

Three Experiments on Institutions

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Abstract

Institutions are an ubiquitous presence in our lives. The focus in this Thesis is on norm compliance, analyzed as an important component of the institutional framework within which decisions are made.

The first paper of this Thesis (Chapter 2) evaluates how norms of symmetry and centrality affect the functioning of two ways to allocate resources described in the economic anthropology literature, namely reciprocity and redistribution. The main conclusion of the experimental inquiry is that reciprocity and redistribution can seldom allocate resources efficiently in the absence of norms of symmetry and centrality in the experimental design. By symmetry we mean a common acknowledgement that certain features are shared in the group. By centrality we mean a common acknowledgement that a degree of differentiation in roles is acceptable in the group.

The second paper of this Thesis (Chapter 3) presents an experimental investigation of a well-known repeated network formation game. Heterogeneity and perceived similarity are found not to influence networking choices. Players do not frequently engage in naive best responses when transitioning from one round of play to the next in the repeated game. Although Nash networks are rare in this environment, subjects come often close to achieving an equilibrium network. Reciprocity is found to discourage naive best responses.

The third paper of this thesis (Chapter 4) discusses two instruments through which corporate law attempts to promote trust and trustworthiness in business organizations: (i) monitoring of the manager by a principal, as in the agency approach; (ii) moral suasion, as in the approach according to which managers are held to a standard of trustworthiness. A laboratory experiment shows that the “fiduciaries” language increases the investors’ trust. Monitoring also increases the investors’ trust, but only when the manager is not aware of the experimental identity of the principal. The manager is trustworthy up to a certain degree, regardless of the governance structure of the organization and of the accuracy with which

he/she observes each investor's entrustment.

Ai miei genitori, Francesco e Rosa Anna

“et ideo illa Respublica maxime libera est, cujus leges sana ratione fundatae sunt; ibi enim unusquisque, ubi velit, liber esse potest, hoc est, integro animo ex ductu rationis vivere. ”

— SPINOZA

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All omissions and mistakes are my own.

Contents

Approval	ii
Partial Copyright License	iii
Ethics Statement	iv
Abstract	v
Dedication	vii
Quotation	viii
Acknowledgments	ix
Contents	x
List of Tables	xiii
List of Figures	xiv
1 Introduction	1
2 Norms and trades	4
2.1 Introduction	4
2.2 Reciprocity	9
2.2.1 An initial experiment	10
2.2.2 The control study	12
2.2.3 The game with a pre-play communication (PPC) stage	14
2.3 Redistribution	17

2.4	Exchange	22
2.5	Final remarks	25
3	Norms and networks	28
3.1	Introduction	28
3.2	The Bala-Goyal model of network formation	29
3.3	The experimental literature on network formation	33
3.4	The experimental design	35
3.5	Hypotheses	39
3.6	Data analysis	40
	3.6.1 The dataset	40
	3.6.2 Summary statistics	41
	3.6.3 The data generating process (DGP)	45
	3.6.4 Challenges to consistent estimation	46
3.7	Estimation results	48
	3.7.1 Random effects model	48
	3.7.2 Fixed effects	49
	3.7.3 Discussion	50
3.8	Final remarks	51
4	Norms and organizations	53
4.1	Introduction	53
4.2	Agency	57
4.3	Trusteeship	59
4.4	Experimental design	61
4.5	Hypotheses	67
4.6	Results	70
	4.6.1 Trust	73
	4.6.2 Trustworthiness	78
	4.6.3 Behaviour of the principal	81
	4.6.4 Discussion	81
4.7	Final remarks	84
5	Conclusions	85

