara, Marta, 2012. "The cost of acting "girly": gender stereotypes and educational choices." Discussion Paper Series, Forschungsinstitut zur Zukunft der Arbeit, No. 7037.

Gneezy, Uri, and Aldo Rustichini, 2004. "Gender and competition at young age." *American Economic Review Papers and Proceedings* 118, 1049-1074.

Hausken, Kjell, 2000. "Cooperation and between-group competition." *Journal of Economic Behavior and Organization* 42(3), 417–425.

Niederle, Muriel, and Lise Vesterlund, 2010. "Explaining the gender gap in math test scores: the role of competition." *Journal of Economic Perspectives* 24, 129-144.

Niederle, Muriel, and Lise Vesterlund, 2007. "Do women shy away from competition? Do men compete too much?" *Quarterly Journal of Economics* 122, 1067–1101.

Puurtinen, Mikael, and Tapio Mappes, 2009. "Between-group competition and human cooperation." *Proceedings of the Royal Society B: Biological Sciences* 276, 355–360.

Rapoport, Amnon, and Gary Bornstein, 1987. "Intergroup competition for the provision of binary public goods." *Psychological Review* 3, 291–299.

Teyssier, Sabrina, 2008. "Experimental evidence on inequity aversion and self-selection between incentive contracts." Mimeo.

Zhang, Jane, 2012. "Culture and the gender gap in competitive inclination: Evidence from the Communist experiment in China." Mimeo.

Table A1. Correlations between cooperativeness and competitiveness measures, overall sample

	Coop	Math choice	Word choice	Math perf	Word perf	Running
Math choice	-0.1722***					
Word choice	-0.0473					
Math perf	0.0336	0.0457				
Word perf	0.0571		0.0245			
Running	0.031			-0.0449	-0.0056	
Skipping rope	-0.032			0.039	0.0322	0.0175

Table A2. Correlations between cooperativeness and competitiveness measures, boys only

	Coop	Math choice	Word choice	Math perf	Word perf	Running
Math choice	-0.1498**					
Word choice	0.0031					
Math perf	0.0467	0.0949				
Word perf	0.1175		-0.0026			
Running	0.0081			-0.1481**	0.0442	
Skipping rope	-0.0438			-0.0355	0.1121*	0.1242**

Table A3. Correlations between cooperativeness and competitiveness measures, girls only

	Coop	Math choice	Word choice	Math perf	Word perf	Running
Math choice	-0.1945***					
Word choice	-0.095					
Math perf	0.046	0.043				
Word perf	-0.0022		0.0569			
Running	0.0481			0.0652	-0.0611	
Skipping rope	-0.0225			0.0638	-0.046	-0.0895

Table A4. Correlations between cooperativeness and competitiveness measures, Colombia only

	Coop	Math choice	Word choice	Math perf	Word perf	Running
Math choice	-0.1902***					
Word choice	-0.0401					
Math perf	-0.1188*	0.0733				
Word perf	0.0794		0.0165			
Running	0.006			-0.0451	-0.0423	
Skipping rope	-0.0801			-0.0864	-0.0345	0.0046

Table A5. Correlations between cooperativeness and competitiveness measures, Sweden only

	Coop	Math choice	Word choice	Math perf	Word perf	Running
Math choice	-0.1339*					
Word choice	-0.0628					
Math perf	0.2262	0.0276				
Word perf	0.0404		0.0427			
Running	0.0314			-0.0561	0.1026	
Skipping rope	0.0114			0.0492	0.0859	-0.008

Table A6. OLS regression analysis competitive choices. [15]

VARIABLES	(1) Choice Math	(2) Choice Math	(3) Choice Word	(4) Choice Word
Cooperativeness[a]	-0.018*	-0.015*	-0.002	-0.000
	(0.010)	(0.008)	(0.006)	(0.005)
Female		0.044		-0.014
		(0.088)		(0.056)
Sweden		0.048		0.192**
		(0.071)		(0.082)
Female*Sweden		-0.240**		-0.109
		(0.092)		(0.092)
Age		-0.029		-0.002
		(0.047)		(0.042)
Performance Stage 2		0.009		-0.018**
		(0.008)		(0.008)
Risk taking[b]		0.059***		0.032**
		(0.011)		(0.014)
Overconfidence		0.121		0.287***
		(0.087)		(0.083)
Constant	0.378***	0.462	0.298***	0.272
	(0.075)	(0.515)	(0.036)	(0.437)
Observations	312	312	325	325
R-squared	0.025	0.132	0.000	0.070

Clustered robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
a) Cooperativeness is measured as the number of balls the individual placed in the public bin.
b) Risk taking is measured as the number of risky choices selected by the individual.
c) Overconfidence is measured as the difference between self-assessed and actual performance in the tournament.

[15] Conducting an OLS analysis with bootstraped clustered standard errors provides a qualitatively similar result.

Table A7. OLS regression analysis performance change math and word

VARIABLES	(1) Perf. Change Math	(2) Perf. Change Math	(3) Perf. Change Word	(4) Perf. Change Word
Cooperativeness[a]	0.032	0.031	0.060	0.014
	(0.052)	(0.054)	(0.039)	(0.035)
Female		0.116		0.015
		(0.681)		(0.375)
Sweden		-0.616		-2.595***
		(0.731)		(0.668)
Female*Sweden		0.384		-0.489
		(1.011)		(0.506)
Age		0.925***		-0.343*
		(0.287)		(0.189)
Performance Stage 2		0.185**		0.403***
		(0.075)		(0.083)
Risk taking[b]		0.117		0.124
		(0.238)		(0.102)
Overconfidence		1.654**		0.689
		(0.611)		(0.847)
Constant	0.890**	-11.196***	0.103	2.371
	(0.427)	(3.703)	(0.233)	(2.334)
Observations	312	312	326	326
R-squared	0.001	0.156	0.005	0.201

Clustered robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Cooperativeness is measured as the number of balls the individual placed in the public bin.

b) Risk taking is measured as the number of risky choices selected by the individual.

Table A8. Regression analysis performance change running and skipping rope

VARIABLES	(1) Perf. Change Running	(2) Perf. Change Running	(3) Perf. Change Skipping	(4) Perf. Change Skipping
Cooperativeness[a]	0.001	-0.013	-0.287	-0.347
	(0.018)	(0.016)	(0.441)	(0.389)
Female		-0.371		2.135
		(0.332)		(4.895)
Sweden		-0.071		4.983
		(0.190)		(4.721)
Female*Sweden		0.320		4.778
		(0.324)		(9.162)
Age		0.140*		2.129
		(0.079)		(1.692)
Performance Stage 2		0.015		-0.591
		(0.019)		(0.481)
Risk taking[b]		0.015		0.467
		(0.066)		(1.238)
Overconfidence		0.091		0.808
		(0.164)		(5.381)
Constant	-0.358**	-1.870**	9.889***	-14.973
	(0.133)	(0.862)	(2.120)	(18.052)
Observations	487	487	504	504
R-squared	0.000	0.031	0.001	0.015

Clustered robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Cooperativeness is measured as the number of balls the individual placed in the public bin.

b) Risk taking is measured as the number of risky choices selected by the individual.