

# PEACE AND GOODWILL? USING AN EXPERIMENTAL GAME TO ANALYSE PAZ Y DESARROLLO

---

*Orazio Attanasio*  
*David Phillips*



EDePo

**Centre for the Evaluation  
of Development Policies**

THE INSTITUTE FOR FISCAL STUDIES  
EWP08/03

# Peace and Goodwill? Using An Experimental Game to Analyse *Paz y Desarrollo*

Orazio Attanasio\*

David Phillips♦

August 2008

## Abstract:

Several decades of conflict, rebellion and unrest severely weakened civil society in parts of Colombia. Paz y Desarrollo is the umbrella term used to describe the set of locally-led initiatives that aim at addressing this problem through initiatives to promote sustainable economic development and community cohesion and action.

This project analyses the findings from a series of "public goods" games that were conducted in the spring and winter of 2006 in 103 municipalities in rural and urban Colombia with predominantly poor participants. These municipalities included both those with and without Paz y Desarrollo in place, and within those municipalities where it was ("treatment" municipalities), both individuals who are participants in the programme and those who are not. The municipalities where PYD is not in place ("control" municipalities) were surveyed as part of the evaluation of another programme - Familias en Accion (FEA), and this project also analyses the impact of this programme on game-play. The game is structured as a typical free-rider problem with the act of contributing to the "public good" (a collective money pot) being always dominated by non-contribution. We interpret contribution as an act consistent with a high degree of social capital.

We find weak evidence that the programme acts at the group level: game sessions involving programme participants have higher levels of contribution than those not involving participants. In addition, there is some evidence that intensity of the programme matters: the more participants, the larger the impact. However, there is no evidence that the programme impacts at the individual level with participants no more likely to contribute than non-participants in treatment areas.

**Acknowledgements:** The authors would like to thank the Economic and Social Research Council for funding this research and our partners, Econometria, in Colombia for the provision of additional variables.

**Keywords:** Social Capital, Experimental Games, Public Goods, Evaluation Methods.

**JEL classification:** C93, I38

**Correspondence:** David Phillips, corresponding author, david\_p@ifs.org.uk

---

\* University College London, Institute for Fiscal Studies, London and NBER

♦ Institute for Fiscal Studies, London.

## Section 1: Introduction

Several decades of conflict, rebellion and unrest severely weakened civil society in Colombia. The legacy of past and ongoing violence has led to a weakened economy (Cardenas, M., 2002; Riascos & Vargas, 2004) and citizens that may have difficulty interacting with and trusting those outside their immediate social group, and engaging with local and national government agencies and organisations (McIlwaine & Moser, 2000). *Paz y Desarrollo (Peace and Development)* is the umbrella term used to describe the set of locally-led initiatives that aim at addressing these problems through programmes to promote sustainable economic development and community cohesion and action. Ultimately, the programme aims to foster an increase in social capital; to encourage the formation of social networks across social divides and to therefore increase the degree of trust between individuals. When individuals can trust each other, contracting can be less costly and fewer resources devoted to enforcement, thereby aiding economic development. But how can one measure the impact of a programme designed to improve this ‘social capital’? One could attempt to measure a final output; economic activity for instance. However, this is difficult both for reasons of data collection (particularly at the sub-regional level), and because improvements in behaviours associated with social capital may be considered an end unto themselves (for instance, by making future conflict less likely). With this in mind, a significant literature focuses on analysing measures of civic engagement (e.g. voting behaviour, group membership) (see Putnam 1995 and 2000, for instance) and survey responses (designed to elicit trust and trust-worthiness, for instance). However, economists have increasingly made use of experimental methods; specially designed games, often with real payoffs, that allow the researcher to analyse the determinants of cooperative (or indeed, uncooperative) behaviour (Barr & Genicot 2007; Karlan 2005; Mosley & Verschoor 2005).

In this paper we analyse the findings from a series of “public good” games that were conducted in the winter and spring of 2006 in 103 municipalities in rural and urban Colombia with mainly poor participants. These municipalities include both those with and without *Paz y Desarrollo (PyD)* in place, and within those municipalities where it is (‘treatment’ municipalities), both individuals who were beneficiaries/participants in the programme and those who were not. The municipalities where PyD is not in place (‘control’ municipalities) were surveyed as part of the evaluation of another programme – *Familias en Accion (FeA)*, and this paper also analyses the impact of this programme on social capital.

The game is structured as a typical free-rider problem with the act of contributing to the ‘public good’ (a collective money pot) being always dominated by non-contribution. The

game is played twice, with a short group discussion between participants taking place between the first and second round allowing either social pressure to contribute or the individual incentives to not contribute to be explained to those who do not understand. In this paper we take the act of contribution to the collective money pot as our measure of social capital – a willingness to forgo a private return for the social good, and to trust other players to contribute and act in a reciprocal manner despite the incentive not to.

The rest of this paper proceeds as follows. Section 2 details the PyD programme and the survey data collected as part of the evaluation of this programme (and also available for the controls from the FeA dataset) as well as other variables used. Section 3 describes in more detail the public goods game and provides some basic descriptive statistics for game-play. Section 4 provides an analysis of Paz y Desarrollo, firstly using a comparison between beneficiaries and non-beneficiaries in areas where the programme was running, and then by comparing with control municipalities. Section 5 focuses upon an analysis of *Familias en Accion*, and finally, section 6 offers our conclusions.

## **Section 2: *Paz y Desarrollo* and the Survey Data**

*Paz y Desarrollo* is the umbrella term used to describe a set of projects run at the regional and local level (and supported by the Colombian government) with the aim of fostering the accumulation of social capital amongst those Colombians worst affected by the history of violence and conflict in the country. A mixture of public education, information, and more proactive help, example projects include:

- Environmental clean-up and recovery and conservation work engaging local people.
- Psycho-therapeutic treatment for the victims of violence and the promotion of non-violence and mediation for the resolution of disagreement.
- Promoting “creative uses of free time” that promote social interaction.
- Helping small producers to form networks to aid production and chains of goods and materials, and support for technology take-up.
- Promotion of the importance of health (including prevention) and education.
- Encouraging a participative democracy by focussing on giving citizens the skills to engage and lead in communal projects.<sup>1</sup>

In some municipalities these programmes have been running for several years and in an

---

<sup>1</sup> See <http://www.redprodepaz.org/objetivos.htm> for more details of the objectives of the programme and the projects run as part of it.

effort to evaluate their effectiveness, a survey and set of experimental games was undertaken in winter 2006. This survey contains a detailed set of demographic and socio-economic information, together with qualitative information about the respondents' experiences of the Paz y Desarrollo programme. Those surveyed included both direct beneficiaries of the programme, and non-beneficiaries living in municipalities where the programme operated. We are able to link this dataset with recorded behaviour in the public goods game, together with some further municipality level data provided by our partners in Colombia.

The experimental games were conducted in [an appropriate manner] in 42 municipalities where the programme was in place<sup>2</sup> and we make use of results from games conducted in a further 70 municipalities where the programme was not in place; these shall be used as controls. The control municipalities were surveyed and had games administered in order to evaluate another programme in place in Colombia called *Familias en Accion*. Whilst *Familias en Accion* may have acted upon social capital, it was primarily designed to increase families investments in their children's human capital (education and health) through conditional cash transfers. When the games were conducted in these municipalities it was not envisioned that they would be used as control municipalities for the evaluation of *Paz y Desarrollo*, and hence, the 'control' municipalities and individuals were not chosen to be comparable to the 'treatment' ones (but instead to be representative of those potentially entitled to *Familias en Accion*). Nevertheless, the controls are similar to those where PyD was active in terms of rurality, income and some other key dimensions.<sup>3</sup> There are three municipalities that are surveyed in both samples.

