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**Working Paper**

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SSE/EFI Working Paper Series in Economics and Finance, No. 735

**Provided in Cooperation with:**

EFI - The Economic Research Institute, Stockholm School of Economics

*Suggested Citation:* Cárdenas, Juan-Camilo; Dreber, Anna; von Essen, Emma; Ranehill, Eva (2011) : Gender and cooperation in children: Experiments in Colombia and Sweden, SSE/EFI Working Paper Series in Economics and Finance, No. 735, Stockholm School of Economics, The Economic Research Institute (EFI), Stockholm

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# **Gender and Cooperation in Children: Experiments in Colombia and Sweden\***

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EFI Working Paper Series in Economics and Finance

No 735

April, 2011

## **Abstract**

We compare how children aged 9-12 in Colombia and Sweden cooperate in a Prisoner's Dilemma. We introduce a new measurement device for cooperation that can be easily understood by children. There is some evidence of more cooperation in Sweden than in Colombia. Girls in Colombia are less cooperative than boys, whereas our results indicate the opposite in Sweden. Girls are in general more cooperative with boys than with girls. Relating cooperation to competitiveness, this appears to be task and country dependent.

**Keywords:** cooperation; children; gender differences; experiment.

**JEL codes:** C91; D03; J16.

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\* We are grateful for comments from Johan Almenberg, Magnus Johannesson, Astri Muren and David G. Rand as well as encouragement from Uri Gneezy and help with the field work in Colombia from Adriana Molina and Gloria Rodriguez. Financial support from the Jan Wallander and Tom Hedelius Foundation and the Carl Silfvén Foundation (E.R.), the Swedish Council for Working Life and Social Research (FAS), and the Department of Economics at the Universidad de Los Andes is gratefully acknowledged. Eva Ranehill thanks the IEW, Zürich, for their hospitality.

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# 1. Introduction

The possibility to overcome social dilemmas through cooperation is important in domains such as the provision of public goods, the use of common-pool resources and the maintenance of social norms. Cooperation varies substantially among individuals and across culture and socio-economic status (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 cooperativeness, how it develops with age and differs across cultures and genders, is therefore an important topic. Experiments on children in different countries may be one way to increase this understanding.

In this paper we make an exploratory attempt to study gender differences in cooperation among children in Colombia and Sweden. This is part of a larger project where we explore whether the gender gap in preferences for competition, risk and cooperation differs systematically between Sweden, a country that typically places in the top on macroeconomic indices pertaining to gender equality, and Colombia, that places substantially lower (e.g. Hausmann et al. 2010).<sup>1</sup>

We introduce a novel version of a Prisoner's Dilemma that can be implemented in a physical education class. Earlier results on gender differences in cooperation among adults are mixed (Croson and Gneezy 2009), and among children no gender difference has been found (Harbaugh and Krause 2000).<sup>2</sup> Meanwhile, men are typically more competitive than women (Croson and Gneezy 2009), and in order to understand this gender gap further, the correlation between competitiveness and social preferences have recently received attention (Bartling et al. 2009, Balafoutas et al. 2010).<sup>3</sup> We therefore also study the correlation between cooperation and competitiveness.

We find evidence of children in Colombia being less cooperative than children in Sweden. This is mainly due to a significant difference in cooperation between girls from the two countries. Girls in Colombia are less cooperative than boys, whereas our results suggest the opposite in Sweden. We find some impact of the gender of the opponent, with girls being more cooperative with boys than with girls. Correlating behavior in the cooperative task and

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<sup>1</sup> The gender gap in competitiveness and risk taking is explored in Cárdenas et al. (forthcoming).

<sup>2</sup> In the other two experiments on cooperation as measured by either a prisoner's dilemma or a public goods game that we are aware of, gender differences are not explored (Peters et al. 2004, Sally and Hill 2006).

<sup>3</sup> Competitiveness is typically measured as either the change in performance between a competitive and a non-competitive setting or by the self-selection of the individual to a competitive or non-competitive setting.

the competitive tasks, we find different results comparing girls from the two countries, but these correlations are not present in all tasks. There is no evidence of a correlation among boys.

The outline for 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.

## **2. Experimental setup**

The experiment consisted of two parts: a physical education class (PE) 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 cooperation task was performed in the PE part before the children were aware of the competitive element of the study. The cooperation task had the form of a Prisoner's Dilemma where each player made 10 subsequent allocation choices (this game can thus easily be transformed into a multiplayer public goods game). The units allocated were balls and cooperation and defection were represented by two different physical bins, called the public bin and the private bin, in a basket. Two separate baskets were placed 7 meters in opposite directions from a pool of 10 green balls and 10 white balls. Children were randomly paired<sup>4</sup> (the opponent was unknown until the tasks started), assigned a basket and a color, and given 2 minutes to fetch the balls, one at a time, and place it either in the public or private bin.<sup>5</sup> Each ball in the private bin gave 3 private points, whereas each ball in the public bin gave 2 points per child.

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 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. Our measure of cooperation is the number of balls placed in the public bin.