List of Tables

3.1	Summary statistics	42
3.2	Estimation results : RE with <i>link</i> as dependent variable	48
3.3	FE model with <i>link</i> as dependent variable	49
4.1	Summary of all treatments and controls, and number of participants for each study (<i>P</i>).	67
4.2	Summary of all the decisions and parameters of our experiment.	68
4.3	Summary statistics	71
4.4	Estimation results : regressand is trust decision r_i	75
4.5	Estimation results : regressand is effort e_i	77
4.6	Estimation results : regressand is <i>transfperc</i> $_{M,i}$, no cross-interaction terms between r_i , e_i and the treatment dummies	79
4.7	Estimation results : regressand is <i>transfperc</i> $_{M,i}$, with cross-interaction terms between r_i , e_i and the treatment dummies	80
4.8	Estimation results : regressand is <i>payoff</i>	80

List of Figures

2.1	Average gift decisions (absolute figures, player 1 to 9), control experiment . . .	13
2.2	Average gift decisions (as percentage of the endowment, player 1 to 9), control experiment	14
2.3	Average gift decisions (absolute figures, player 1 to 9), PPC study	16
2.4	Average gift decisions (as percentage of the endowment, players 1 to 9), PPC study	16
2.5	Average number of points appropriated by the Central Players in the three redistribution experiments	20
2.6	Average number of points contributed out of the endowment (10 experimental points) in the three redistribution experiments	20
2.7	Allocative efficiency by round in the three redistribution experiments	21
2.8	Number of transactions concluded per round in the exchange experiments . . .	24
3.1	Rating of the opponent “555”	37
3.2	The interface where subjects choose to whom (if anybody) they want to link. In this case, subject ‘acis’ has decided to create a link with subjects ‘lily’ and ‘dante’.	38
3.3	A summary of the hypothetical networking choices made by all group members.	38
3.4	Histogram of variable <i>totaly</i> . Subpanel 1 is for <i>TG1</i> , subpanel 2 for <i>TG2</i> , and subpanel 3 for <i>CG</i>	42
3.5	Average number of links at each <i>t</i> . Subpanel 1 is for <i>TG1</i> , subpanel 2 for <i>TG2</i> , and subpanel 3 for <i>CG</i>	43
3.6	Average efficiency at each <i>t</i> . Subpanel 1 is for <i>TG1</i> , subpanel 2 for <i>TG2</i> , and subpanel 3 for <i>CG</i>	44
4.1	Trust Game between a principal with monitoring powers (P) and an agent (A).	62

4.2	Histogram of the punishment decision <i>punish</i>	72
4.3	Histogram of the return on the investors' investment	73
4.4	Histogram of the trust decision r_i	74
4.5	Mean trust decision r_i in all treatments and controls. The labels of each column are explained in Table 4.1	75
4.6	Scatterplots of points sent by each investor versus points received back from the manager, for the sessions with high and low noise.	78

Chapter 1

Introduction

Institutions are an ubiquitous presence in our lives. In this thesis I study institutions through three laboratory experiments. The results of these experiments confirm the important role of institutions and compliance with norms such as symmetry, centricity, inequity aversion, reciprocity and trustworthiness in human experimental behaviour.

In a classic contribution, North (1994) defines institutions as the “rules of the game”, or constraints imposed on the actions or strategies that are available to the players. This set of available actions is typically subject to changes: one can easily think about labour laws, such as minimum wages, and how the set of choices available to labour market participants changes as institutions evolve.

A second common interpretation of institutions in economics is “stable equilibria of a game” (Schotter 1981), rather than the rules of the game itself. One can view the rules regarding who appropriates profits in organizations and property rights that determine who has the right to exclude from use as equilibria of underlying games, equilibria that have passed the test of time.

A third definition of institutions interprets them as a synonym for different forms of organizations, such as universities, central banks and financial organizations. The legal literature also refers to particular constructs such as tort law as institutions, a view that shares features with both the view of institutions as rules of the game, as tort law allocates liability in the face of wrongdoing; as well as with the view of institutions as equilibria, as liability rules can be viewed as the result of a game about the allocation of risks deriving from the use of an economic resource.