The survey data used includes the following variables regarding game participants:

- Individual demographics including sex, age and household income.
- Household characteristics like location and amenities.
- Responses to survey questions designed to elicit trust and helpfulness (treatment areas only).
- *Paz y Desarrollo* treatment status (municipality and individual level) and *Familias* treatment status (municipality).
- A series of municipality level variables including inequality measures, deprivation measures, and measures of civic engagement.

---

<sup>2</sup> There were several other municipalities where fewer than 20 participants played which made the methodology of the game invalid.

<sup>3</sup> However, the PYD sample is more heterogeneous in terms of sex, age and income. It is also on average higher altitude and with more violence and less political engagement.

Each participant was asked whether they were acquainted with, friends with, or related to every other participant in their game session. From this we constructed a measure of the proportion of other participants each knew (by type of relationship) and indicators of whether they knew anyone at all.

Further variables are available for the Familias dataset (at both the individual and municipality level) but these cannot be used in analysing PyD because of their absence from the dataset for the treatment areas. Table 1 below provides descriptive statistics for the key variables available in both surveys, separately for treatment and control areas.

*Table 1a: Descriptive Statistics (Treatment Areas)*

<b>Variable</b>	<b>Statistic 1</b>	<b>Statistic 2</b>	<b>Statistic 3</b>
Sex	Male: 45.3%	Female: 54.7%	
Age	10 <sup>th</sup> : 24	Median: 40	90 <sup>th</sup> : 59
Less than Primary	39.9%		
Full Primary	19.1%		
Some Secondary	15.9%		
Full Secondary +	24.8%		
Hhold Income	10 <sup>th</sup> : 60,000	Median: 250,000	90 <sup>th</sup> : 700,000
Location	Rural: 44.3%	Urban: 55.7%	
Altitude	10 <sup>th</sup> : 20	Median: 1339	90 <sup>th</sup> : 2250
Murder Rate	10 <sup>th</sup> : 1.04	Median: 5.00	90 <sup>th</sup> : 13.27
Voting Rate	10 <sup>th</sup> : 29.8%	Median: 82.4%	90 <sup>th</sup> : 113.3%
Net Refugees	10 <sup>th</sup> : -248.8	Median: - 15.6	90 <sup>th</sup> : 33.9
Gini Coefficient	10 <sup>th</sup> : 0.41	Median: 0.59	90 <sup>th</sup> : 0.81
Rural Deprived	10 <sup>th</sup> : 8.6%	Median: 29.7%	90 <sup>th</sup> : 54.1%
Urban Deprived	10 <sup>th</sup> : 31.2%	Median: 60.2%	90 <sup>th</sup> : 77.8%

Table 1b: Descriptive Statistics (Control Areas)

Variable	Statistic 1	Statistic 2	Statistic 3
Sex	Male: 16.1%	Female: 83.9%	
Age	10 <sup>th</sup> : 28	Median: 40	90 <sup>th</sup> : 57
Less than Primary	61.4%		
Full Primary	13.5%		
Some Secondary	14.6%		
Full Secondary +	5.3%		
Hhold Income	10 <sup>th</sup> : 0	Median:220,000	90 <sup>th</sup> : 600,000
Location	Rural: 42.0%	Urban: 58.0%	
Altitude	10 <sup>th</sup> : 25	Median: 450	90 <sup>th</sup> : 1912
Murder Rate	10 <sup>th</sup> : 0.31	Median: 2.44	90 <sup>th</sup> : 7.66
Voting Rate	10 <sup>th</sup> : 55.8%	Median: 90.9%	90 <sup>th</sup> : 109.6%
Net Refugees	10 <sup>th</sup> : -108.5	Median: - 9.0	90 <sup>th</sup> : 18.4
Gini Coefficient	10 <sup>th</sup> : 0.43	Median: 0.63	90 <sup>th</sup> : 0.76
Rural Deprived	10 <sup>th</sup> : 18.3%	Median: 34.4%	90 <sup>th</sup> : 59.0%
Urban Deprived	10 <sup>th</sup> : 34.1%	Median: 56.9%	90 <sup>th</sup> : 78.3%

Table 1c: Differences between Control and Treatment Area

Variable	Difference <sup>a</sup>	Significant Differences <sup>4</sup>
Sex	32%	Yes
Age	0.5 yrs	No
Less than Primary	22%	Yes
Full Primary	6%	Yes
Some Secondary	1%	No
Full Secondary +	20%	Yes
Hhold Income	35,692	No
Location	3% (difference)	No
Altitude	459m	No
Murder Rate	4.32	Yes
Voting Rate	11%	No
Net Refugees	3.38	No
Gini Coefficient	0.02	No
Rural Deprived	3.82	No
Urban Deprived	3.61	No

a. Absolute difference in means.

These statistics confirm that these municipalities are deprived and that, in particular, those actually taking part in the games are very poor. Game participants from treatment areas are somewhat less poor, are more likely to be male and have higher levels of

<sup>4</sup> Standard errors allow for clustering at the municipality level.

education than those in control areas, with the last two differences statistically significant. The rural parts of treatment areas are less deprived than the control areas, but have greater levels of violence (as one would expect if violence warranted their inclusion in the *PyD* programme), although only the latter is significant.

### **Section 3: The Public Goods Game**

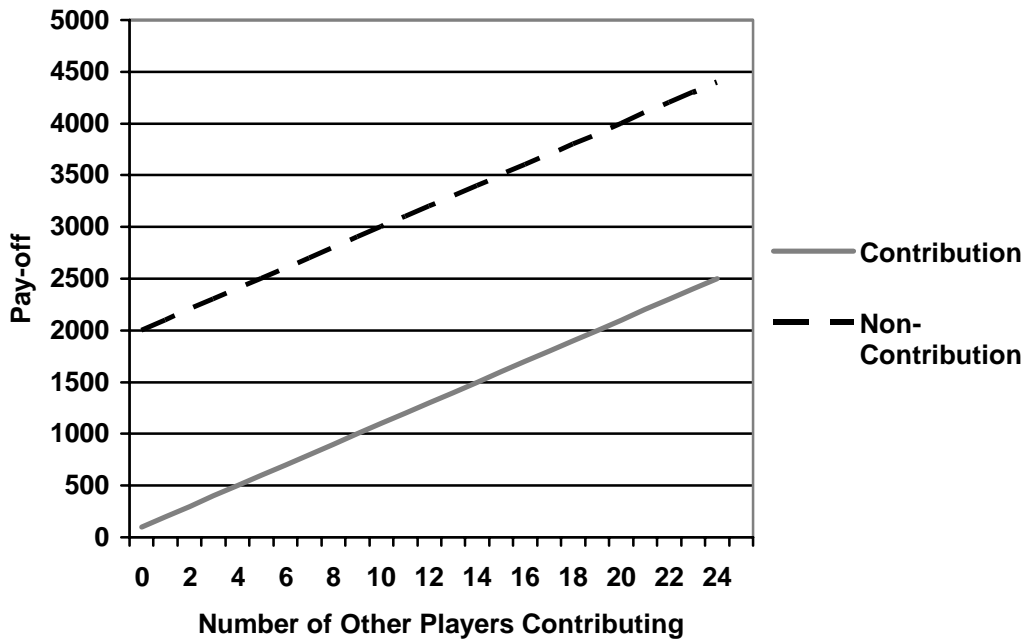
The public goods game has been designed to elicit information regarding the degree of social-mindedness that participants display. Initially, players are given a token and are provided with two options, either:

- ‘Invest’ it in a ‘private pot’ and at the end receive 2000 pesos, and in addition receive 100 pesos for everyone who contributes to the ‘public pot’ within their game session, or;
- ‘Invest’ it in the public pot in which case they forgo any private return and receive only 100 pesos for everyone contributing to the ‘public pot’.

