Relational networks, CSR and the sustainability of the cooperation between the firm and its stakeholders: An experimental study.

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Abstract

We present the results of an experimental study on the sustainability – in terms of full mutual cooperation – of networks of agents with partially conflicting interests. The net of relations that involves the firm and its stakeholders is one of the most relevant example of this type of network. We briefly discuss some recent contributions based on network games and behavioural game theory that provide some valuable insights on the emergence of cooperation between the firm and its stakeholders, stakeholder activism and the impact of the adoption of CSR practices. The experiment is aimed at studying a stylized version of the relation between the firm, weak and strong stakeholders, and it allows to test a set of empirical hypotheses derived from the theory. Our results confirm the important role of agreements on impartial principles of distributive justice for the sustainability of cooperation. In particular, we observe a significant and positive effect on the activation of endogenous motivations to adopt socially responsible behaviours. The evidence on strong stakeholder's disposition to enforce compliance is mixed.

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1 Introduction: networks and the relation between the firm and its stakeholders.

In a very well know article published on *The Academy of Management Review* in 1997, Timothy Rowley showed how stakeholder theories could be improved by moving from the analysis of dyadic interactions between the firm and single stakeholders toward the study of how the structural characteristics of the network of stakeholders and the position of the firm within the network affect the behaviour of the actors, and in particular the firm's degree of resistance to stakeholders' pressure. The adoption of this approach is even more justified for the study of today's network economy, as Robert Phillips (2009) acknowledges in his recent attempt to apply network analysis to the study of the attribution of moral responsibility in network organizations. Phillips points out how some characteristics of the structure of the network in which the firm and its stakeholders are embedded could facilitate or hamper the attribution of responsibility to one actor's for the conduct of other actors directly connected with it. A typical example is that of a firm who denies to be responsible for the conduct of its subcontractors based in other countries. Firm's denial might be founded on the presumed lack of information or direct control, and it might be supported by the lack of direct connections (flows of information) between subcontractors and other stakeholders like customers, state administration, shareholders, NGOs etc. The intervention of subjects who fill this gap, letting the information flow from the subcontractors to the other stakeholders, creates new links and reduces the distance between the actors in the network. In the example discussed by Phillips this role is played by mass media, that report evidence of misconduct by subcontractors. The removal of information asymmetries and the consequent growth of the density of the network result in an increase stakeholders' pressure on the firm - that now cannot deny of being informed about the conduct of its subcontractors - and it enables a clear attribution of the responsibility.

Besides these two important contributions, this approach to the study of the relation between the firm and its stakeholder could be applied to the analysis of important phenomena like the emergence and the stability of forms of multi-stakeholder governance, stakeholder activism, the adoption of CRS and/or social accountability practices, etc.

In this paper we support this view, but at the same time we depart from the sociological approach to the analysis of networks that characterizes the works by Rowley and Phillips. Our main objective is to identify the conditions for the emergence and the sustainability of a network of cooperative relations between the firm and its stakeholders. We will concentrate on the strategic nature of the interaction between the actors in the network, rather than on information flows. In particular we are interested in the identification of the determinants of the firm and stakeholders' incentives to cooperate and to enforce the cooperation within the network. The focus will be on the impact of the adoption of shared principles of distributive justice on these incentives. The typical situation that we are interested in is the one described by Degli Antoni and Sacconi (2010) of a network in which there is a mutual interest for cooperation between the firm and some stakeholders – the so called strong stakeholders -, while the relation between the firm and another class of stakeholders – the weak stakeholders - is characterized by asymmetries in the incentives to cooperate: weak stakeholders are interested in long run cooperation with the firm, but the latter does not have any incentive to sustain a cooperative relation with them. As in Degli Antoni and Sacconi, we aim at identifying the conditions under which cooperation between the firm and both strong and weak stakeholders is possible, as well as the conditions under which strong stakeholders might decide to take action for supporting the interests of weak stakeholders.

Our approach is based on a original mix of network games theory, behavioural game theory and experimental economics' methodology. In the theoretical part (section 2 and 3) of the paper, which draws upon Degli Antoni and Sacconi (2010), we briefly discuss a model of relational networks and its application to the firm-stakeholders net of relations. We will identify the conditions for the sustainability of this network, stressing the role of agreements on impartial principles of social responsibility and beliefs-dependent preferences for compliance. The experimental part (section 4) reports the results of a study aimed at testing some aspects of the theory. Section 4 concludes with a discussion of the experimental results.

2 Relational networks

The literature on strategic interaction between agents embedded in complex networks has significantly grown in last decade. Different approaches have been developed, with areas of application ranging from public goods provision to criminal activity, inter-firm partnerships, etc. (for extensive surveys see Jackson, 2008 and Goyal, 2007). In this paper we will focus on a recent and original contribution by Lippert and Spagnolo (2011) which appears to be particularly suited for the analysis of relations between firm and its stakeholders.

