Gender and Cooperation in Children:

Experiments in Colombia and Sweden[*]

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Abstract

This paper compares cooperation among Columbian and Swedish children aged 9-12. We illustrate the dynamics of the prisoner's dilemma in a new task that is easily understood by children and performed during a physical education class. We find some evidence that children cooperate more in Sweden than in Colombia. Girls in Colombia are less cooperative than boys, whereas our results indicate the opposite gender gap in Sweden. On average, children are more cooperative with boys than with girls.

Keywords: cooperation; children; gender differences; experiment.

JEL codes: C91; D03; J16.

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1. Introduction

The possibility to overcome social dilemmas through cooperation plays an important role in many everyday situations such as the provision of public goods, the use of common-pool resources and the sustainment of social norms. Cooperation varies substantially among individuals and across contexts (e.g. Cárdenas and Carpenter 2008, Martinsson et al. 2009, Gächter et al. 2010), yet relatively little is known about the formation of preferences for cooperation. Understanding the foundations of cooperative preferences, how it develops with age, and differs across cultures and genders, is therefore an important topic. Experiments on children in different countries are one way to increase this understanding.

In this paper we study gender differences in cooperation among more than 800 children aged approximately 9-12 in Colombia and Sweden. We introduce a novel version of a prisoner's dilemma that can be implemented in a physical education (P.E.) class. In this task, children are randomly paired, and decide in private how to divide a total of 10 balls between a private bin that gives three individual points for each ball and a public bin that gives two points per ball to each child. The balls are placed in the middle, and each pair of bins are placed jointly and in opposite directions from the balls. The children are then given two minutes to fetch the balls one by one and make their decisions on how to allocate the balls. Cooperation is measured by the number of balls placed in the public bin.

We find evidence of children in Colombia being less cooperative than children in Sweden, due to a significant difference in cooperation between girls from the two countries. No difference in cooperation is found comparing boys in the two countries. Within countries, we find that girls in Colombia are less cooperative than boys, whereas our results suggest the opposite in Sweden. We also find some impact of the gender of the opponent; children are more cooperative with boys than with girls. These results suggest that it is important to not generalize results from only one country when exploring gender differences in economic behaviors such as cooperation.

Earlier results on gender differences in cooperation in the prisoners' dilemma among adults are mixed, with some studies finding that men are more cooperative, some studies finding that women are more cooperative, and some studies finding no gender difference (see Croson and Gneezy 2009 for a review). A few studies aim to understand this variation further. Charness and Rustichini (2011) explore to what extent gender differences in cooperative behaviors are influenced by context, by having subjects in a prisoner's dilemma make their decision

whether to cooperate or defect while being observed by in-group members or out-group members. While men cooperate less when observed by their in-group compared to their outgroup, women behave in the opposite way. Boschini et al. (2011) study a modified prisoner's dilemma and find that men in an all-male context are less likely to punish deviators from a cooperation norm compared to both men in a gender-mixed context and to women in either type of context. Together these studies suggest that more attention has to be paid to the contexts and perhaps gender-related social expectations in social dilemma games in order to systematically investigate gender differences in cooperation.

Among children, gender differences in cooperation remain largely unexplored: In the two studies that we are aware of, Harbaugh and Krause (2000) find no gender differences in a sample of 6-12 year old American children, whereas Tedeschi et al. (1969) find that girls in another sample of American children are more cooperative than boys.[1] This study aims to contribute to this relatively small literature by comparing the gender gap in cooperation among children in two countries that vary substantially in gender equality: Sweden typically places in the top on macroeconomic indices pertaining to gender equality whereas Colombia places substantially lower (e.g. Hausmann et al. 2010).