Bowles (2009, p.47-48) proposes the following definition of institutions, which I follow

in this Thesis: “the laws, informal rules, and conventions that give a durable structure to social interactions among the members of a population”. The author notices that conformity to the behaviour that institutions try to promote or deter is achieved sometimes through coercion, as in the case of legal norms backed by an enforcer; sometimes by social sanctions (informal rules); and sometimes by mutual expectations that conformity will take place, as in the case of conventions.

This definition of institutions is flexible enough to allow us *not* to make any pre-determined commitment to the view of institutions as rules of the game or as equilibria. It has been noticed that this distinction is often too rigid for researchers, as it ignores a substantial amount of institutional interdependencies, whereby equilibria of one game might function as rules of another game (Greif 2006, Ch.1). Also, one could view the two approaches as both useful to characterize the strategic interaction the players face in its two distinct constituent elements: on one side the “game form” (the rules), encompassing the opportunities and constraints the players face when approaching the game. On the other, the solution concept one employs for prediction and analysis purposes, once the preferences of the agents are taken on board. In all of the experiments presented in this Thesis, it will not be straightforward to distinguish whether the institutional manipulations we introduce affect the way the players perceive the rules of the game, or whether the manipulations have changed the behavioural equilibria of the game. The manipulations we present in this paper never change the rational-player equilibrium, which for all of the games presented in this Thesis (indirect reciprocity, voluntary contributions, network formation, and trust games), has been discredited to different extents by previous research (cf. references in the single Chapters).

Chapter 2 starts with a further discussion of institutions and norms. Then, it presents the results of experiments on three ways to allocate resources that are described in the economic anthropology literature. Two of these allocation modes, reciprocity and redistribution, are found to rely on norm compliance in order to allocate resources efficiently.

Chapter 3 studies a repeated network formation game in which subjects can form beliefs about the participants’ compliance with norms of inequity aversion and reciprocity. We find a role for norm compliance in networking choices, even when norm compliance clashes with rational best-response behaviour.

Finally, Chapter 4 studies a laboratory organization that features a group of workers and a manager. The results of this inquiry show that a substantial amount of trust and

trustworthiness takes place among the players. We find that certain types of monitoring, and describing the manager in ways that specifically appeal to his/her norm compliance, have significant positive effects on the trusting behaviour of the workers.

Chapters 2, 3 and 4 of this Thesis are the result of joint work (cf. the Acknowledgments of this Thesis). Where *we* is used in Chapters 2, 3 and 4, this refers to me and my coauthor.

Chapter 2

Norms and trades

2.1 Introduction

In this paper we investigate whether social norms are a necessary precondition for non-market allocation modes to develop into institutions. As already mentioned, Bowles (2009, p.47-48) defines institutions as “the laws, informal rules, and conventions that give a durable structure to social interactions among the members of a population”. Compliance with behavioural norms is arguably part of this structure. Social norms share features with the category of informal rules, in that they usually lack external enforcement bodies to sanction non-compliance; and with conventions, in that compliance with social norms is typically based on the expectation that everyone else will also comply with the norm.

The link between norms and expectations has been made explicit in the work by Bicchieri (2005, p.10-11). Bicchieri reconstructs the circumstances in which a norm exists as those where a rule is known to exist by player i ; i prefers to conform to the rule if she believes most other players will also conform to it; and i believes that most other players expect her to conform to the rule, possibly with provisions in place to sanction non-compliance.¹ Norms are an important topic of research in the field of Law, Economics and Organization. Kandell and Lazear (1992), for example, theoretically characterize equilibria where norms develop in organizations that establish an expected level of effort provision.

