

Cooperation and Self-interested behavior A Field Experiment in Ivorian plantain sector¹

Keywords: Agriculture, Cooperation, Field Experiment

JEL Classification: Q13, C93, L23

Pr. Serge BLONDEL, Professor of Economics, serge.blondel@univ-angers.fr

Corresponding Author: **Rodrigue BRIN**, PhD student, rodrigue.brin@univ-angers.fr

GRANEM, University of Angers, 13 all. François Mitterrand BP 13633, 49036 Angers, France

Dr. Camille KOFFI, CNRA

Economics, National Center for Agricultural Research (CNRA), 01 BP 1740 Abidjan 01, Côte

kofficamille60@yahoo.fr

EXTENDED ABSTRACT

In Ivory Coast, plantain² sector is insufficiently organized: Is it due to the individualistic behavior of its agents?

Background

The concept of cooperation in economics has a long history. According to Adam Smith's invisible hand, markets allow convergence among collective and individual interests. In World development and agriculture organization, cooperative behavior and their determinants, are the subject of numerous research in economics.

In the context of African countries agriculture, the capacity of various basic units to cooperate - information's flow, exchanges, collective decisions capacity, the compliance with these decisions and control- is a real opportunity to generate added value and achieve substantial economies of scale (Buchanan et Yoon 2014). However, most initiatives in staple food crop this sense have all ended in failure (Gentil et Mercoiret 1991; Woods 1999; Wanyama, Develtere, et Pollet 2009). In fact, in practice these initiatives are not successful.

¹ This study was supported by the program COSIVEG (Région Pays de la Loire) and (CNRA). Murielle Gnamien (PhD student); Flora Soumahoro (trainee), Aimé Ronin (independent consultant), Victoria and Joseph Vouhi Boty (commercial agents), Lou Michel and Désiré Hirié M'Bro (CNRA technicians), helped us to conduct the experiments. We thank Gemma Davies, Nicole Geslin and Ludovic Temple (CIRAD) for their comments.

² The distinction between bananas and plantains is a source of some confusion. The FAO and the International Institute of Tropical Agriculture (IITA), among other research centers, use the word "banana" to refer to Musa species that are sweeter and eaten raw and "plantain" to denote Musa species that are starchier and cooked before eating (Robinson et Saúco 2010). In this paper, we will follow the convention of FAO and refer to bananas and plantains separately.

Why these significant conditions do not create a systematic production and marketing collective action, and then affect only a small percentage of actors, especially in food crop (local market), in Ivory Coast, as in many developing countries?

Cooperative behaviour in Economics

The facts such as the cooperation institution's history, the group's size, the cooperation costs, the profit, the associations objectives, the social determinants, considered as really restricting, group, have been attempt to identified and explained as critical issues to the success of these initiatives (Cardenas 2004).

However, cooperation depends heavily on the comprehension of individual's preference to engage themselves in strategic behavior (Cardenas et Carpenter, 2008) . In fact, the theory of non-cooperative games developed through Nash's (1953) findings, or the free rider problems; demonstrate that individual interests often lead to a suboptimal solution (Samuelson 1954). If standard rationality leads to non-cooperation when the latter is a dominant strategy, people actually have various behaviors, ranging from altruism to individualism. Social preferences may have theoretical foundations in the context of repeated games theory (Axelrod 1984).

Consequently, the capacity to cooperate seems to come under a alchemy and the elements activation research in the heterogeneity of Ivoirian smallholder and wholesaler, remains to be discovered. The objective of this paper is to measure plantains actors' ability to cooperate. We investigate the main roles of agent's selfish behavior in the collective action's emergence, with theses following hypotheses:

H1 Higher degree of individualism influence the cooperative behavior

H2 We test the consistency of our results with the field labs well-known results in the developing world (see for more results)

H3 Subjects increase their cooperation level, when mechanisms of sanctions are implemented

H4 The professional, member of smaller-sized group are more ability to cooperate than larger group

Since Peter Bohm's early work in the 1970, various experimental games³ measure the behavior of individuals where an individual's success depends both on the choices that he/she makes and on the choices made by others. In this study, we use the public goods game, which suits our case study best. This game is a generalized form of the prisoner's dilemma with several players, and it is also a non-cooperative game raising a social dilemma. The level of cooperation is measured by the different

³ In the literature (Chaudhuri 2011), five games are regularly used to analyze this behavior: the prisoner's dilemma created by Dresher and Flood in 1950 at the RAND seminar (Flood, 1958), the public goods game (Samuelson, 1954), the ultimatum game (Güth and al., 1982), the dictator game (Forsythe et al., 1994), and the trust game (Berg, Dickhaut, and McCabe 1995) .

levels of contribution, from non-cooperation (zero contribution) to maximum cooperation (maximum contribution).

A field experiment has been conducted to analyze plantains actor’s behavioral ability to cooperate:

We conducted a field experiment, based on a random assignment process for comparing two or more group of subjects : treatment group and the comparison group (Duflo, Glennerster, et Kremer 2007; List 2007), who have been exposed to different treatments. In this survey, the banana sector was chosen for the control group because the agronomic conditions are close to those of plantain, and they have the same marketing potential.