In a previous paper (Cárdenas et al. in press) we explored whether the gender gap in competitiveness and risk preferences differs systematically between Colombia and Sweden. Given previous results on the gender gap in competitiveness across cultures and contexts, we expected boys to be more competitive than girls in Colombia, with a smaller if any gender gap at all in Sweden. However, we found no evidence of a gender gap in competitiveness in Colombia, whereas the results in Sweden were mixed depending on the task performed and the type of competitiveness measure. We also reported a larger gender gap in risk taking in Colombia compared to Sweden, with boys being more risk taking than girls in both countries. It is not obvious how these results should translate to gender gaps in cooperation in Colombia and Sweden, and previous literature on the topic is largely silent when it comes to making predictions about this. Thus, the current paper remains largely explorative.

The outline of our paper is the following. In section 2, we present the experimental setup. We present our results in section 3, and finish with a discussion in section 4.

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[1] In two other experiments that we are aware of on cooperation as measured by either a prisoner's dilemma or a public goods game among children, gender differences are not explored (Peters et al. 2004, Sally and Hill 2006).

2. Experimental setup

The experiment consisted of two parts: a P.E. class part followed by a classroom part either the same day or the same week. Both parts of the study were overseen by at least one teacher and two experimenters. The focus of this paper is the cooperation task, which was performed only in the P.E. part. In this part, the children participated in a cooperation task, as well as competed in running and skipping rope (competitiveness is explored in Cárdenas et al. in press). The cooperation task was performed before the children were aware of the competitive elements of running and skipping rope.

The cooperation task had the form of a Prisoner's Dilemma game where each player made 10 subsequent allocation choices (this game can thus easily be transformed into a public goods game with more than two players). The units allocated were balls and cooperation and defection were represented by two different physical bins, called the public bin and the private bin, both placed within one, larger basket. Two separate baskets were placed seven meters in opposite directions from a pool of ten green balls and ten white balls. Children were randomly paired (the opponent was unknown until the task started), assigned a basket and a color, and given two minutes to fetch the balls, one at a time, and place it either in the public or private bin.[2] Each ball in the private bin gave three private points, whereas each ball in the public bin gave two points per child. The children were told that each ball was a choice and that they could place each ball in any of the two bins.

Even though other children were present while the task was performed, measures were taken in order to ensure that the children made their actual choices largely in private; other children were prevented from watching ball placements. The total number of points earned was announced at the end of the PE part, when points were converted into attractive pens, markers and erasers. The children were informed about the set up in the beginning of the class, including that more points correspond to more prizes.[3] Our measure of cooperation is the number of balls placed in the public bin.

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[2] If the class consisted of an odd number of children one child was randomly chosen to participate twice. In this case only the first participation of that child is used in the analysis. All children finished the task within the time limit of two minutes. The timing was introduced in order to make sure the children exercised as part of the P.E. class.

[3] Given that the children were aware of the setup and could potentially infer the behavior of the other child from the amount of prizes earned, this could influence cooperation decisions. Note however that this is kept constant across countries.

3. Results

In this section we test whether there is a gender gap in cooperation among children in Colombia and Sweden, within as well as between the countries. The analysis is based on how many units (balls) between 0 and 10 that were placed in the public bin. For the tests in this analysis we have performed a Mann-Whitney tests as well as a two-sided t-test. Throughout the analysis we present only the p-value for the Mann-Whitney test unless the two tests vary in terms of significance, in which case both p-values are reported.[4] In order to test whether the size of the gender gap differs between Colombia and Sweden we conduct a regression analysis.[5]

3.1 Basic statistics

A total of 1240 children (50% girls, 631 participants in Colombia and 609 in Sweden) predominantly aged 9-12 participated in the study during the academic year 2009-2010.[6] Table 1 provides summary statistics pertaining to our sample in this paper (Appendix Table A1 provides variable descriptions). While there likely is some selection among schools that participated, no self-selection among the children occurred since all children present in school on the day that the study took place participated. Among the participating classes, a subsample of classes was randomly picked such that in the cooperation task 459 children participated in Colombia and 364 in Sweden.