In this paper we study two norms, namely symmetry and centricity, which differ in terms of accompanying beliefs. Symmetry is accompanied by beliefs that some features are shared among the interested parties, as in the case of kin. In contrast, centricity is a “political”

¹Cf. also Guala and Mittone (2010)

norm accompanied by beliefs that a degree of asymmetry is acceptable, possibly because doing so is functional in limiting risks of different kinds.²

Institutions and norms have attracted the attention of scholars from both economics and anthropology. Institutions have been proposed as an explanation for the different degree of economic development of communities that share similar environments and peoples (Acemoglu and Robinson 2012). Of the two norms discussed in this paper, centricity often appears in the political economy literature (cf. e.g. Alesina and Angeletos 2005) as a necessary precondition for public transfer schemes of different kinds. The language of symmetry is not often employed in economics, even though one could argue that observed phenomena such as conformity to principles of justice (cf. e.g. Grimalda and Sacconi 2005), peer pressure (cf. e.g. Kandel and Lazear 1992), and ingroup bias (cf. e.g. Yamagishi, Mifune, Liu, and Pauling 2008) are all related to the players having a notion of symmetry within a reference group.

In anthropology, the substantivist school points to specific arrangements in traditional societies to illustrate the importance of institutions. K. Polanyi (1886-1964) is a central figure of the substantivist school. His key controversial contention is that “man’s economy is, as a rule, submerged in his social relations” (Polanyi 1944, p.46).

Polanyi’s *opus* is devoted to the description of the institutional matrix within which individual choices occurred throughout human history. He draws on case studies in the anthropological literature to support his claim that Western European history, with the exception of the last few centuries, has been characterized by economies based on redistribution or reciprocity, or a combination of these two trading mechanisms with market exchanges (Polanyi 1957b, p. 294). He describes reciprocity, redistribution and exchange as follows:

Reciprocity denotes movements between correlative points of symmetrical groupings; redistribution designates appropriational movements toward a center and out of it again; exchange refers here to vice-versa movements taking place as between “hands” under a market system. Reciprocity, then, assumes for a background symmetrically arranged groupings; redistribution is dependent upon the presence of some measure of centricity in the group; exchange in order to produce integration requires a system of price-making markets (Polanyi 1957b, p. 250)

²Cf. the discussion in Johnson and Earle (2000, p.301-305).

The three allocation modes described by Polanyi³ can be viewed as shorthand notations for the way in which the production and circulation of material goods “integrates” within society (Valensi 1974). In Polanyi’s interpretation, traditional societies like Melanesia managed land and labor through social laws of kinship, an example of a reciprocity economy. In contrast, the great empires of Hammurabi in Babylonia and the New Kingdom of Egypt “were centralized despotisms of a bureaucratic type” and depended upon the redistribution of land and slave labor (Polanyi 1957b, p. 312).⁴

The paradigmatic example of a reciprocity economy we use in this paper is the *kula* trade of the Trobriand islanders. Malinowski (1978) observed this complex ceremonial practice during his journeys in the Trobriand islands, an archipelago off the coast of Papua New Guinea.⁵ The *kula* objects (*vaygu’a*, in the Trobriandese language) come in two varieties: bracelets (*mwali*) and necklaces (*soulava*). Both are made of common seashells and appear to be of little intrinsic value. To exchange with someone else a *vaygu’a* seems intuitively to be a costless activity that is void of any strict economic significance. On closer inspection, however, the *kula* trade appears to attribute a symbolic value to each specific *vaygu’a*. Malinowski (1978) explains how a *vaygu’a* gains an intrinsic value through trading that overrides any aesthetic consideration related to the age or obsolescence of the objects. Old *kula* objects have in fact passed through the *kula* circle many times, a feature that adds to the prestige of these objects. When someone decides to exchange an old *vaygu’a*, one is cooperating in favour of the whole community of the *kula*, indirectly returning the favour previously received from the community that allowed him to gain control over such valuable objects for a period of time.

Polanyi believes the *kula* is an example of giving as an act valuable in itself:

Trobriand economy [...] is organized as a continuous give-and-take, yet there is no possibility of setting up a balance, or of employing the concept of a fund. Reciprocity demands adequacy of response, not mathematical equality (Polanyi

³Along with these three, Polanyi (1944) also describes a fourth allocation system, the household economy. Instances of this system are manorial estates and subsistence smallholdings. In the later essay *The Economy as Instituted Process*, the household economy is described as a hybrid of redistribution and reciprocity under a regime of autarchy. Cf. also Polanyi (1957a).