Lippert and Spagnolo investigate on the enforcement of relational contracts within networks of repeatedly interacting agents. Agents have mixed interests and cooperation among them can be sustained through endogenous sanctions on free riders. The authors study how the sanctioning power of the agents and the equilibrium conditions change under different network configurations and information transmission technologies. Their main objective is to identify the conditions for the sustainability of a relational network - i.e. a network of mutual cooperative relations between the agent.

To sketch out the main features of Lippert and Spagnolo's models let us consider a set of N infinitely lived agents i={1… N} who interact in pairs according to a given connection structure. In each period, connected agents *i* and *j* play a classical Prisoner's Dilemma (see figure 1), in which each player has two strategies: Cooperate (*C*) or Defect (*D*). The payoffs of the four possible outcomes of the game are $a,b,c,d \in R$ such that $a > b > c > d$. The Nash Equilibrium in dominant strategies of this game is (D_i,D_j) while the efficient outcome is (C_i,C_j).

[Figure 1 here]

The game is played for an indefinite number of periods and agents share the same discount factor $\delta < 1$.

In this situation, two agents share a relation if they repeatedly play (C_i,C_j).

Let be $g_{i,j}$ player *i*'s net expected discounted payoff from the relation with *j*, i.e. the difference between the discounted payoff from playing (C_i,C_j) forever and the discounted payoff from defecting once and play (D_i,D_j) thereafter: $g_{i,j}=b_i-(1-\delta)a_i-\delta c_i$. A relation of player *i* with player *j* is deficient for player *i* if the net expected discounted payoff from cooperating with *j* is negative ($g_{i,j} < 0$) and non-deficient if $g_{i,j} \geq 0$.

The relation *ij* is mutual if and only if $g_{i,j} \geq 0$ and $g_{j,i} \geq 0$, i.e. if the relation is non-deficient for both the players. Graphically, this relation is represented by the symbol $\leftrightarrow$.

The relation *ij* is unilateral if and only if either $g_{i,j} < 0$ and $g_{j,i} \geq 0$ or $g_{i,j} \geq 0$ and $g_{j,i} < 0$, i.e. if the relation is deficient at least for one of the players. Graphically, a unilateral deficient relation for a player is identified by the an outgoing arrow $\rightarrow$, while a unilateral non-deficient relation is identified by an ingoing arrow $\leftarrow$.

Finally, the relation *ij* is bilaterally deficient if and only if $g_{i,j} < 0$ and $g_{j,i} < 0$, i.e. if the relation is deficient for both the players. This relation is identified by the symbol —.

From the literature on relational contracts and repeated games we know that a mutual relation between two agents can be sustained by bilateral endogenous sanctions. Both the agents have an incentive to cooperate in the long run as their expected net discounted payoff from cooperation is non-negative. But the case of interest is that of unilateral relations, where only one of the agents has an incentive to cooperate.

We will limit our discussion to one of the cases discussed by Lippert and Spagnolo, in which agents in the network have full information and adopt a so called Multilateral Grim (MG) Strategy: player *i* starts by cooperating (strategy C_i) with agents with whom she is connected, she cooperates as long as she observers no defection (strategy D_i) by any player in the network, and reverts to defection forever otherwise.

A relational network is sustainable if all agents cooperates with their neighbours. A network like the one in figure 2a is sustainable even if it consists only of unilateral relations. In fact, if every player adopts the MG strategy, the gain that she obtains by cooperating in her non-deficient relations compensates the costs of cooperating in her deficient relations. For example, agent 1 has a deficient relation with agent 2, but the costs of cooperating with 2 are compensated by the gains of cooperating in her non-deficient relation with 6. If one of the players defects, the others will stop cooperating according to the MG strategy, and this would imply a loss deriving from the interruption of non-deficient relations. In the example, if 1 defects in her relation with 2, 6 will implement the MG strategy and she will revert to defection. The sustainability of the network rests on the recursive application of this rule in every node.

[Figure 2 here]

The network in figure 2b is an example of a non-sustainable relational network. Agent 1 does not have any incentive to cooperate neither with 2 nor with 6, because both the relations are deficient. In this case the implementation of the MG strategy by the other agents does not represent an effective threat for 1, because she has not non-deficient relations at risk. But, according to Lippert and Spagnolo's view, if we add a mutual relation to the network of figure 2b we are back to a sustainable network (figure 2c). Now agent 1 has a mutual relation with agent 7 and two unilateral deficient relations with agent 2 and agent 6. If 1 does not cooperate with either 2 or 6, 7 will choose according to the MG strategy and will stop to cooperate with 1. This would imply a cost for 1, who has a strong incentive to cooperate with 7.

But note that, as the relation between 7 and 1 is mutual, also 7 has a strong incentive to cooperate with 1. Starting from this observation Degli Antoni and Sacconi (2010) raise the following point: why agent 7 should apply the MG strategy? Why should she care of how 1 plays with 2 and 6? She would be better off is she opt for a collusive relation with 1, in which the two agents cooperate with one another, regardless of what happens in the rest of the network. The problem with this approach, then, is the lack of a rational justification for the adoption of the MG strategy. This argument is quite relevant because, as Degli Antoni and Sacconi show, the network of figure 2c is particularly well suited to represent the relation between the firm and its stakeholders.