Table 1. Summary statistics

Variable	Mean	Sd	Median	N	Min	Max
Age	10.89	0.93	11	758	8	15[†]
Gender (boy=0, girl=1)*	0.51	0.50	1	808	0	1
Country (Sweden=1, Colombia=0)	0.44	0.50	0	823	0	1
Contribution to PD	4.11	4.16	3	823	0	10

* For 15 children we were not able to determine the gender.
[†]There is one child who is 15 years old, two who are 14 years old, 20 who are 13 years old, and three who are 8 years old. Age per se is however not the focus of the paper.

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[4] We present the Mann-Whitney test since none of our variables are normally distributed when using a skewness and kurtosis test.
[5] The regression analysis is based on parametric assumptions that may not be fulfilled. We compare the results from regressions with no controls with controls for age and risk preferences, using both OLS and a Tobit regression (Lower limit= 0 and upper limit=10).
[6] The data for Sweden was collected in parallel to the data collection in Colombia, hence the Swedish sample is not the same as in Dreber et al. (2011). The sample is however the same as in Cárdenas et al. (in press).

3.2 Overall results

Of the 10 units available the participating children allocated on average 4.11 units to the public bin. In point estimates, Colombian children cooperated somewhat less (4.0 units) than Swedish children (4.3 units). However, this difference is only marginally significant (p=0.0825, see table 2).[7] The Colombian distribution is further more extreme than the Swedish one, with a larger proportion of children cooperating fully or not at all.[8]

3.3 Gender differences within countries

We find no significant difference in average cooperation between boys (4.2 units) and girls (4.0 units) (p=0.5911). Some gender differences appear, however, within each country. In Colombia girls cooperate significantly less than boys do (p=0.0291). In Sweden, we find an indication of the opposite, with girls cooperating more than boys (p=0.0664).[9] Hence, the point estimate in Sweden goes in the opposite direction to the one in Colombia. Table 2 displays average cooperation for each country by gender.

Table 2. Average cooperation

Country\Gender	All	Boys	Girls	p-value
All	4.11	4.24	3.99	0.5911
Colombia	4.00	4.46	3.54	0.0291
Sweden	4.25	3.98	4.55	0.0664
p-value	0.0825	0.4426	0.0006	-

3.4 Gender differences between countries

Comparing the difference in how children behave across countries, we find some difference between Colombia and Sweden.[10] This difference is driven by the gap in cooperation between Colombian and Swedish girls. As can be seen in table 2 above, Colombian girls cooperate the

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[7] With a t-test, however, this is not significant (p=0.3828).

[8] Similarity of the distributions is rejected using a Kolmogorov-Smirnov test (p=0.003).

[9] This is not significant with a t-test (p=0.164).

[10] The regressions give marginally significant p-values of the interaction between country and gender, which remain when controlling for risk preferences and age using Tobit whereas it disappears using OLS specification. Age correlates positively and significantly with cooperation, whereas risk preferences do not. Throughout, our results are qualitatively similar when we control for school affiliation. As reported in Cárdenas et al. (in press), there are also gender differences in risk taking in the pooled data (p<0.001). The change in estimates, due to specification, could also be caused by randomness or differences in distributions since we have a truncated dependent variable. For further information see Appendix table A2.

least and Swedish girls the most, and these groups differ significantly (p=0.0006). Boys in the two countries behave similarly (p=0.4426).[11]

3.5 Gender of the opponent

Previous literature has also looked at gender interactions in behavior (see Croson and Gneezy 2009 for a review of this literature). We find that average cooperation when a child in the full sample faces a boy compared to a girl is 4.45 and 3.80 units respectively (p=0.0125). Separating the sample by gender, the effect is significant among girls (p=0.0395) and there is also evidence of an effect among boys (p=0.0837).[12] However, analyzing boys and girls in each country separately, we find no significant effect of the gender of the opponent in any group (see table 3).[13]

Table 3. Average cooperation based on gender of opponent*

	N	Average number of units			
		Boys	**Girls**	**Difference**	**p-value**
Colombia	219/239	4.41	3.63	0.78	0.0543
Boys vs.	115/103	4.69	4.20	0.49	0.2089
Girls vs.	99/127	4.17	3.06	1.11	0.1416
Sweden	182/179	4.51	4.03	0.48	0.1374
Boys vs.	82/97	4.30	3.78	0.52	0.2331
Girls vs.	100/81	4.67	4.38	0.29	0.5128

*We lack information about the gender of the opponent for four participants.