⁴Silver (1983) criticizes Polanyi’s interpretation of the Babylonian case, arguing that markets played a prominent role in ancient Mesopotamia and the Middle East.

⁵The influence that such a practice has gained in the modern theory of reciprocity is great, to the point that Lévi-Strauss (1965, p. xxxvii) claims that the Melanesian people are the true authors of the modern theory of reciprocity.

1957b, p. 273).

Uberoi (1971) describes the *kula* as serving multiple functions, such as creating new bonds and severing old ones. These are functions that can be typically analyzed with the tools of formalist (meaning, means/ends) analysis⁶.

The *kula* is an example of indirect reciprocity: the original trusting act and the reciprocity obligation arising from it do not necessarily involve the same actors.⁷ The importance of indirect reciprocity for the development of large-scale cooperation systems has been discussed by Alexander (1984, p. 85-93). Indirect reciprocity exempts the parties from costs due to the establishment of a specific relationship. In a socio-economic arrangement based on indirect generalized reciprocity, the parties cooperate in the expectation that “someone” will do the same to them in case of need.

Polanyi argues that only in symmetrically organized groupings will reciprocative behaviour result in economic institutions of some historical and anthropological importance. Similarly, only where there exists an allocation system organized around a central figure will a redistributive economy be observed. Market exchange is different from the other transactional modes in that they are not expressions of any social obligation or principle: this is due to the fact that market exchange is “disembedded” from the social matrix (Isaac 2005, p. 14). The distinctive feature of a market system is its ability to carry out transactions “with almost countless people that one does not know and for whom one has no special caring” (Niskanen 2009).

The Nobel Laureate Douglass C. North recognizes that “Polanyi was correct in his major contention that the nineteenth century was a unique era in which markets played a more important role than at any other time in history” (North 1977, p.706). North proposes a choice of the different modes of allocation based on the notion of *transaction costs*. As an illustration of his approach, North (1977, p.713) argues that “reciprocity societies can be considered as a least-cost trading solution where no system of enforcing the terms of exchange between trading units exists”.

In this paper we do not attempt an overall assessment of the legacy of Karl Polanyi. Our aim is to subject to experimental test the claim that non-market allocation modes rely on specific norms in order to sustain trades between the parties. Our reciprocity experiment

⁶Lee (2011) is a noteworthy attempt to formally analyze the *kula* as an equilibrium circular outcome of a maximization process in which the agents, the Trobriand islanders, value consumption and status.

⁷Corriveau (2012) shows that a *kula* arrangement can also be generated by norms of direct reciprocity as well as mixed norms.

tries to capture some features of the *kula*, in particular indirect reciprocation of the gift received and the acquisition of value as the fungible asset we use (experimental points) changes hands. We find evidence that priming the norm of symmetry dramatically increases the allocative efficiency of redistribution, with respect to a control with no priming.

In our redistribution experiment a group of players decide how much of their endowment they wish to transfer to a central player who redistributes all assets received. We find that the presence of a central player in a game of voluntary contributions produces near-full levels of allocative efficiency, regardless of the way the central player is chosen and of the extent of the central player's potential subtraction of points. We also find that a simple exchange game in which buyers and sellers compete to conclude a transaction achieves high levels of allocative efficiency, regardless of the information available to the buyers about the sellers' compliance with norms.

One may wonder if experimental tools and economic measures of performance can be applied to investigate an hypothesis stressing the organic link between economy and the social matrix within which the economy is embedded. Symmetries and centricity are admittedly aspects of society, often coming from the religious or political domains, or from the spatial architecture of social relations among different members of the same society. Our attempt here is not to perform an (hard to imagine) test regarding the organic link between economy and society, as posited by the substantivist economic anthropology literature. Rather, we attempt to reproduce in a laboratory three institutional arrangements that can mimic selected features of the three allocation modes described by Polanyi. In a controlled laboratory environment it is possible to introduce refinements that are suggested by the anthropological theory itself. In principle, this can increase the performance of the different allocation modes.