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<sup>4</sup> 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.

<sup>5</sup> All children finished the task within the 2 minutes. The timing was introduced in order to make sure the children ran and thus exercised as part of the PE class.

The competitiveness tasks are described extensively in Cárdenas et al. (forthcoming). We study competitiveness in running and skipping rope during the PE part, and math and word search in the classroom. In all four tasks, the children first perform the task individually, and then compete against another child. This enables us to look at competitiveness as the performance change between these two settings in all four tasks. In math and word search, the children are also given the choice whether to compete or not in a third stage, providing us with a second measure of competitiveness for these two tasks. In running and skipping rope, no compensation is offered but the intrinsic motivation from winning. In math and word search, the children are given a certain amount of points (that corresponds to pens) per correct exercise solved in the individual setting, and twice the amount of points if they solve at least as many exercises as the person they are paired with in the competition setting. We include these four tasks in order to see if competitiveness is task dependent.

### **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 two countries. The analysis is based on a continuous measure of cooperation, 0 to 10 units (balls) placed in the public bin. For all 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.<sup>6</sup> When testing whether the size of the gender gap differ between Colombia and Sweden we conduct a regression analysis.<sup>7</sup>

#### **3.1 Basic statistics**

A total of 1240 children (50% girls, 631 participants in Colombia and 609 in Sweden) mainly aged 9-12 participated in the study during fall-spring 2009-2010.<sup>8</sup> Table 1 provides summary statistics (Appendix Table A1 provides variable descriptions). While there likely is some selection in schools that participated, no self-selection among the children occurred, since all

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<sup>6</sup> We present the Mann-Whitney test since none of our variables are normally distributed when using a skewness and kurtosis test. When there is a difference between the tests in terms of significance we also report the p-values for the t-test.

<sup>7</sup> When testing whether the size of the gender gap differ between Colombia and Sweden we conduct a regression analysis, which is based on parametric assumptions that may not be fulfilled. However, the analysis performed with both parametric and non-parametric tests shows similar results. We compare the results from regressions with no controls with controls for age and risk preferences, using both OLS and a Tobit regression truncated between 0 and 10.

<sup>8</sup> 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. (2009). The sample is however the same as in Cárdenas et al. (forthcoming).

children present participated. In the cooperation task, classes were randomly picked such that 459 children participated in Colombia and 364 in Sweden.<sup>9</sup>

**Table 1. Summary statistics**

Variable	Mean	Sd	Median	N	Min	Max
Age	10.89	0.93	11	758	8	15 <sup>†</sup>
Class year	4.18	0.78	4	823	3	5
Gender (boy=0, girl=1)*	0.50	0.50	1	823	0	1
Country (Sweden=1, Colombia=0)*	0.44	0.50	0	823	0	1
Contribution to PG	4.11	4.16	3	823	0	10

\*(share between 0 and 1)

<sup>†</sup>There is one child who is 15 years old, two who are 14 years old, 20 that are 13 years old, and three that are 8 years old.

### 3.2 Overall results

Of the 10 units available, cooperation was on average 4.11 units. There is some evidence of a difference in cooperation between Colombia and Sweden ( $p=0.0825$ ); in point estimates Colombian children cooperated somewhat less (4.0 units) than Swedish children (4.3 units).<sup>10</sup> The Colombian distribution is more extreme than the Swedish one, with a larger proportion of children cooperating fully or not at all.<sup>11</sup>

### 3.3 Gender differences within countries

We find no significant difference in average cooperation between boys (4.2 units) and girls (4.0 units). Some gender differences appear however within each country. In Colombia girls cooperate significantly less than boys do ( $p=0.0382$ ). In Sweden, we find an indication of the opposite, with girls cooperating more than boys ( $p=0.0574$ ). 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.

<sup>9</sup> Time constraints made it impossible to have all children in all classes participate in the cooperation task. Children and classes were randomly sampled to participate or not.

<sup>10</sup> We find some evidence of a positive correlation between age and cooperation. Throughout, our results do not change controlling for school affiliation in a regression analysis.

<sup>11</sup> Similarity of the distributions is rejected using a Kolmogorov-Smirnov test (corrected asymptotic  $p=0.002$ ).

**Table 2. Average cooperation**

<b>Country\Gender</b>	<b>All</b>	<b>Boys</b>	<b>Girls</b>	<b>P</b>
<b>All</b>	4.11	4.22	4.00	0.681
<b>Colombia</b>	4.00	4.43	3.57	0.0382
<b>Sweden</b>	4.25	3.96	4.55	0.0574
<b>p-value</b>	0.0825	0.4288	0.0008	-

### 3.4 Gender differences between countries

Comparing the difference in how boys and girls behave across countries we find differences between Colombia and Sweden.<sup>12</sup> This difference is driven by the gap in cooperativeness between Colombian and Swedish girls. As can be seen in table 2 above, Colombian girls cooperate the least and Swedish girls the most, and these groups differ significantly ( $p=0.0008$ ). Boys in the two countries behave similarly ( $p=0.4288$ ).<sup>13</sup>

### 3.5 Gender of the opponent

Previous literature has also looked at gender interactions in behavior. We find that average cooperation when facing a boy vs. a girl is 4.45 and 3.89 units respectively ( $p=0.0125$ ). However, breaking the analysis down further indicates that this is only significant for girls in Colombia (see table 3). Thus, also regarding the effect of the opponent's gender we find a difference in the behavior of Colombian and Swedish girls.