3 The relation between the firm and its stakeholder as a relational network.

Degli Antoni and Sacconi (2010) distinguish between two categories of stakeholders. Strong stakeholder are stakeholders who bring strategic assets into the firm: highly skilled workers, institutional investors, strong members of a cooperative, etc. Weak stakeholders are those who do not bring strategic assets into the firm: for example, ordinary investors, unskilled workers, unskilled contractors, week members of a cooperative, non-organized consumers, recipients of social services, etc.

The net of relations between the firm, strong and weak stakeholders can be described as a network with the same characteristics of the one presented in figure 2c (figure 3). The firm and the strong stakeholder share a mutual relation, while the relation between the firm and the weak stakeholders is unilateral and deficient for the firm. The net discounted payoff that the strong stakeholder and the firm obtain from cooperating forever with each other is non-negative. Whereas, while the weak stakeholder would like to cooperate forever with the firm, the net discounted payoff that the firm obtains by cooperating with it is negative.

[Figure 3 here]

Actually, Degli Antoni and Sacconi analyze a relation between the three types of agent which is slightly more complicated than the the one presented in figure 3. This relation is described as a game in which there are three players: the firm , the strong stakeholder (Strong) and a weak stakeholder (Weak)) (figure 4). The firm and Strong are active players, in the sense that they make actual choices. The weak stakeholder instead is a dummy player, whose payoff depends on the choices made by the two active players. Strong moves first and decide whether to enter (e) or not the relation with the firm (ne). If Strong decides to stay out, all the players get 1[1]. If Strong decides to enter, the two active players choose simultaneously one out of two strategies: to collude (C,) excluding Weak from the division of the surplus generated by the relation between the firm and Strong or to not collude (F), allocating a fair share of the surplus to the weak stakeholder. If the firm and the strong stakeholder decide to collude, they get 3 and the weak stakeholder gets zero. If only one of them colludes, the weak stakeholder gets zero, the active player who has decided to collude gets 4 and the other player gets 2. If both the firm and the strong stakeholder decide not to collude, then the surplus is equally divided and every player gets 2.

[Figure 4 here]

In the Nash equilibrium of this game the strong stakeholder enters the game and collude with the firm (e, C,C). This is also an equilibrium in the case of the infinite repetition of the game. Therefore, the problem is to find a rational justification for the existence of a different equilibrium in repeated game in which the active players adopt a strategy similar to the MG strategy described by Lippert and Spagnolo. In this equilibrium the strong stakeholder does not collude and, at the same time, it enforces the cooperation between the firm and the weak stakeholder by conditioning its decision to enter the game on the observation of the past conduct of the firm.

Degli Antoni and Sacconi show that the explanation of the emergence of this form of stakeholder activism rests on the introduction both of additional assumptions on the active players' preferences, and of the possibility to achieve an ex-ante agreement on principles of social responsibility.

In line with the spirit of behavioural and psychological game theory, the two authors assume that agents' choices depend on a complex system of preferences represented by a utility function

[1] The payoff of the weak stakeholder is in brackets.

characterized by both a material and an ideal component. In particular, they assume that subjects are endowed with conformist preferences (Grimalda and Sacconi, 2005, Sacconi, 2007), i.e. they aim at maximizing their material payoff, but they also desire to conform to agreed ideal principles if their beliefs of first and second order are compatible with reciprocal conformity. This implies that, if subjects agree on a principle of fairness before knowing their role in the game, when they play the game and discover their role, they will conform to the principle if they believe that their opponents will conform to the principle (first order beliefs) and if they believe that their opponents believes that they will conform to the principle (second order belief). Experimental evidence provides support to this hypothesis, and show also that the presence of the agreement is a sufficient condition for the emergence of reciprocal beliefs of conformity (Sacconi and Faillo, 2010; Faillo, Ottone and Sacconi, 2008[2]; Tammi 2012).

Degli Antoni and Sacconi prove that conformist preferences provide a rational foundation to the use of MG-like strategies. If the firm and its strong and weak stakeholders agree on an impartial shared principle of social responsibility, active players will behave accordingly to the principle if they have reciprocal beliefs of conformity, which could emerge as the result of the repeated observation of cooperation and socially responsible decisions. Strong stakeholder activism will be the result of this desire to comply with shared principle and to induce the firm to do the same.

4 The experiment

In this section we present an experimental study which is aimed at testing the Degli Antoni and Sacconi's hypothesis about the sustainability of the cooperation between the firm and both its strong and weak stakeholders. The use of the experimental method allows direct observation of how agents with given roles behave in response to the manipulation of some relevant variables. But it gives also the opportunity to illustrate the key feature of the theory, to verify its internal coherence and to test its empirical implications.