Decisions are made privately and are kept confidential from the rest of the group, limiting the potential for social pressure and the enforcement of sanctions. Figure 1 overleaf demonstrates that the dominant strategy of this game is to not contribute to the public pot; the payoff is higher under this strategy irrespective of what the other players do. However, provided that there are at least 21 participants, the social optimum is for all to invest in the public pot, as if all contribute each will receive at least 2100 versus 2000 if none contribute. In Figure 1 we assume 25 participants and show the pay off for a given player for his two strategies for different numbers of contributors (zero to twenty four) amongst the other game players.



Figure 1: Public Goods Game Incentives



We interpret contributions to the public good as a measure of social capital because it involves forgoing a private return in order to increase the social return, and, presumably demonstrates a belief that others are likely to do this and a commitment to act in a reciprocal manner. This interpretation, however, is not the only one. An alternative is that contribution to the public good instead reflects a lack of understanding of the private incentives of the game (and vice versa). If this were the case we might expect less educated people to be more likely to contribute, something we shall test.

In the second round of the game, game participants are given the opportunity, and indeed encouraged, to discuss how the game should be played in the second round. This could be used to exert 'social pressure' to contribute to the public good. Decisions remain confidential in the final round and hence this social pressure must act through 'internal' channels (e.g. feelings of obligation, duty or guilt) for the majority of participants.<sup>5</sup>

Table 2 shows the proportion contributing in each round and by the type of municipality and beneficiary status.

<sup>5</sup> Except, perhaps for the small number of participants with close friends / family members also playing who may be able to tell if they are lying (e.g. through observing subsequent behaviour and spending.)

Table 2: Contribution to the Public Good

Group	First Round	Second Round
<b>PyD Areas</b>	61.0%	69.9%
<b>Beneficiaries</b>	61.8%	71.3%
<b>Non Beneficiaries</b>	60.4%	68.7%
<b>Non-PyD Areas</b>	37.0%	44.8%
<b>FeA in Place</b>	36.4%	49.5%
<b>FeA not in Place</b>	38.1%	35.5%

In the first instance, comparison between the treatment and control areas would suggest that PyD is associated with greater ‘social capital’. Furthermore, the very small differences between beneficiaries and non-beneficiaries in the treatment areas would suggest that this operates at the level of the municipality rather than the individual. However, in order to validate this we need to look more closely at the data and attempt to rule out other alternative explanations; differences in the conduct of the survey between the treatment and control samples, unobserved differences between treatment and control areas, or errors in interpreting contribution as social capital. We do this in the next section.

#### Section 4: An Analysis of *Paz y Desarrollo*

In this section we analyse the determinants of contribution to the public good and use a series of probit regressions to assess the impact upon this measure of ‘social capital’. Initially we confine the sample to those municipalities where PyD is active and look at the differences in behaviour between beneficiaries and non-beneficiaries. However, if the programme is having wider benefits beyond those directly participating in it and improves the levels of social capital municipality-wide this method of assessing the impact would be invalid. Hence, we then compare areas where PyD is active to comparable areas where it is not (the control sample). Finally, to investigate the possibility that the programme works at neither the individual, nor municipality level, but somewhere in between (and to overcome worries that differences in the manner the survey was carried out between the treatment and control areas are driving results) we include as an explanatory variable the proportion of beneficiaries in the game session. The results of this final model are potentially key to the evaluating the programme because in the absence of pre-programme data (allowing difference-in-differences), this

offers some possibility of avoiding some of the problems of unobserved differences between treatment and control areas.

A key concern in this work is the potential endogeneity of certain explanatory variables with notable examples including those relating to civic engagement, levels of unrest and migration and economic development. On the one hand, PyD was implemented in poor violent areas, but it may have subsequently improved these outcomes. Hence, including such variables will tend to bias estimates of programme effect. On the other hand, if these variables are exogenous, but differ between treatment and control areas, *excluding* them will lead to biased estimates of the programme effect. For this reason, all analyses is conducted twice: once including these variables, and then excluding them.

It is also important to note that in order to interpret our results causally, identification relies upon any unobserved heterogeneity being orthogonal with respect to our Paz y Desarrollo variables: whether an individual is a direct beneficiary of the programme; whether they live in a treatment area; and the proportion of beneficiaries in their game. If one is not willing to make this leap-of-faith, the results should be seen as persuasive and consistent with the causal effect that we suggest *may* be occurring. We believe that in the absence of panel data with pre-programme data (which would allow use of a fixed-effects approach) or a suitable instrument, it would be unwise to simply dismiss the results obtained here, imperfect as the evaluation strategy is. A number of robustness checks are carried out and results all point towards the same direction.

In section 4.1 and 4.3 we restrict our samples to individuals living in treatment areas and playing games conducted as part of the Paz y Desarrollo evaluation. There are three treatment municipalities for whom we have two samples: one from the Paz y Desarrollo survey, and the other from Familias survey. We are unable to use the latter sample in these sub-sections because we are unable to identify who are beneficiaries of the programme (it is not asked in the Familias survey) and this is key in these sections. This restricts our sample size

#### **4.1 Using Non Beneficiaries as Controls**

Table 3 shows the results from the regression of contribution to the public good in the first round on individual and household characteristics *within* eligible municipalities and sampled as part of the main Paz y Desarrollo evaluation survey. The first two columns include only those variables likely to be exogenous with respect to participation in the programme, whilst the last two include variables that may be endogenous.

The first point to note is that beneficiaries of Paz y Desarrollo are no more likely to contribute to the public good than others, in either case, although when we include the potentially endogenous regressors the coefficient becomes negative and almost significant. We interpret this to mean that at the individual level, PyD has no impact on 'social capital' as measured by first round contributions. There are, however, some other variables that do have a significant impact on contribution, namely; the older one is the greater the likelihood of contribution to the public good; those with higher family income are more likely to contribute; those with some education are more likely to contribute to the public good than those with none; and those that deem others more trustworthy are also more likely to contribute. The latter two determinants are the most interesting. Firstly, the positive coefficient on education goes some way to counteracting the worry that contribution reflects a misunderstanding of individual incentives rather than pro-social behaviour. Secondly, that those who believe others are trustworthy are more likely to contribute demonstrates the importance of reciprocity; participants are more willing to forgo the private return for the benefit of the group if they believe others will do so too.

Table 3 – First Round Contributions (PYD Municipalities Only)

	Excl Endogenous Regressors		Incl Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
Beneficiary	-0.02009	0.03009	-0.03255	0.0295501
Female	-0.00779	0.028754	0.018838	0.0244081
Session Size	-0.00011	0.000677	0.0003	0.0005378
Age	<b>0.004107</b>	<b>0.0011069***</b>	<b>0.003842</b>	<b>0.0011551***</b>
Family Income	7.67E-08	6.92E-08	<b>1.12E-07</b>	<b>5.70E-08**</b>
Income Squared	2.73E-15	2.11E-14	-5.44E-15	1.89E-14
Some Primary	<b>1.16E-01</b>	<b>0.0496618**</b>	<b>1.18E-01</b>	<b>0.0487405**</b>
Full Primary	<b>0.097815</b>	<b>0.0559333*</b>	<b>0.098921</b>	<b>0.0575712*</b>
Some Secondary	0.092574	0.060015	0.08312	0.0627639
Full Secondary	<b>0.118433</b>	<b>0.0611393*</b>	0.091492	0.0643686
Max. Education	-	-	-0.01042	0.0205835
Village Altitude	-2.55E-06	2.43E-05	1.22E-05	0.0000271
Urban Residence	0.027614	0.055446	0.023577	0.0503224
Piped Water	<b>1.35E-01</b>	<b>0.044585***</b>	<b>0.127213</b>	<b>0.0450428***</b>
Sewage	-0.04618	0.046986	-0.03474	0.0461214
Rubbish Collected	-0.08513	0.056173	-0.07212	0.0542714
Piped Gas	-0.02609	0.02825	-0.01193	0.0280699
Own Phone	0.003772	0.03392	0.008786	0.033338
Mostly Helpful	-	-	0.047354	0.0294039
Some Helpful	-	-	0.02263	0.0363732
Mostly Trustworthy	-	-	<b>0.0921</b>	<b>0.0333946***</b>
Some Trustworthy	-	-	0.03659	0.0287561
Murder Rate	-	-	-3E-05	0.0044442
Net Migration	-	-	-4.3E-05	0.0002043
Voting Rate	-	-	-0.03024	0.1112621
Urban Poverty	-	-	<b>-0.00363</b>	<b>0.0014552**</b>
Rural Poverty	-	-	0.001827	0.0020152
Gini Coefficient	-	-	-0.03019	0.086427
Proportion Know	-	-	<b>-0.20938</b>	<b>0.1278387*</b>
Proportion Leaders	-	-	0.193673	0.2294066
Proportion Friends	-	-	-0.07425	0.1884681
Proportion Family	-	-	<b>-1.1114</b>	<b>0.4049724***</b>