The measure we use of the performance of each allocation mode we study is allocative efficiency. This is defined as the ratio of the sum of the actual gains of the players in the game to the potentially attainable gains if optimal behaviour were to take place (Gode and Sunder 1997).

The paper is structured as follows. In Section 2.2 we present our first experimental design, a game of reciprocity. Section 2.3 presents our game of redistribution. Section 2.4 discusses the results of a market exchange game. Final remarks follow.

2.2 Reciprocity

The game we devised to experimentally replicate a *kula* arrangement shares features with both the Investment Game⁸ and the Centipede Game⁹, and has been studied in similar forms by Greiner and Levati (2005). In the sequential game studied experimentally by Greiner and Levati (2005) player i is aware of the investment choices of player $i - 1$, but is unaware of the investment decisions of players $1, \dots, i - 2$. Each player i receives an investment from player $i - 1$, and is free to choose the points she wishes to send forward to player $i + 1$. The last player N chooses how much to return to player 1, after which point the game reaches completion. After each transfer from one player to the next, the number of points transmitted is tripled.

Greiner and Levati (2005) study a partners-condition (whereby it is the same group that interacts ten times), and a strangers-condition (groups are randomly formed after each round). They report that the average amount sent is significantly higher for partners compared to strangers. Furthermore, 3-player groups tend to have higher average investments than 6-player groups. Such a result is consistent with the argument by Boyd and Richerson (1989) that indirect reciprocity is likely to be effective in cases of small and tightly connected groups in which the players meet frequently.

Our design differs from Greiner & Levati's in several respects. In Greiner and Levati (2005) every player has the same endowment, in order, the authors claim, to prevent potentially confounding inequity aversion effects. In our reciprocity game only player 1 has a positive endowment, which can be used to initiate the gift trade. The amount available to player 1 is very limited (16 or 28 euro cents, depending on the treatment), and the amount at stake grows in value as gifts are made from one player to the next. If every player sends as a gift the entire endowment of points the first player's final payoff would be more than 50 times the initial amount she was endowed with by the experimenter. The stakes of the game are therefore very low at the beginning, but can grow significantly in magnitude if

⁸In this game a trustor can entrust an asset to a trustee, who can choose whether or not to abuse their trust. Though the Nash equilibrium analysis of this game predicts that the trustor does not entrust anything to the trustee, knowing it is always optimal for the trustee to abuse, Berg et al. (1995) find a substantial amount of trust and trustworthiness taking place in this game.

⁹In the centipede game, originally played with two players only, the players alternately obtain access to a larger share of a pie that increases in size at every decision node. Subgame perfection dictates that the game should end immediately in the fear of opportunistic behaviour at later stages. However, in an experimental study of a six-move centipede game, McKelvey and Palfrey (1992) report that only in 37 of 662 games did the players choose to close the game immediately. 23 games arrive at the end of the centipede.

gifts take place in sustained amounts. This feature of our experiment is meant to replicate the feature of the *kula* trade whereby the objects acquire value only through the gifting process: one could imagine that the initial value of these largely symbolic objects must have been typically low.

Each player's decision whether to send points to the next player as a gift is crucially linked to the assessment of the likelihood that players taking the same decision at later stages of the game also send gifts.¹⁰ The decision to send points depends in particular on the beliefs about the behaviour of player 9 who, if all players send all points available to them, would gain unbounded access to a sum of about 40 euros.¹¹ The choice to divide the points at the end of the decisional chain, rather than formally closing the game with the last player's gift to the first as in Greiner and Levati (2005), was motivated by the desire to have all participants partake in the "value" generated by the gift trade, a feature of the *kula*, to which our design is inspired.