The experiment involved 111 undergraduate students (66% from economics, 52% females). Participants were paid with real money for their decisions and received also a show-up fee of €3. The study was conducted under complete anonymity, without any form of communication between the participants, and with the use of computers programmed with the Z-tree platform (Fischbacher, 2007). Instructions were read by participants on their computer screen while an experimenter read them loudly. Subjects were also asked to answer a set of control questions in order to check for full understanding of the instructions. At the end of the experiment, socio-demographic data were collected by means of a computerized questionnaire.

In each session subjects were divided into groups of three members and were assigned the roles of A, B and C. The interaction between the three players can be conceived as a stylized version of the interaction between the strong stakeholder (player A), the firm (player B) and the weak stakeholder (player C). Player A and player B had an active role in the game and were asked to make actual choices. Player C did not have any possibility to choose and her earnings were determined by active players' decisions. The interaction between the three players is a variation of the game used by Degli Antoni and Sacconi (figure 5). The payoffs are expressed in an experimental currency called tokens[3]. At the end of the experiment tokens were exchanged at a rate of 0.15 euro to one token.

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[2] For theoretical and empirical analyses of the role of reciprocal expectations in inducing compliance with social norms see also Bicchieri (2006), Charness and Dufwenberg (2006), Bicchieri and Xiao (2009).

[3] Player C's payoff is in brackets.

[Figure 5 here]

At the beginning of the game every player is endowed with 1 token. Player A moves first and she must decide whether to enter or not the game. If she decides to stay out, all the players keep their endowment of 1 token. If player A decides to enter the game, a surplus of 12 token is created. Note that if player A decides to start the game, player C automatically loose her endowment of 1 token. This captures the idea, already present in the Degli Antoni and Sacconi game, of a specific investment that the weak stakeholder must make in order to start to interact with the firm. At this point player B must make two subsequent choices. First, she has to decide how much of the surplus to keep for herself, choosing one of three alternative amounts: 12, 8 or 6 tokens. Then, she has to decide whether to share or not the remaining part of the surplus with player C. If she decides to share, the remaining amount of tokens is equally divided between player B and player C.

For example, if player A decides to enter the game (first node), player B decides to keep for herself 6 tokens (second node), leaving 6 tokens to player A, and not to share the 6 tokens with player C (third node), at the final node player A and player B receive 6 tokens, players C receives 0 tokens. This is the case in which player A and player B “collude” and player C is excluded from the division of the surplus and looses her specific investment (1 token). Ex-post, given the player B’s decision, Player C would be better off if player A decided not to enter the game.

A different outcome is reached when player A decides to enter the game, player B decides to keep for herself 8 tokens, leaving 4 tokens to A, and to give 4 tokens to player C. Player A and player B now receive 5 tokens, players C receives 4 tokens (5 tokens minus the token that she has to pay when the game starts). This is the case in which the surplus is equally divided among the three players. An intermediate outcome is the (9,5,0) one, where player A decides to enter, player B gives 4 tokens to A and nothing to B. In this case, we observe a weak form of collusion between A and B in which B is in a better position, but A’s payoff is still greater than the one she would obtain by not entering. Finally, an extreme outcome is the one in which player A decides to enter, player B keeps for herself the entire surplus and she does not share it with player C. In this case, player A keeps her endowment, player B appropriate the entire surplus and player C loose her endowment. In total there are six possible outcomes.

The game was repeated for an indefinite number of periods. At the end of each period, for each group, a number between 1 and 100 was randomly drawn. If the number was smaller or equal to 5 the game ended. In this way we implemented a repeated game of indefinite length, with a probability of continuation of 95%, with different groups playing games of different lengths. The final payoff for the single subject was the sum of her payoffs from each round.

According to game theory, if the game is played only once, and assuming that players A and B want to maximize only their monetary payoffs, there are two Sub-Perfect Nash Equilibria of the stage game: {out, keep 12- don’t share}, {in, keep 12 – don’t share}. In other words, if Player B behaves in a purely selfish way, she should appropriate the entire surplus. Player A anticipates this choice and is indifferent between entering and not entering the game (her payoff is 1 in both the cases).

But game theory tells us also that if the game is repeated for an indefinite number of times many more equilibria are possible. Strategies become more complex, as active players (A and B) now can condition their choice at time *t* on their opponent’s choice at time *t-1*. In any case, if player A is purely selfish, in defining her strategies in the repeated game she should take into account only the choices made by B in her first node, because her payoff depends only on this choice.

It is possible to identify a number strategies in the repeated game which can sustain outcomes in which the surplus is divided between player A and player B, like (5,9,0) and (7,7,0). The idea is that player A might decide to "punish" player B - by not entering the game - if in the previous period B was unkind with her. But at the same time, if B acts in a purely selfish way, she should never share the sum with C and A should never punish B for not sharing with C. Thus, according to standard game theory, if players maximize only their own monetary payoffs, player C should never be included in the division of the surplus.

The relations between player A and B is mutual, because the net discounted expected payoff from cooperation is positive for both. Whereas the relation between B and C is deficient for B and non-deficient for C. C aspires to cooperate with B, but B has not any incentive to cooperate with C. At the same time, A has not any incentive to use a MG-like strategy. It follows that, under the hypothesis that player are purely selfish, this relational network is not sustainable.