R<sup>2</sup> is 0.0274 and 0.0423, respectively. Observations 1908 and 1798, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

Indicators of significance: \* - 10% level, \*\* - 5% level, \*\*\* - 1% level

This model is a probit. Results are robust to specification as a logit.

Table 4 shows the results for the same probits for the second round of the game. Again there is no impact of participation in the *Paz y Desarrollo* programme on individual decisions to contribute. Of the other variables, the behaviour of the player in the first round is important, as is family income. When entered as a quadratic, family income has coefficients that imply higher contribution for those with lower incomes, although the rate at which the probability of contribution declines with income falls as income rises. This may reflect the poor being more susceptible to social pressure. Females are also more likely to contribute in the second round (but not the first); perhaps this group is

also more susceptible to pressure during the group discussion. Whilst higher income reduces the probability of contribution, variables associated with material deprivation (e.g. altitude, telephone ownership and the urban poverty measure) suggest that those who are less physically deprived are more likely to contribute to the public good. This apparent inconsistency may relate to the impact of access to services and infrastructure: those with better access to infrastructure provided by the public or formal private sector are more likely to have interacted with those beyond their immediate acquaintances in a positive manner.

It would be expected that the presence of people that one knows (and have a good disposition towards) would increase the likelihood of contribution to the public good. However, this is not the case in either the first or second round of the game; those who have a greater proportion of friends in the game are no more likely to contribute to the public good, and acquaintance or familial connection significantly reduces the likelihood of contribution in the *first* round. In any case one must be cautious at giving a causal interpretation to the time-varying (i.e. non-familial) variables as these could be endogenous with respect to participation in Paz y Desarrollo.

Overall, analysis of the impact of Paz y Desarrollo at the individual level suggests that there is no effect of direct programme participation on social capital. In many cases, the coefficient on the dummy indicating beneficiary status is actually negative (although insignificant), even when controlling for potentially endogenous variables, notably violence and civic participation.

Table 4 – 2nd Round Contributions (PYD Municipalities Only)

	No Endogenous Regressors		Inc. Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
1 <sup>st</sup> Round Play	<b>0.312077</b>	<b>0.0375096***</b>	<b>0.3090383</b>	<b>0.0392563***</b>
Beneficiary	-0.00913	0.0317629	-0.0119898	0.0317021
Female	<b>0.059297</b>	<b>0.0288196**</b>	<b>0.0681422</b>	<b>0.028481**</b>
Session Size	0.000663	0.0009409	0.0003429	0.0008442
Age	-0.00062	0.0010468	-0.0003859	0.0010424
Family Income	<b>-1.85E-07</b>	<b>8.61E-08**</b>	<b>-1.44E-07</b>	<b>7.20E-08**</b>
Income Squared	<b>7.35E-14</b>	<b>4.02E-14*</b>	<b>5.58E-14</b>	<b>3.01E-14*</b>
Some Primary	-0.00361	0.0366474	0.0005301	0.0355577
Full Primary	0.031508	0.0390539	0.0193713	0.039198
Some Secondary	-0.01296	0.0464546	-0.0154924	0.0460476
Full Secondary	-0.03331	0.0560027	-0.0407426	0.0556842
Max. Education	-	-	0.0255949	0.0235772
Village Altitude	<b>-4.6E-05</b>	<b>0.0000266*</b>	-0.0000339	0.0000227
Urban Residence	-0.01877	0.0431371	-0.0356465	0.0423353
Piped Water	0.036645	0.0390877	0.0446903	0.0405066
Sewage	0.009809	0.035863	0.0107927	0.0377178
Rubbish Collected	-0.00458	0.0422892	0.0125279	0.0432145
Piped Gas	0.027489	0.0290598	0.0222851	0.0253653
Own Phone	<b>0.048066</b>	<b>0.0277999*</b>	0.0394894	0.0322853
Mostly Helpful	-	-	-0.0169115	0.0289948
Some Helpful	-	-	0.0113146	0.0326768
Mostly Trustworthy	-	-	0.0466942	0.0454211
Some Trustworthy	-	-	0.0099608	0.0433746
Murder Rate	-	-	0.0042808	0.005248
Net Migration	-	-	0.0003516	0.0002303
Voting Rate	-	-	-0.0146956	0.1134732
Urban Poverty	-	-	<b>-0.003197</b>	<b>0.0018473*</b>
Rural Poverty	-	-	0.0000614	0.001689
Gini Coefficient	-	-	-0.1394714	0.1231499
Proportion Know	-	-	-0.2537129	0.1756278
Proportion Leaders	-	-	0.1135857	0.15014
Proportion Friends	-	-	-0.3328634	0.2509224
Proportion Family	-	-	-0.5502398	0.4245577

R<sup>2</sup> is 0.1324 and 0.1321, respectively. Observations 1908 and 1798, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

Indicators of significance: \* - 10% level, \*\* - 5% level, \*\*\* - 1% level

This model is a probit. Results are robust to specification as a logit.

#### 4.2 Using *Familias en Accion* Sample as Controls

If *Paz y Desarrollo* acts at the level of the municipality<sup>6</sup>, using non-beneficiaries from municipalities where the programme is active as controls would not be an appropriate

<sup>6</sup> Or, if non beneficiaries and beneficiaries are simply non-comparable across unobserved dimensions.

evaluation strategy; instead, one should use individuals from other municipalities<sup>7</sup>. The programme may operate at the level of the municipality due to spillovers between friends and acquaintances, for instance. The *Familias en Accion* sample allows this municipality level analysis to take place. Analysis of the composition of the two samples suggests that whilst the composition differs somewhat (in particular, *Paz* participants tend to live in areas with better infrastructure – e.g. water, sewage, telephone systems– than *Familias* areas), it does not differ in important ways in terms of the observed characteristics that matter for contribution choice. Based upon observables, characteristics are sufficiently similar to combine these samples and to use *Familias* as a control, but it is important to remember that unobserved characteristics may differ significantly between areas. It is therefore safer to see results as suggestive rather than causal.<sup>8</sup>

The coefficient on the dummy variable indicating that a participant lives in a *Paz y Desarrollo* treatment area is fairly large and significant in both specifications; the effect is robust to the inclusion (and exclusion) of potentially endogenous regressors. Of the other variables, only a few are significant: age, where older participants are more likely to contribute; the variable recording access to piped water; and session size, although the latter only for the specification including potentially endogenous regressors. As in results presented in table 3, contribution is highest for those with the highest levels of education, again soothing worries about the interpretation of contribution as “social capital”. Of the potentially endogenous variables, the murder rate and net migration are significant: both are positively associated with contribution to the public good, perhaps surprisingly.

PTO

---

<sup>7</sup> Alternatively, if direct beneficiaries and non-beneficiaries are very different in unobserved ways, non beneficiaries will be a poor control group.

<sup>8</sup> See the appendix for details on how treatment and control areas are compared.