2.2.1 An initial experiment

We randomly formed six groups of ten players each who voluntarily accepted to take part in the experiments after a public announcement¹². In the game we devised, 9 players decide one after the other how many points they wish to send to the next player in the randomly-determined decisional chain. Only the first player, who initiates the game, has an endowment of points, which is very small (16 euro cents in Treatment 1, and 28 in Treatment 2). All other players start with an endowment of zero prior to any gift that they receive from the player prior to them in the decisional chain. While the players were not informed about the amount of points available to previous or subsequent players, the number of players and any other payoff-relevant information was common knowledge among them.

The game starts with the first player's decision about the amount she wishes to send to

¹⁰Cf. Nowak and Sigmund (1998, p. 573): "a donor provides help if the recipient is likely to help others (which often means, if the recipient has helped others in the past). In this case, it pays to advertise cooperation, as the cost of an altruistic act is offset by an increased chance to become the recipient of an altruistic act later".

¹¹If each player sends to the next player all of one's endowment, players in our study can earn about 8 euros each, or 14 euros each, depending on the treatment.

¹²All experiments described in this paper took place at the Cognitive and Experimental Economics Laboratory (CEEL) of the University of Trento (Italy). The experimental subjects are all students of the University of Trento. No participant was allowed to take part in any of the experiments described in this paper more than once. Instructions were in Italian, and are available in translation upon request from the corresponding author for all the experimental treatments described in this paper.

the second player out of the endowment. The first player pockets whatever remains from the endowment. The experimenter then doubles the points sent by the first player to the second. Player number 2 then takes the same decision, i.e. how many points to send to the third player. The multiplication of points takes place at each transfer from one player to the next. In our experiment, player 10, the last player in the decisional chain, is only a dummy player, as the amount that reaches her is divided equally among all ten of the group's members. The final payoff of the players is calculated as the sum of the points each player keeps out of the endowment, plus the points that reach player number 10, divided by 10. At the end of the experiment, the points gained were converted into euros, with one experimental point being equivalent to one euro cent.

Subgame perfection dictates that, as in a standard centipede game, player number 1 closes the game immediately by sending zero points to player number 2, as a self-interested player number 2 would keep all points, sending zero points to the next player. In this equilibrium only player 1 has a positive (but meagre) payoff, i.e. her initial endowment. All other players have a final payoff of zero. This is an inefficient result as the compounded multiplication of points happening at each transfer of points from one player to the next would give every player a payoff in the order of 8-16 euros, depending on the initial endowment of player 1. In this initial experiment, the players were subject to severe information conditions, as they were unaware of the endowment of previous players. In this initial experiment we tried to limit the players' opportunism by limiting the maximum amount payable to 25 euros.

Our game tries to mimic a *kula*-ring by retaining the indirect reciprocity feature of this arrangement. Another feature of the *kula* our design tries to capture is the generation of idiosyncratic non-tradable value embodied in those *kula* objects which have passed through many hands. In our experiment the fungible asset the subjects send as a gift (the experimental points) is worth very little at the beginning of the game, but increases in value as the number of users increases.

In two groups (both with Tr. 1) we observe the game theoretic prediction, i.e. player 1 sends zero points to the second player, effectively closing the game. In two groups (1 with Tr. 2 and 1 with Tr. 1) the game stops at an early stage. Only in one group (Tr. 2) all players are given the chance to make a decision about how many points to send ahead, with an insignificant final redistribution of 8 points. Two features of our game seem to have undermined the success of the gift trade. First, the absence of information about the

endowment of previous players likely decreased the willingness of the players to send points. This is because the players might think that previous players had large sums available and had decided to send very little.¹³ Second, there seems to be a computational failure on the part of the players to understand the compounded multiplication of points happening at every transfer. We have taken those critical factors into account to design our control study.