The aim of this experiment is to explore the possibility to induce a change in the behaviour of the two active players by activating beliefs-dependent preferences for compliance on a shared principle of distributive justice. In the presence of an ex-ante agreement on how to divide the surplus, the psychological mechanism described by Degli Antoni and Sacconi should induce the subjects characterized by conformist preferences to implement the strategies which are compatible with the content of the agreement.

In order to test this general hypothesis we run two different treatments. In the Baseline Treatment (BT) subjects played the indefinitely repeated game that we have just described. In the Agreement treatment (AT), in each group, before knowing their role in the game, participants were invited to vote for a rule for the division of the surplus. The voting procedure was computerized, anonymous and without communication. Participants must reach a unanimous agreement on a rule within 10 trials. At the end of each trial they received a feedback on other members' vote. The agreement was not binding, but failure in reaching it was costly, since only groups who reached an agreement in this stage had the chance to participate to the second stage. Participants must choose one out of four rules consisting of a statement followed by the corresponding outcome of the game:

Rule 1. The division of the surplus depends on the participant's type. In particular, B should receive all the 12 tokens, while A and C should receive 0 tokens. This corresponds to:

- 1 token for A
- 13 tokens for B
- 0 token for C

Rule 2. The division of the surplus depends on the participant's type. In particular, the surplus should be divided between A and B. C should receive 0 tokens. This corresponds to:

- 7 tokens for A
- 7 tokens for B
- 0 tokens for C

Rule 3. The division of the surplus does not depend on the participant's type. The surplus should be equally divided among the three participants. This corresponds to:

- 5 tokens for A
- 5 tokens for B

- 4 tokens for C

Rule 4. The division of the surplus depends on the participant's type. In particular, A should receive 6 tokens, the remaining 6 tokens should be equally divided between B and C. This corresponds to:

- 7 tokens for A
- 4 tokens for B
- 3 tokens for C

After the agreement, subjects played the same game as in the Baseline Treatment, but they had the possibility to implement the strategy compatible with rule agreed in the first stage or to choose a different strategy.

4.1 Empirical hypotheses.

Three empirical hypotheses can be formulated by considering the peculiarities of the voting stage and applying the Degli Antoni and Sacconi's (2010) theory to this experiment.

Hypothesis 1: In the baseline, Player A takes into account only the choices made by B in her first node. A punishes B if she keeps 12 tokens. B does not share the surplus with C and A never punishes B for not sharing.

Hypothesis 2: In the Agreement treatment, the agreement should be reached by all the groups because it is not binding, but its failure is costly (failure would prevent the players from entering the second stage of the game). Furthermore, we can expect that the rule which corresponds to the equal division of the surplus among the three players (Rule 3) will be chosen by the majority of the groups.

Hypothesis 3: In the Agreement Treatment, preferences for compliance are activated. If the voted rule is the equal division one (Rule 3), A will punish B if she does not share the surplus with both A and C. B should be more cooperative both because of the threat of sanctions by A and because of the activation of her own preferences for compliance.

According to the first hypothesis, even if participants are characterized by conformist preferences, the lack of any explicit agreement on a rule for the division of the surplus will prevent the emergence of beliefs of reciprocal cooperation and it will induce the subjects to choose the course of action which maximizes only their monetary payoff. Thus, player A's choice will depend only on how kind B has been with her in the previous round, i.e. on the amount of tokens left by B to A. At the same time B will not take into account the payoff of player C, but she will try to maximize her long-run payoff by choosing the best reply to A's strategy in the repeated game. This will lead to a prevalence of outcomes where A and B collude, by sharing the surplus, while C is excluded.

With regard to the second hypothesis, when participants choose the rule in the first stage of the Agreement treatment (the voting stage) they do not know what will be their roles (A, B, or C) in the second stage (the Game). The perspective under which subjects vote is a typical constitutional one, which allows for the choice of rules incorporating a view of fairness. According to a contractarian approach to the constitutional choice of principles, in this situation it is likely that players will assume an impartial perspective and will judge the outcomes of the game from the point of view of each of the three roles in turn, choosing a rule acceptable from whichever point of view. This implies a solution that must be invariant to the permutation of the individual points of view, that is, the equal distribution of the surplus. Note that in this setting, the equal division is also the choice with the highest ‘salience’. Given that agreement in this phase is a necessary condition for accessing the second stage phase, subjects may vote for the most salient rule to coordinate their choices in the minimum number of trials.

Finally, with hypotheses 3 we maintain that after the agreement, if A and B are characterized by conformist preferences, and if they agreed on the equal division of the surplus, then both the active players should contribute to the implementation of the rule. Now Player A should punish B also if the latter is unkind with C. At the same time, B should take into account also the welfare of C, both because of the (exogenous) threat of a sanction by A and because, if she is characterized by conformist preferences, she (endogenously) desires to contribute directly to the implementation of the rule.