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<sup>12</sup> OLS and Tobit regressions using the continuous measure as dependent variable gives significant p-values of the country and gender interaction variable, 0.039 and 0.008 respectively. This result does not alter when controlling for risk preferences and age. The significance of the gender coefficient disappears when controlling for risk and age. This could be due to a selection when the number of observations drops between the regressions. It could also be caused by the fact that age is correlated with cooperation and there are more girls than boys that older in the sample. As reported in Cárdenas et al. (forthcoming), there are gender differences in risk taking in the pooled data ( $p<0.001$ ). Age is further significant in both specifications, indicating that older children are more cooperative. The coefficient for risk does not alter the result and is moreover not significant; hence risk preferences do not seem to correlate with cooperation. Age is significant in both specifications, indicating that older children are more cooperative. The change in estimates could also be caused by randomness. For further information see table A2 in the appendix.

<sup>13</sup> Similarly, a Kolmogorov-Smirnov test indicates that we can reject the null of equal distributions among girls across countries ( $p<0.0001$ ), but not among boys ( $p=0.193$ )

**Table 3. Average cooperation based on gender of opponent\***

	N	Average number of units		
		Boys	Girls	P
<b>Colombia</b>	219/239	4.41	3.63	0.0543
<b>Boys vs.</b>	118/110	4.57	4.29	0.638
<b>Girls vs.</b>	101/129	4.22	3.07	0.0412**
<b>Sweden</b>	182/179	4.51	4.03	0.137
<b>Boys vs.</b>	82/98	4.30	3.74	0.358
<b>Girls vs.</b>	100/81	4.67	4.38	0.610

\*Based on 819 participants (four participants lack information on opponent gender).

### 3.6 Cooperation and competition

In addition to the previous analysis, our data allows us to correlate behavior in the cooperation task with competitiveness in the PE part (where we look at performance change in running and skipping rope) and in the classroom (where we look at performance change as well as the choice to compete in math and word search).<sup>14</sup> In Colombia, girls display a negative significant correlation between cooperation and competition in math, using both performance change ( $p=0.028$ ) and choice of competition ( $p=0.041$ ). We get opposite results in Sweden, with a significant positive correlation between cooperation and performance change in math among the total sample of children ( $p=0.003$ ), driven by the correlation among girls ( $p=0.012$ ). There are no other significant correlations with competitiveness. The relationship between cooperation and competitiveness thus seems to be task dependent.

## 4. Discussion

In this paper we have introduced a new measurement device for cooperation that can be used among children in a physical education class. This measure is simple and does not require elaborate resources and is thus easy to use in a wide range of settings and with different age groups. In particular, it is useful in cross-cultural studies like the one performed in this paper. This 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 and the decision task whether to cooperate or not. This combination of effort and payoff structure provides a realistic task illustrating the dilemma of cooperating to the children.

<sup>14</sup> In this part of the analysis we have use Spearman's rank correlation test, a non-parametric test.



Little is known about gender differences in cooperation among children. Our results show that they may differ across cultures. This is also evidenced among adults in a study by Andersen et al. (2008), who find higher cooperation in a matrilineal society compared to two patriarchal societies in India. Interestingly, and unlike us, they find that this difference 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. There is however a relevant study on social preferences. Martinsson et al. (forthcoming) examine children aged 10-15 years old in Austria and Sweden in terms of social preferences measured by modified dictator games (as in Charness and Rabin 2002). 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. (forthcoming).

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 exploring other age groups, including adolescents and adults, in a large number of cultural contexts with the focus on the determinants of a wide range of preferences.

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## Appendix

**Table A1. Set of variables used, variable description**

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

**Table A2. Cooperation regressions**

VARIABLES	OLS	Tobit	OLS with controls	Tobit with controls
<b>Female</b>	-0.791** (0.401)	-2.202** (0.979)	-0.735 (0.483)	-1.889 (1.201)
<b>Sweden</b>	-0.408 (0.431)	-1.036 (1.026)	-0.456 (0.503)	-0.864 (1.232)
<b>Female*Sweden</b>	1.243** (0.603)	3.859*** (1.448)	1.375** (0.693)	3.600** (1.696)
<b>Age</b>			0.582*** (0.192)	1.557*** (0.473)
<b>Risk</b>			-0.0404 (0.0798)	-0.154 (0.200)
<b>Constant</b>	0.204 (1.783)	3.833*** (0.689)	-1.839 (2.100)	-12.73** (5.195)
<b>Observations</b>	758	823	559	559
<b>R-squared</b>	0.016		0.027	

Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1