Table 5: Comparing Treatment with Control Areas, Round 1

	No Endogenous Regressors		Inc. Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
Treatment	<b>0.1916105</b>	<b>0.0513262***</b>	<b>0.166876</b>	<b>0.0526814***</b>
Familias Area	-0.0274656	0.0571854	-0.01008	0.0560851
Female	-0.040618	0.0261414	-0.03455	0.0248576
Session Size	0.0010392	0.0007797	<b>0.001761</b>	<b>0.000715**</b>
Age	<b>0.0030664</b>	<b>0.0007987***</b>	<b>0.00301</b>	<b>0.000829***</b>
Family Income	6.13E-09	4.98E-08	2.16E-08	4.90E-08
Income Squared	5.97E-15	1.61E-14	1.06E-15	1.66E-14
Some Primary	<b>0.0686318</b>	<b>0.0297612**</b>	<b>0.06109</b>	<b>0.0313591*</b>
Full Primary	4.64E-02	3.46E-02	0.038665	0.0364793
Some Secondary	<b>8.19E-02</b>	<b>0.0343332**</b>	<b>0.071258</b>	<b>0.0352967**</b>
Full Secondary	<b>0.1048784</b>	<b>0.0407737**</b>	<b>0.094167</b>	<b>0.0416794**</b>
Village Altitude	0.0000318	0.0000237	3.52E-05	2.44E-05
Urban Residence	-0.0199607	0.0336368	-4.01E-02	3.06E-02
Piped Water	<b>0.1033708</b>	<b>0.0344415***</b>	<b>0.107115</b>	<b>0.0341759***</b>
Sewage	-0.0466103	0.0335449	-0.03754	0.0320003
Rubbish Collected	-0.029646	0.0341515	-0.02879	0.0336354
Piped Gas	-0.0107712	0.0317919	-0.01422	0.0319708
Own Phone	0.0176887	0.0303642	0.035882	0.0306904
Murder Rate	-	-	<b>0.005898</b>	<b>0.0024488**</b>
Net Migration	-	-	<b>0.000189</b>	<b>0.0000708***</b>
Voting Rate	-	-	-0.10449	0.1004005
Urban Poverty	-	-	-0.00251	0.0021181
Rural Poverty	-	-	0.000932	0.0021961
Gini Coefficient	-	-	-0.14614	0.118823

R<sup>2</sup> is 0.057 and 0.069, respectively. Observations 4024 and 4024, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

Regressions of second-round behaviour in table 6 show, again, that those who contributed in the first round are very much more likely to contribute in the second round. Even after controlling for first round behaviour, there is still an impact of living in a Paz y Desarrollo treatment area on contribution probability, and this has a significant magnitude. In both specifications, family income is negatively correlated with contribution probability, as is the altitude of the village, whilst those playing in a game with more participants are more likely to contribute to the game. Again, variables indicating low material deprivation are, generally, associated with higher probabilities of contribution to the public good, perhaps for the reasons discussed above. Inclusion of endogenous regressors leaves the coefficients on our main variables of interest (treatment and beneficiary) practically unchanged.

Table 6: Comparing Treatment with Control Areas, Round 2

	No Endogenous Regressors		Inc. Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
1 <sup>st</sup> Round Play	<b>0.38754</b>	<b>0.0293732***</b>	<b>0.3845542</b>	<b>0.0303171***</b>
Treatment	<b>0.175268</b>	<b>0.0751087**</b>	<b>0.1556481</b>	<b>0.0759276**</b>
Familias Area	0.047928	0.069434	0.0428308	0.0685446
Female	0.011918	0.028651	0.0122353	0.0280515
Session Size	<b>0.002533</b>	<b>0.0011515**</b>	<b>0.0030084</b>	<b>0.000946***</b>
Age	-0.00106	0.000746	-0.0009246	0.0007526
Family Income	<b>-1.60E-07</b>	<b>6.54E-08**</b>	<b>-1.39E-07</b>	<b>6.45E-08**</b>
Income Squared	<b>4.47E-14</b>	<b>2.35E-14*</b>	<b>3.82E-14</b>	<b>2.16E-14*</b>
Some Primary	-3.17E-02	3.05E-02	-0.0217875	0.030604
Full Primary	-3.47E-03	3.51E-02	0.0026181	0.0342112
Some Secondary	-0.02991	0.04072	-2.77E-02	4.00E-02
Full Secondary	-0.02642	0.04468	-2.66E-02	4.39E-02
Village Altitude	<b>-6.3E-05</b>	<b>-2.9E-05**</b>	<b>-0.0000543</b>	<b>0.0000307*</b>
Urban Residence	0.004859	0.043364	-0.0223413	0.0384978
Piped Water	0.025659	0.037887	0.0418747	0.0381679
Sewage	-0.00626	0.036008	0.0008572	0.0365119
Rubbish Collected	-0.05681	0.040792	-0.0348171	0.0394571
Piped Gas	<b>0.090871</b>	<b>0.0360918**</b>	<b>0.1033637</b>	<b>0.0359659***</b>
Own Phone	<b>0.071313</b>	<b>0.030585**</b>	<b>0.0907713</b>	<b>0.0315901***</b>
Murder Rate	-	-	0.0015819	0.0027503
Net Migration	-	-	<b>0.0001737</b>	<b>0.0000544***</b>
Voting Rate	-	-	0.0349166	0.1217901
Urban Poverty	-	-	-0.002993	0.0023582
Rural Poverty	-	-	-0.0016052	0.0021558
Gini Coefficient	-	-	-0.1423343	0.1416346

R<sup>2</sup> is 0.1726 and 0.1852, respectively. Observations 4024 and 4024, respectively.  
Variables for missing values included for some variables (others cannot due to multiple near-colinearity).

Regressions were also run that included indicators of acquaintance, friendship, and kinship (and proportions). Inclusion of these dummies changes the coefficient quite notably, although not qualitatively; the dummy for living in a treatment area is much more significant and is substantially increased in size for the second round (to about 0.25). Results for these regressions can be found in table 7, although caution should be used in interpreting these due to potential endogeneity issues. The dummy variables themselves do not have the expected positive signs (i.e. we would expect indicators of having friends and family in the game to *increase* contribution) although the negative coefficients are not significant.

Table 7: Including Network/ Connection Information: Round 1 and 2

	First Round		Second Round	
	Coefficient	S.E	Coefficient	S.E
1 <sup>st</sup> Round Play	-	-	<b>0.382434</b>	<b>0.0314597***</b>
Treatment	<b>0.216127</b>	<b>0.0563329***</b>	<b>0.257676</b>	<b>0.0652912***</b>
Familias Area	0.018748	0.061439	0.101636	0.064481
Female	-0.01596	0.020951	0.042469	0.026632
Session Size	<b>0.001407</b>	<b>0.0007109**</b>	<b>0.00228</b>	<b>0.0009653**</b>
Age	<b>0.002982</b>	<b>0.0008469***</b>	-0.00063	0.000748
Family Income	4.44E-08	5.04E-08	<b>-1.28E-07</b>	<b>6.44E-08**</b>
Income Squared	-4.85E-15	1.65E-14	<b>3.61E-14</b>	<b>2.09E-14*</b>
Some Primary	<b>6.05E-02</b>	<b>0.0305664**</b>	-1.66E-02	3.04E-02
Full Primary	0.034764	0.036592	0.005301	0.034778
Some Secondary	<b>0.072346</b>	<b>0.0359087**</b>	-0.01414	0.039413
Full Secondary	<b>0.075291</b>	<b>0.0415351*</b>	-0.02913	0.045619
Village Altitude	4.11E-05	0.000025	-4.4E-05	3.14E-05
Urban Residence	-0.02351	0.032998	-0.00362	0.037979
Piped Water	<b>0.094739</b>	<b>0.0352255***</b>	0.0265	0.038561
Sewage	-0.04936	0.033915	-0.01183	0.036629
Rubbish Collected	-0.02905	0.034518	-0.02743	0.039806
Piped Gas	-0.01755	0.029803	<b>0.07715</b>	<b>0.0302558**</b>
Own Phone	0.0325	0.03098	<b>0.075728</b>	<b>0.0312841**</b>
Murder Rate	<b>0.005077</b>	<b>0.0023682**</b>	0.00151	0.002623
Net Migration	<b>0.000181</b>	<b>6.24E-05***</b>	<b>0.000177</b>	<b>0.00005***</b>
Voting Rate	-0.1073	0.102102	0.044612	0.12267
Urban Poverty	-0.00259	0.002121	-0.00324	0.002371
Rural Poverty	0.0008	0.002198	-0.00168	0.002148
Gini Coefficient	-0.13641	0.118559	-0.13795	0.139642
Prop. Acquainted	-0.05594	0.13585	-0.0916	0.13052
Prop. Friends	0.1425	0.194347	-0.33301	0.246527
Prop. Family	-0.39849	0.501256	-0.6322	0.441912

R<sup>2</sup> is 0.0727 and 0.194, respectively. Observations 3912 and 3912, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-colinearity).