4.2 (Preliminary) Results

We have conducted two sessions for the Baseline Treatment (57 subjects – 38 active players) and two sessions for the Agreement Treatment (54 subjects – 36 active players).

To start, we consider the difference in the distribution of three outcomes of the game in the two treatments: The fair division (5,5,4), the full collusion (7,7,0) and the weak collusion (5,9,0). Figure 6 shows that in the baseline weak collusion prevails, while in the Agreement treatment the fair division of the surplus is the most frequent outcome.

[Figure 6 here]

The percentage of fair division outcomes across the periods is significantly higher in the Agreement treatment than in the baseline (Mann-Whitney test with groups’ percentage of 554 outcome as observations, p=0.06), weak collusion outcomes is more frequent in the baseline treatment than in the Agreement Treatment (Mann-Whitney test, p=0.05), while we do not observe significant differences in the distributions of the full collusion outcome (Mann-Whitney test, p=0.10) (figure 7)[4].

[Figure 7 here]

This evidence is summarized by the following result:

Result 1: The introduction of the agreement has a significant impact on the decision to include the non-active player in the division of the surplus. Weak collusion prevails in the Baseline treatment while fair division prevails in the agreement treatment.

Result 1 seems to be the consequence both of the achievement of an agreement on the rule of equal division and of the desire to comply with this rule. In fact, in the Agreement Treatment all the groups agreed on Rule 3 which dictates the outcome 554, and this is coherent with hypothesis 2.

[4] We consider only periods from 1 to 18 as only few groups are still active after period 18.

But did the active players give the same contribution to the implementation of the rule? And do endogenous (conformist preferences) and exogenous (threat of sanctions) reasons to comply have the same role in the explanation of Result 1? To answer these questions we must look at the choices made by the active players at the different nodes of the game tree.
We start by looking at player A's reaction at period *t* to the B's decision at period *t-1* on how to divide the surplus between herself and A (second node of the game tree).

[Table 1 here]

When player B chooses to keep the entire surplus for herself (leaving nothing to player A) at period *t*, player A punishes B by deciding to stay out at period *t+1* in the 31% of the cases in the baseline and in the 40% of the cases in the Agreement treatment (Table 1). There are not significant differences between the player A's reactions in the two treatments. Result 2 follows.

Result 2. In both the treatments player A punishes player B if she appropriate the entire surplus.

We consider now player A's reaction to the player B's decision at the third node of the game tree, when B must decide whether to share or not with player C the amount of tokens left after her first decision. We focus only on the case in which in her first choice player B has decided not to keep the entire surplus (choices 6 or 8 at the second node). Table 2 shows that the probability of being punished by player A for not sharing the surplus with player C is only of 5% in the baseline treatment and of 6% in the Agreement treatment. Note also that in the Baseline the probability of being punished is independent on the choice made at node 3. Furthermore, in the Agreement treatment players B who do not share with players C have only a slightly higher probability of being punished with respect to those who decide to share.

[Table 2]

Result 3 follows.

Result 3. In both the treatments Player A reaction to player B' s decision to exclude C from the division of the surplus is weak.

According to Result 1 and 2 we cannot reject hypothesis 1. Result 2 and 3 are only partially coherent with hypothesis 3.

5 Discussion and conclusions.

The net of relations between the firm and its weak and strong stakeholders can be modeled as a relational network (Lippert and Spagnolo, 2006) characterized by both mutual (firm-strong stakeholders) and unilateral relations (firm- weak stakeholder). The sustainability of this network rests on the willingness of agents involved in the mutual relations both to cooperate also in their deficient relations and to enforce cooperation in unilateral relations through the adoption of some form of grim strategy.

At the theoretical level, the main problem is to find a rational justification for this conduct. Degli Antoni and Sacconi (2010) proposed a solution based on the hypothesis that agents are characterized by conformist preferences. They show that in the presence of an agreement on a principle of distributive justice agents endowed with these preferences will comply with the agreement and will activate to enforce the compliance, given the existence of a beliefs of reciprocal conformity which will emerge as the result of the repeated observation of cooperative and socially responsible decisions.

We have designed an experiment that replicates the structure of the relation between the firm and its weak and strong stakeholders and which is aimed at testing a set of empirical hypothesis derived from the theory.

We observe that the introduction of the pre-play agreement has a significant impact on the decision to include the weak player in the division of the surplus. Collusion between the two active players prevails in the Baseline, while in the Agreement treatment the equal division of the surplus among the three players is the most frequent outcome (Result 1). This seems to be the result of full convergence on a equal division rule in the voting stage and of the consequent implementation of this rule by the majority of players B.

The role of players A as enforcers of the rule is less clear. We observe a strong reaction by A to B's decision to keep the entire surplus (Result 2), but only a weak reaction to player B's decision to exclude player C from the division of the surplus (Result 3). In both the treatments Players A does not show a strong interest in the weak player's fate. The significant higher percentage of equal division outcome in the Agreement treatment seems to be better explained by the activation of player B's preferences for compliance than by the player' A willingness to enforce the agreement.