4. Discussion

In this paper we have introduced a new measurement of cooperation. It illustrates the dynamics of the prisoners' dilemma and the public goods games and is easily understandable, and therefore suitable for running experiments on children. Moreover, this measure can be implemented during a P.E. class and does not require elaborate resources. Therefore, it is easy to use in a wide range of settings, with different age groups. In particular, it is useful in studies like the one performed in this paper where we study two different countries. This explorative study compares children from quite different societies in terms of culture (including gender norms) and socio-economic backgrounds. Moreover, the cooperation task involves both a physical component associated with the effort of running to collect the balls

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[11] Similarly, a Kolmogorov-Smirnov test indicates different distributions among girls across countries (p<0.001), but not among boys (p=0.229)
[12] For boys this is not significant with a t-test (p=0.219).
[13] Among girls in Colombia, the difference is significant with a t-test (p=0.050).

and the decision task whether to cooperate or not. The combination of effort and payoff structure provides a realistic task illustrating the prisoner's dilemma to the children.

Little is known about gender differences in cooperation among children. We find that girls are less cooperative than boys in Colombia whereas the opposite relationship appears to be the case in Sweden. These results should however be interpreted with caution since they often depend on test specification, possibly caused by the differences in distributions. Our results thus indicate that gender differences in cooperation may differ across countries, and that it is important to systematically study gender differences in behavior in different countries or contexts in order to draw general conclusions about gender difference. This is also supported by a study on adults, which finds higher cooperation in a matrilineal society compared to two patriarchal societies in India (Andersen et al. 2008). Interestingly, and unlike what we find among children, they find that this difference across societies among adults is mainly due to a difference in how men behave.

We are unaware of other studies exploring gender differences in cooperation among children in different countries. A relevant study on social preferences is Martinsson et al. (2011), who measure social preferences using modified dictator games in a sample of Swedish and Austrian children aged 10-15 years old. Boys are found to be more efficiency concerned and girls more inequality averse, and Swedish children are more social-welfare oriented and less difference averse than Austrian children. A natural extension of our paper would be to use our cooperation setup and also measure social preferences as in e.g. Martinsson et al. (2011).

Exploring behavior in different contexts is important for understanding the determinants of the gender gap in preferences. Moreover, studies on children can increase our understanding of how preferences develop over age, and how children's behavior compares to that of adults. Future research should expand this type of work by comparing different age groups and countries, while at the same time systematically varying key features of the context in order to understand the determinants of a wide range of preferences.

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Appendix

Table A1. Set of variables used, variable description

Sweden (Colombia=0, Sweden=1)	Dummy variable for country
Female(Boy=0, Girl=1)	Dummy variable for gender
Female*Sweden	Interaction variable between gender and country
Cooperation	Continuous measure of cooperation
Age	Age measured in years
Risk	Risk preferences from the incentivized lotteries (see Cárdenas et al. forthcoming)

Table A2. Cooperation regressions

VARIABLES	OLS	Tobit	OLS with controls	Tobit with controls[§]
Female	-0.642	-1.527	-0.565	-1.358
	(0.440)	(1.086)	(0.449)	(1.102)
Sweden	-0.108	0.0405	-0.173	-0.0935
	(0.453)	(1.067)	(0.450)	(1.060)
Female*Sweden	1.059*	2.678*	0.979	2.472*
	(0.613)	(1.449)	(0.612)	(1.443)
Age			0.401**	1.102***
			(0.170)	(0.406)
Risk			0.0407	0.0457
			(0.0983)	(0.245)
Constant	4.194***	3.250***	-0.278	-8.867*
	(0.323)	(0.774)	(1.907)	(4.584)
Observations	712	712	712	712
R^2/Pseudo R^2	0.007	0.003	0.016	0.005

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$
§ We here use the lower limit set to 0 and the upper limit set to 10