### 4.3 Regressions including the proportion of beneficiaries as a regressor

In order to further investigate the nature of the impact of Paz y Desarrollo on public goods contributions as measured in the experimental game, we now present a series of probit regressions that include the proportion of beneficiaries in the game session (for treatment areas only), and the proportion of beneficiaries in the whole municipality. This will allow investigation in to how the programme works in increasing “social capital” as measured by the public goods game; is it purely a municipality level phenomenon, does it depend upon the number of beneficiaries in the municipality, or even the number of beneficiaries in a specific context (e.g. in playing the public goods game).

In the ‘extensions’ section we break these regressions down by demographic group (e.g. high versus low education) to see if the programme has a heterogeneous impact. Three municipalities are included in both the PyD sample and the FeA sample and for the main analysis the games conducted as part of the FeA evaluation in these areas are excluded from the analysis. In order to maximise sample size and test robustness, we include these games and make different assumptions about the proportion of beneficiaries amongst those participants living in Paz y Desarrollo treatment areas but sampled as part of the FeA Survey,. That is: the same as the proportion in those same municipalities’ PyD sample; the same as for the municipality as a whole; and zero. Higher proportions of beneficiaries are possible, but implausible.

As table 8 shows, for both the first and the second round of the game, the coefficient on the proportion of beneficiaries is quite large but imprecisely estimated, which may be due to the small sample size. Other variables have coefficients similar to those in tables 3 and 4 for the first and second rounds respectively. The proportion of beneficiaries in the game is not related to the proportion of beneficiaries in the municipality as a whole (in fact there is a slight negative correlation)<sup>9</sup> and if one uses the latter variable instead, we get a coefficient close to zero indicating that if there is an impact it will likely act at the level of the game rather than the level of the municipality as a whole.<sup>10</sup>

---

<sup>9</sup> It was planned that 50% of game participants would be PyD beneficiaries in each municipality; whilst, on average, this was true there is quite a degree of variation across municipalities which is not correlated with the variation in municipality programme ‘intensity’. This is useful in terms of identifying the social capital mechanism.

<sup>10</sup> Notice that the proportion of beneficiaries in the municipality as a whole may be endogenous in any case; areas with particularly high violence and low social capital might have a more ‘intense’ programme in place, designed to counteract the particularly severe problems.

Table 8: Including the Proportion of Beneficiaries (Excluding Endogenous Regressors)

	First Round		Second Round	
	Coefficient	S.E	Coefficient	S.E
1 <sup>st</sup> Round Play	-	-	<b>0.309726</b>	<b>0.0372688***</b>
Beneficiary	-0.02841	0.0302513	-0.01781	0.032465
Proportion Treated	0.305674	0.2344031	0.295777	0.248007
Female	-0.0053	0.0282489	<b>0.062305</b>	<b>0.028077**</b>
Session Size	0.000143	0.000665	0.000911	0.000939
Age	<b>0.004057</b>	<b>0.0011118***</b>	-0.00066	0.00106
Family Income	8.49E-08	6.44E-08	<b>-1.74E-07</b>	<b>8.67E-08**</b>
Income Squared	3.93E-16	2.00E-14	<b>6.88E-14</b>	<b>4.08E-14*</b>
Some Primary	<b>0.110829</b>	<b>0.0489502**</b>	-0.00854	0.036323
Full Primary	0.090902	0.0558022	0.024876	0.039631
Some Secondary	0.084691	0.0600425	-0.02107	0.047316
Full Secondary	<b>0.111434</b>	<b>0.0605028*</b>	-0.04065	0.057489
Village Altitude	-2.62E-07	0.0000237	-4.4E-05	2.65E-05
Urban Residence	0.029066	0.0558072	-0.01731	0.042835
Piped Water	<b>0.126834</b>	<b>0.0457585**</b>	0.028765	0.039506
Sewage	-0.05179	0.0473864	0.003927	0.035509
Rubbish Collected	-0.07988	0.0551064	-0.00021	0.042727
Piped Gas	-0.02283	0.0273037	0.031013	0.028333
Own Phone	0.002236	0.032947	<b>0.046651</b>	<b>0.0276897*</b>

R<sup>2</sup> is 0.0257 and 0.1131, respectively. Observations 1799 and 1799, respectively.  
Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

#### 4.4 Extensions

Breaking down the results by demographic group shows that there are some groups where the proportion of beneficiaries is significant; the lower educated (during the first round) and females (during the second round). The size of the coefficient (even if insignificant at standard levels of significance) is larger for those with low education, low education and female, i.e. those groups perhaps most affected by any social pressure brought to bear during game-play or anticipated social pressure following the game.

Perhaps more importantly is that splitting the sample up into sub-samples along four different dimensions into eight subgroups results for each two rounds of game results in 15 out of 16 regressions that have positive coefficients on the variable recording proportion of beneficiaries. This robustness of the positive coefficient for beneficiary proportion indicates that whilst it may not be statistically significant, the positive coefficient is robust to changing the sample. This is reassuring. Table 9, below, provides the coefficient (and its standard error) of beneficiary status for these regressions. The description in the first column of the table refers to the sub-group this coefficient relates to.

Table 9: Disaggregating by Demographic Group

	First Round		Second Round	
	Coefficient	S.E	Coefficient	S.E
<b>Education</b>				
Low Education	<b>0.54487</b>	<b>0.246863**</b>	0.27302	0.250222
High Education	0.1535	0.294824	0.296397	0.288013
<b>Sex</b>				
Female	0.422345	0.326719	<b>0.743363</b>	<b>0.339238**</b>
Male	0.244951	0.217161	-0.12007	0.258302
<b>Session Size</b>				
Under 40	0.279068	0.236743	0.427092	0.288976
40 or Over	0.516361	0.360588	0.108291	0.270422
<b>Family Income</b>				
Under 250k Pesos	0.428113	0.286326	0.307557	0.238096
Over 250k Pesos	0.159193	0.302798	0.238136	0.393426

Table 10 shows the results of various different assumptions on the proportion of beneficiaries in the treatment areas sampled as part of the FeA survey. Under the assumption that the proportion of beneficiaries in these sessions are equal to the proportion in these municipalities' PyD survey samples (which seems a reasonable upper bound given the latter survey heavily over-samples beneficiaries), the beneficiary proportion has a significant positive coefficient. This becomes progressively larger and more significant as the proportion assumed is reduced, as would be expected.