The decision situation in which the experiment was embedded is a standard linear public goods game (see Ledyard 1995; Fischbacher, Gächter, and Fehr 2001). Six subjects⁴ ($n=6$) interact simultaneously to finance private goods (A) and common goods (B), they collected tokens throughout the experiment. Each individual i has an endowment $e_i=4$, that he/she can invest in A and/or B . There were 6 groups, totaling 12 or 18 subjects. The 4 sessions mobilized a total of 60 people and were conducted with different participants in the banana and plantain sector (see Table 1 and 2 Experimental design and descriptive statistics summary)

The experiments were conducted in Ivory Coast, directly in the location where the professionals worked and involved the following sample of producers and commercial agents. The experiment lasted roughly 1 hour. These experiments mobilized 60 professionals (farmers and wholesalers) in banana and plantain sector.

Table 1 *Experimental design*

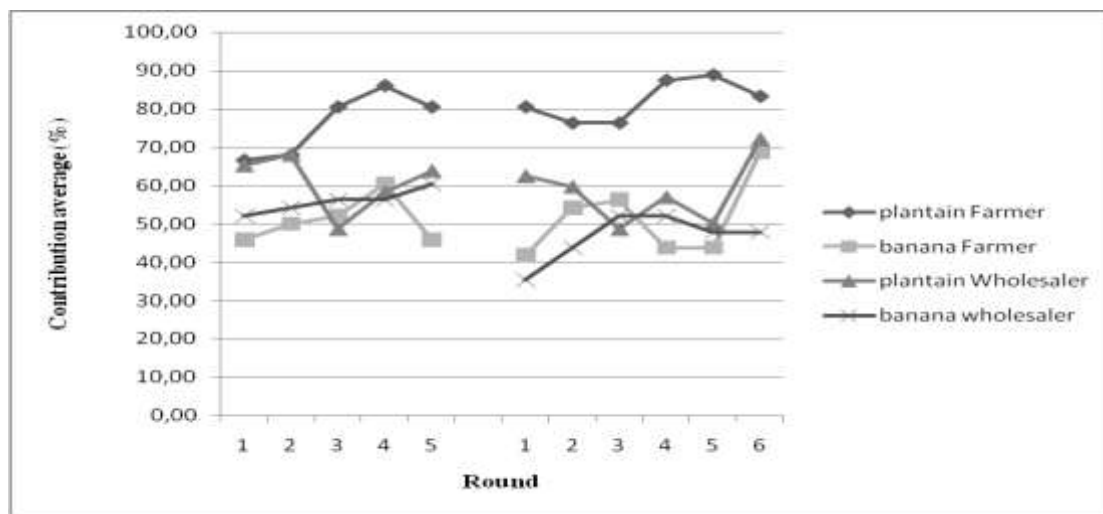
	Treatment 1 ($\alpha = 0,66$) 5 rounds	Treatment 2 ($\alpha = 0,33$) 5 rounds	Monetary sanction ($\alpha = 0,33$) 1 shot	Numbers of session	Numbers of subject
Treatment group (Number of independent group)		3 farmers group 3 wholesalers group		1 1	18 18
Control group (Number of independent group)		3 farmers group 3 wholesalers group		1 1	12 12
			Total	4	60

⁴ We choose six members to provide a more realistic estimate. 7 individual respectably the minimum member number to constitute two legal structures: Simplified Cooperative Enterprise (SCOOPS) and Cooperative Enterprise with board of Directors each (COOP-CA).

Table 2 Descriptive statistics

Subject characteristics	Plantain sector		banana sector	
	Farmer	wholesaler	Farmer	Wholesaler
Number of subjects	18	18	12	12
Average age (years)	46	30	38	38
Illiterate or low education level (%)	34	94	48	83
Men (%)	78	6	100	8
Seniority (years)	7	7	8	15
Member of a collective action (%)	6	33	75	25
Participation in a collective action (%)	6	33	67	33
Survey zone	Azaguie	Adjame	Azaguie	Yopougon

Figure 1 The evolution of average contributions to Games 1 (1-5 rounds) and 2 (1-6)



Results

We compared four groups of professionals. We used rank tests and an econometric regression to determine whether the differences are significant.

We compared the different groups through Mann-Whitney tests. In Game 1, the plantain producers were more cooperative than their banana counterparts ($u = 247; p\text{-val} = 0.007$) and wholesaler ($u = 275; p\text{-val} = 0.0004$). This continues to be true for Game 2 (dessert $u = 185.5; p\text{-val} = 0.001$, commercial actors $u = 275; p\text{-val} = 0.0004$) and Game 2 with penalty (dessert $u = 150; p\text{-val} = 0.062$, commercial agents $u = 210; p\text{-val} = 0.11$). Figure 1 shows the evolution of average contributions (B) for each group of professionals.

Result 1: There is not a higher degree of individualism in the plantain sector than in the banana one

Result 2: The average contribution is in line with the previous experiments but there is not a significant decrease over the contribution

Result 3: Subjects increase their cooperation level, when mechanisms of sanctions are implemented

Result 4: Wholesalers (member of larger group) have a higher degree of individualism than farmer

These results show that the lack of organization is due to the market conditions rather than individualistic behavior. The conditions to allow a durable cooperation require a harmonious balance between (1) a good mechanism of penalty associated and incentives in small size groups and (2) market conditions: homogeneity of production and structures, better planting material, common techniques, regular production, pooling of capital and labor, expertise exchange of news technology, information's flow, collectives decisions. These cropping systems would allow plantain's farmer and wholesalers to benefit from economies of scale by specializing their production and their marketing crops. The potential of the plantain sector is obvious, but underexploited. The Ivorian agricultural policy should thus help them to become more competitive. The plantain agents are willing to coordinate their activities, but they require more favorable conditions.

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