We suspect that this result is the consequence of a peculiar interpretation of how to implement the rule by Players A. If Players A focus on the outcome of the game in the single period they could believe that in order to implement the equal division rule they just have to enter the game, because this is what the rule prescribes in the single period game. The long run implementation of the rule corresponds instead to a strategy in the repeated game, and in particular it should imply a definition of a course of action that depends on the observation of the history of player B's choices. In this case, implementing a rule that prescribes the equal division of the surplus could imply, for example, to enter the game if and only if in the previous period player B has shared the surplus with player C, and to stay out otherwise. In fact, this is a course of action which enforces the inclusion of the weak player in the long run.

The problem can be afforded by designing a new treatment in which the description of the rule is less focused on the outcome of the single period.

This evidence could have interesting implications for the design of CSR norm and for the definition of social responsible conducts. In particular, it seems to suggest that effective norms should prescribe commitments on long run courses of action, rather than focus on single short run initiatives.

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Figures and tables

Figure 1. The Prisoner's Dilemma.

		Player j	
		C_j	D_j
Player i	C_i	b_i,b_j	d_i,a_j
	D_i	a_i, d_j	c_i, c_j

Figure 2. Circular unilateral relational networks (Lipper and Spagnolo, 2006; Degli Antoni Sacconi)

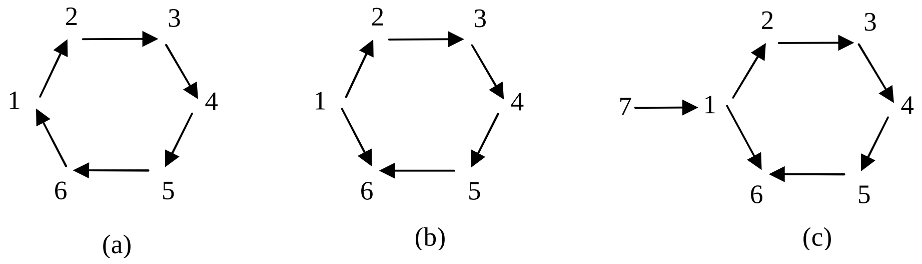

Figure 3. The firm-stakeholders network (Degli Antoni and Sacconi, 2010)

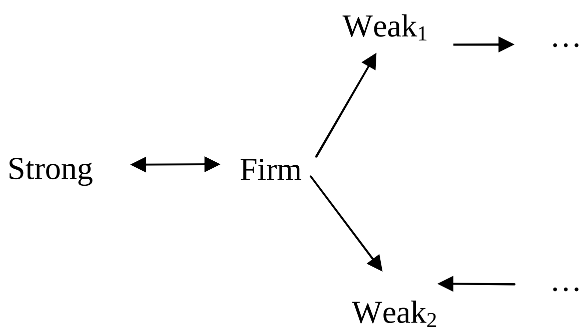

Figure 4. The game between the firm and strong stakholder (Degli Antoni and Sacconi, 2010)

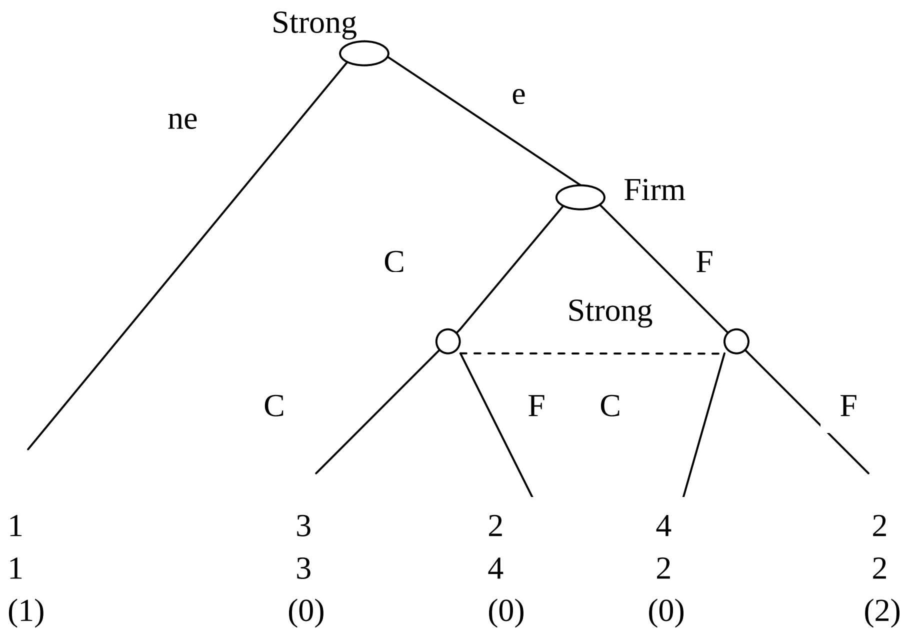

Figure 5. The stage game.