Table 10: Alternative Assumptions

	First Round		Second Round	
	Coefficient	S.E	Coefficient	S.E
<b>Same Proportion as the PyD Sample</b>	<b>0.427647</b>	<b>0.1971241**</b>	<b>0.686324</b>	<b>0.2578895**</b>
<b>Same Proportion as Municipality as a Whole</b>	<b>0.438811</b>	<b>0.1789684**</b>	<b>0.672695</b>	<b>0.1929489***</b>
<b>No Beneficiaries in the Sample</b>	<b>0.545269</b>	<b>0.1370154***</b>	<b>0.574352</b>	<b>0.1744425***</b>

However, notwithstanding the general problem of identification in a model with potentially correlated unobserved heterogeneity, there are reasons one might not treat these results causally. Foremost is the fact that there may have been unobserved

differences in the conduct of the games sessions by the separate field-teams conducting the games as part of the FeA and the PyD evaluations. This would make one wish to investigate hypotheses using the PyD survey samples only: when we include games in treatment areas conducted by the PyD survey teams, as in table 10, our sample is no longer robust to potential differences in the operation of the field experiments across programme evaluations.

#### 4.5 Summary

Sections 4.1 and 4.2 show the following:

- Controlling for observed characteristics, Paz y Desarrollo beneficiaries are no more likely to contribute to the public good than non-beneficiaries who live in treatment areas.
- Interpretation of contribution as a ‘lack of understanding’ finds little support: higher levels of education are not associated with less contribution (and indeed are associated with greater probability of contribution in the first round).
- Controlling for observed characteristics, those living in treatment areas are significantly more likely to contribute to the public good than non-beneficiaries in both rounds of the game. In the second round this holds even after controlling for first round behaviour.

Sections 4.3 and 4.4 investigate how the programme impacts contribution probability: is it the proportion of beneficiaries in the municipality as a whole, or in the proportion in the game session? Results show it is not the former, and there is some evidence the latter channel may be important. Although the impact of beneficiary proportion is insignificant for the entire sample surveyed as part of the PyD evaluation, it does have a significant positive impact for specific demographic subgroups likely to be particularly concerned about social pressure; women and the low educated. If we are willing to assume that the games were conducted in the same manner in the Familias en Accion survey sample as the PyD survey sample, beneficiary proportion is a significant determinant of behaviour, increasing the probability of contribution.

Taking the impact of beneficiary proportion as given, what does this imply for the “channel” of operation of Paz y Desarrollo? It suggests the impact is at neither the individual nor municipality level but at the ‘group level’; groups with greater numbers of beneficiaries operating in a more cooperative manner in both the first and second round of the games. If the effect were only in the second round, one might hypothesise that this related to greater ability to exert social/moral pressure within the context of the conversation taking place during game-play. However, as this effect is observed in the

first round too, this cannot be the entire explanation. Maybe, for instance, there is an expectation that Paz y Desarrollo beneficiaries are better able to organise and hence detect and punish non-contributors after the game, and that the more beneficiaries there are, the greater this threat is. On the other hand, as cooperative behaviour is often undertaken only when it is felt it will be reciprocated, a belief amongst game participants that the PyD beneficiaries will play cooperatively would likewise lead to higher contribution to the public good when there are many of them. This is, however, supposition on the part of the authors and relies upon beneficiaries being identifiable to other players of the game.

## **Section 5: An Analysis of *Familias en Accion***

The public goods game can also be used to evaluate the impact of *Familias en Accion* on social capital. Tables 5, 6 and 7, above, have made use of the FeA sample and include a dummy variable indicating whether the municipality was a treatment area for this programme. The coefficient is insignificant in all these cases. However, the FeA dataset contains several variables not available for the PyD sample, and together with the aforementioned potential for differences in game conduct across the two samples, this makes it worthwhile investigating the impact of the programme using the FeA sample only.

Tables 11 and 12 show regression outputs for the first and second rounds, respectively, again differentiating between regressions that exclude and include potentially endogenous variables. In the first round, the dummy recording residence in a municipality where *Familias en Accion* is active has an insignificant negative coefficient. In the second round, it has a significant positive impact in the specification that excludes potentially endogenous variables. The results of specifications that include potentially endogenous regressors are extremely sensitive with respect to which regressors one includes. The results presented here include the full set of potentially endogenous variables available and show an insignificant positive effect of living in a *Familias en Accion* treatment area. The variables relating to public services are quite strongly correlated with treatment area status and excluding these results in a significant positive coefficient.

Any positive impact of *Familias en Accion* on game play occurs only in the second round of play. This suggests that any positive impact acts through the discussions taking place between the first and second round of the game. Those living in *Familias en Accion* areas are better able to persuade, coordinate and enforce contribution to the public good (the socially optimal behaviour), and the fact that actual decisions remain private in the second round means this likely acts through ‘internal’ channels (e.g. by making non-



contributors feel guilty during conversation, rather than by punishing them more directly). This is in contrast to the impact of Paz y Desarrollo which occurs in the first round as well as the second, if it occurs at all.

Table 11: *Familias en Accion Sample, Round 1*

	No Endogenous Regressors		Inc. Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
Familias Area	-0.05362	0.0616582	-0.01331	0.0702096
Session Size	<b>0.005329</b>	<b>0.002047***</b>	<b>0.008071</b>	<b>0.0020297***</b>
Female	-0.02283	0.0360443	-0.04363	0.0380675
Age	0.001183	0.0010665	<b>0.001769</b>	<b>0.0010588**</b>
Household Size	0.001562	0.0037342	0.00388	0.0037974
Family Income	-6.60E-08	4.34E-08	<b>-8.12E-08</b>	<b>4.31E-08*</b>
Some Primary	0.047528	0.0321608	0.006694	0.0311046
Full Primary	-0.00561	0.0385525	-0.04058	0.0353289
Some Secondary	0.065775	0.0443401	0.023936	0.0429339
Full Secondary	0.075814	0.0654218	0.043705	0.062826
Village Altitude	-5E-05	0.0000497	<b>-0.00011</b>	<b>0.0000558**</b>
Urban Residence	-0.06137	0.0429485	<b>-0.1055</b>	<b>0.03416***</b>
Piped Water	0.070809	0.0483413	0.106604	0.0421462
Sewage	-0.01718	0.0442891	-0.00708	0.0386838
Rubbish Collected	0.061423	0.0453768	0.03291	0.0413409
Piped Gas	-0.05451	0.0652749	-0.09059	0.0540119
Own Phone	0.033082	0.0510266	0.009573	0.0441357
Murder Rate	-	-	<b>0.024582</b>	<b>0.0134395*</b>
Net Migration	-	-	0.000132	0.0001063
Voting Rate	-	-	-0.19262	0.1827881
Urban Poverty	-	-	-0.00238	0.0034652
Rural Poverty	-	-	0.00024	0.0047286
Gini Coefficient	-	-	-0.30674	0.2397589
FARC '02	-	-	-0.08004	0.0853639
Paramilitary '01	-	-	-0.11797	0.0739882
Public Disturbance	-	-	0.157385	0.1007245
Desertion of Duty	-	-	<b>0.229727</b>	<b>0.0816396***</b>
Worker's Strike	-	-	0.035282	0.11218
Teacher Ratio	-	-	<b>0.061908</b>	<b>0.0179308***</b>
School Space	-	-	<b>0.017893</b>	<b>0.0071328**</b>
No. Hospitals	-	-	-0.01545	0.0814904
No. Clinics	-	-	<b>0.043682</b>	<b>0.0234705*</b>
No. Drop-ins	-	-	-0.00772	0.0083612
No. Pharmacies	-	-	0.007073	0.0066347
Curfew '02	-	-	<b>-0.29529</b>	<b>0.0660033***</b>
Eastern Region	-	-	<b>0.285821</b>	<b>0.1398315**</b>
Central Region	-	-	0.064975	0.0966869
Pacific Region	-	-	-0.01099	0.2330322

R<sup>2</sup> is 0.024 and 0.118, respectively. Observations 1957 and 1905, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