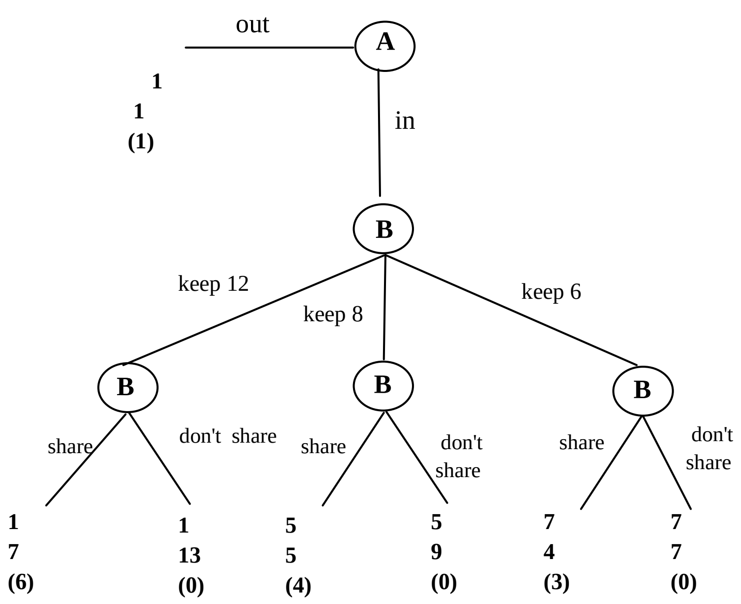

Figure 6. Distribution of outcomes (7,7,0), (9,5,0) and (5,5,4)

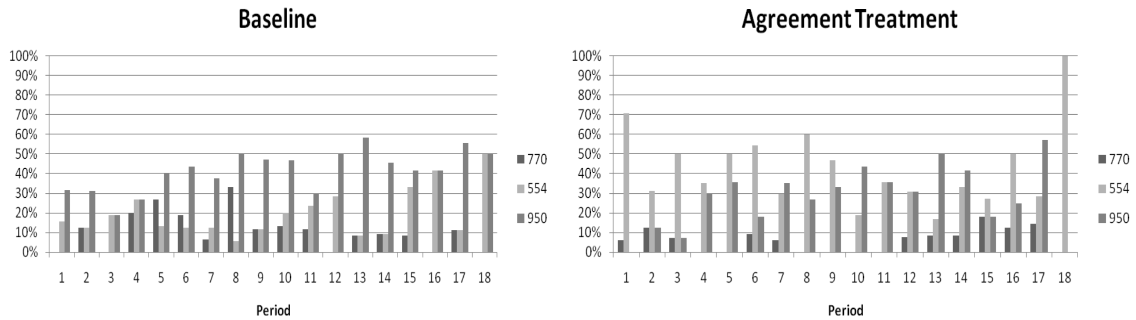

Figure 7. Distribution of outcomes (7,7,0), (9,5,0) and (5,5,4) II

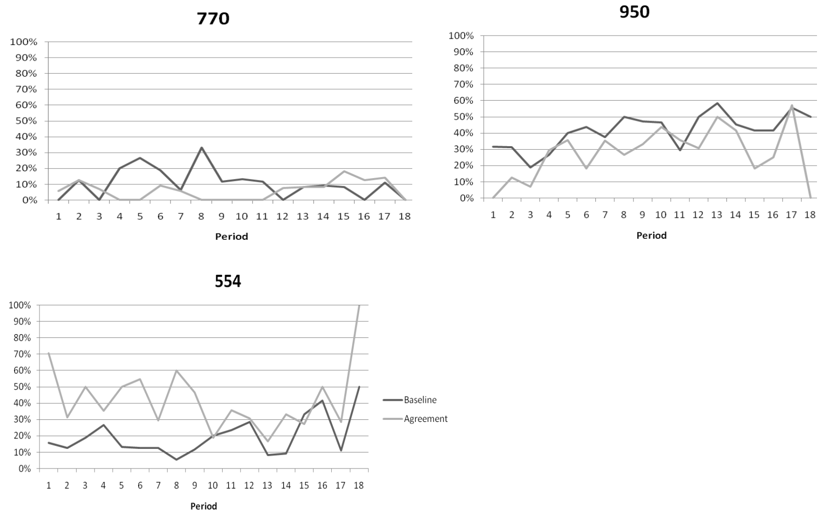

Table 1. Player A's reaction at period t+1 to player B's decision at period t (second node)

	Player A's decision			
	BT		AT	
Player B's choice in stage 2 in T	Ente r in T+1	Do not enter in T+1	Enter in T+1	Do not enter in T+1
Keep 6	93%	7%	95%	5%
Keep 8	95%	5%	97%	3%
Keep 12	69%	31%	60%	40%

Table 2. Player A's reaction at period t+1 to player B's decision at period t (third node), when B keeps less than 12 tokens.

	Player A's decision			
	BT		AT	
Player B's choice in stage 3 in T	Enter in T+1	Do not enter in T+1	Enter in T+1	Do not enter in T+1
Share	95%	5%	100%	0%
Do not share	95%	5%	94%	6%