Table 11: *Familias en Accion Sample, Round 2*

	No Endogenous Regressors		Inc. Endogenous Regressors	
	Coefficient	S.E	Coefficient	S.E
1 <sup>st</sup> Round	<b>0.39536</b>	<b>0.047301***</b>	<b>0.403725</b>	<b>0.0417064***</b>
Familias Area	<b>0.129757</b>	<b>0.0695217*</b>	0.045601	0.072687
Session Size	<b>0.005409</b>	<b>0.0029734*</b>	0.005732	0.004112
Female	-0.03114	0.04468	-0.02185	0.036437
Age	-0.00125	0.000902	-0.00014	0.001107
Household Size	1.72E-03	4.22E-03	0.004368	0.004202
Family Income	-7.81E-08	5.68E-08	-4.86E-08	5.40E-08
Some Primary	-0.04606	0.043533	0.002482	0.041052
Full Primary	-0.03903	0.051642	0.002752	0.04851
Some Secondary	-0.07237	0.055482	-0.04722	0.049247
Full Secondary	-0.01026	0.067174	0.02092	0.059583
Village Altitude	<b>-0.00012</b>	<b>0.0000499**</b>	1.69E-05	6.04E-05
Urban Residence	0.025434	0.054333	0.045303	0.048041
Piped Water	0.005096	0.05321	-0.00045	0.050907
Sewage	0.012402	0.052284	-0.0073	0.051988
Rubbish Collected	-0.06288	0.054701	-0.06113	0.048604
Piped Gas	0.045057	0.061822	0.08008	0.055668
Own Phone	0.07315	0.045448	0.028494	0.037514
Murder Rate	-	-	-0.00783	0.016651
Net Migration	-	-	<b>0.000394</b>	<b>0.0001045***</b>
Voting Rate	-	-	<b>0.469855</b>	<b>0.2398053**</b>
Urban Poverty	-	-	0.00084	0.004756
Rural Poverty	-	-	<b>-0.01037</b>	<b>0.0049295**</b>
Gini Coefficient	-	-	<b>-0.46211</b>	<b>0.2435498*</b>
FARC '02	-	-	<b>-0.23827</b>	<b>0.1032937**</b>
Paramilitary '01	-	-	<b>-0.24632</b>	<b>0.103317**</b>
Public Disturbance	-	-	<b>0.321187</b>	<b>0.1192029**</b>
Desertion of Duty	-	-	0.250508	0.153346
Worker's Strike	-	-	<b>-0.26051</b>	<b>0.0866292***</b>
Teacher Ratio	-	-	<b>0.085317</b>	<b>0.0303473***</b>
School Space	-	-	-0.01103	0.008405
No. Hospitals	-	-	0.040664	0.112901
No. Clinics	-	-	0.04308	0.035531
No. Drop-ins	-	-	-0.00376	0.008565
No. Pharmacies	-	-	<b>0.02181</b>	<b>0.0084267***</b>
Curfew '02	-	-	-0.19402	0.1282
Eastern Region	-	-	<b>-0.33256</b>	<b>0.1235376**</b>
Central Region	-	-	0.160674	0.12626
Pacific Region	-	-	0.303195	0.186682

R<sup>2</sup> is 0.157 and 0.251, respectively. Observations 1957 and 1905, respectively.

Variables for missing values included for some variables (others cannot due to multiple near-collinearity).

In the regressions excluding the potentially endogenous variables, only session size and altitude (in the second round) have a significant impact on contribution probability. Inclusion of potentially endogenous variables makes more variables significant in the first round than when these variables are excluded: contribution increases with age and decreases with family income,. There is some evidence that contribution is higher in

areas where there are better public services as measured by inputs (particularly education), and in the second round, past violence and civil disorder seems to lower the probability of contribution to the public good. Note that controlling for the quality of public services is unwise if treatment was either conditional upon the quality of public services in the municipality (as it was, with *Familias* initially rolled-out to areas with the necessary infrastructure) or if the programme could impact upon the resources provided to public services.

## Section 6: Conclusions

Developing social capital as a precursor to reduced conflict and improved economic vitality is a key priority of the Colombian government. This paper has analysed the impact of one programme targeted at this problem, *Paz y Desarrollo*, through a game that mimics a public goods provision problem. This work suggests that the programme may have a positive impact on social capital, and that this goes beyond those directly participating in the programme. In both the first and second rounds of the game, there is a significant positive coefficient on the dummy variable indicating residence in an area where *Paz y Desarrollo* is in operation whilst the dummy variable indicating individual beneficiary status is insignificant. In order to further investigate the channel through which this effect acts, the proportion of programme beneficiaries in the game session is included as an explanatory variable. This is insignificant for the population as a whole, but is positive and significant for those with low levels of education, and for females and remains positive in sign across 8 separate sub-groups of the sample. Whilst inconclusive, this indicates that the positive coefficient is unlikely to be due simply to chance. If so, the presence of more programme beneficiaries in a game session encourages contributions from others in the session; this could be because participants are trusted to reciprocate, or they are felt better able to punish non-contribution, or in second round, larger groups of participants are better able to exert moral/social pressure during discussions. In terms of policy implications, this implies that programme participation needs to be relatively high – the positive effects do not fully “trickle down” from a few participants but rely upon a critical mass in terms of coverage to have maximum effect on social outcomes.

Turning to *Familias en Accion*, we find evidence that this programme has improved social capital, as measured by the public goods game, although results are sensitive to whether one includes or excludes variables relating to public service quality. Excluding these variables, the probability of contribution to the public good is higher in *Familias en Accion* areas than in areas in the second round of the game. Unlike the impact of *Paz y Desarrollo*, which suggests some role for expectations, this suggests a classical ‘social capital’ impact: those living in treatment areas better able to persuade, co-ordinate and morally enforce a

socially optimal strategy of contribution to the public good. Unfortunately, we are unable to investigate the “group properties” of the impact of the programme as the vast majority of game players in FeA areas are participants in the programme; there is not enough variation in the proportion of participants at the municipality level to use this in the regressions.

There are a number of problems in this evaluation, and these should be addressed in future work. Firstly, the differences in behaviour between treatment and control municipalities (and individuals) found in this analysis may be due to pre-existing differences (fixed effects) that are correlated with both treatment status and social capital. To overcome this omitted variables problem, programmes should be conducted using randomised treatment, or pre-programme experiments should be conducted to act as a baseline for a differences in-differences approach. Secondly, *by design*, there should be variation in the proportion of beneficiaries in the samples from treatment areas: this may prove instrumental in analysis and in this case was only available because the survey company’s planned 50% beneficiary sampling plan failed. The former suggestions, in particular, may face funding and political constraints, however, more robust and persuasive results depend on an evaluation strategy that can control for concerns about omitted or endogenous regressors.

## References

Barr, A. & Genicot, G. (2007), "*Risk Sharing, Commitment and Information: An experimental Analysis*", Centre for the Study of African Economies Working Papers, Oxford University

Cardenas, M. (2002), "*Economic Growth in Colombia: A Reversal of 'Fortune'*", Centre for International Development (Harvard) Working Paper

Helliwell, J. & Putnam, R. (1995), "*Economic Growth and Social Capital in Italy*", Eastern Economic Review, Vol. 20, No. 3

Karlan, D. (2005), "*Using Experimental Economics to Measure Social Capital and Predict Financial Decisions*", American Economic Review, Vol. 95, No. 5

McIlwaine, C. & Moser, C. (2000), "*Urban Poor Perceptions of Violence and Exclusion in Colombia*", World Bank, Washington

Mosley, P. & Verschoor, A. (2005), "*The Development of Trust and Social Capital in Rural Uganda: An Experimental Approach*", University of Sheffield Working Paper

Putnam, R. (2000), "*Bowling Alone: The Collapse and Revival of American Community*", New York.

Riascos, A. & Vargas, J. (2004) "*Violence and Growth in Colombia: A Brief Review of the Literature*", Webpondo.org: Resources for Colombian Economists