2.2.2 The control study

In our control experiment, the subjects (eight groups of ten players) played a game that functioned in the same way as our initial experiment, but with the following modifications:

1. Payable-amount thresholds were removed;
2. We stated in the instructions the number of points players could earn if all players sent all the points at their disposal.
3. Players 1, ..., 9 can no longer send zero and keep the amount earned previously, but had to send at least one point. This ensured that every player had a chance to make a decision.
4. Players 2, ..., 9 can end the experiment. In this case, the amount in the availability of the player who decides to close the game is divided equally between herself and all the *previous* players. All the other players earn zero. This modification was introduced in order to relieve the strong asymmetry between the last player and all previous players.
5. Finally, when called to make a decision, players 2, ..., 9 saw on their screen the average endowment of players positioned before him/her in the decisional chain.¹⁴

The new set of rules changes the subgame perfect Nash equilibrium of the game. While sending zero is not possible under the new set of rules, and closing the game is always suboptimal for everyone¹⁵, in a subgame perfect equilibrium every player sends to the next

¹³In a recent contribution, Gray, Ward, and Norton (2014) find that experimental participants tend to pay forward greed to a larger extent than generosity. In this case, players might have reacted to the perceived greed of the previous players in the decisional chain by sending little or nothing to the next player.

¹⁴Player number 2 saw the exact endowment of player 1.

¹⁵Player 2 is indifferent between closing the game and sending 1 point to the third player if she has the smallest possible endowment (2 points). Notice that for all other players sending forward 1 point, and appropriating all remaining available points, always dominates the choice of closing the game, as closing implies dividing the points with at least two other players.

player only one point, and appropriates the rest of the endowment. With the exception of one session (with Treatment 1), the game always reaches the final redistributive stage. The number of points redistributed is, however, very small.

Figure 3.1 shows the mean across all sessions featuring the same initial endowment of the gift decisions made by players 1, ..., 9. The figure shows that transfers are close to zero

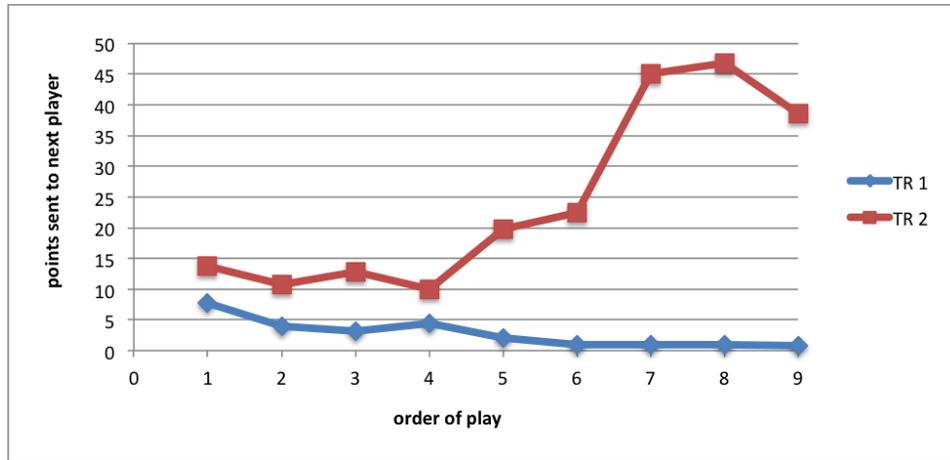


Figure 2.1: Average gift decisions (absolute figures, player 1 to 9), control experiment

in Treatment 1, and are low but with a tendency to increase in Treatment 2 where the game starts with a higher endowment for player 1.

Figure 3.2 shows the average gift decisions as a percentage of each player's endowment. Figure 3.2 shows that gift decisions in percentage terms tend to be cyclical, i.e. decisions to send as a gift a relevant share of one's endowment are usually followed by decisions to withhold most of the endowment, and vice versa. Payoffs tend to be very modest regardless of the initial endowment of points: the maximum amount of points that reached player number 10 was 288 (i.e. less than 3 euros). The allocative efficiency of this allocation mode is consequently very low: 1% on average across all sessions, with statistically significant differences across the two treatments (two-sample Mann-Whitney test, $p = 0.026$). 38% of the subjects played the Nash equilibrium strategy, sending only one point.

In the next section we describe the findings of a study where we prime the norm of symmetry among the players during a stage of pre-play communication.

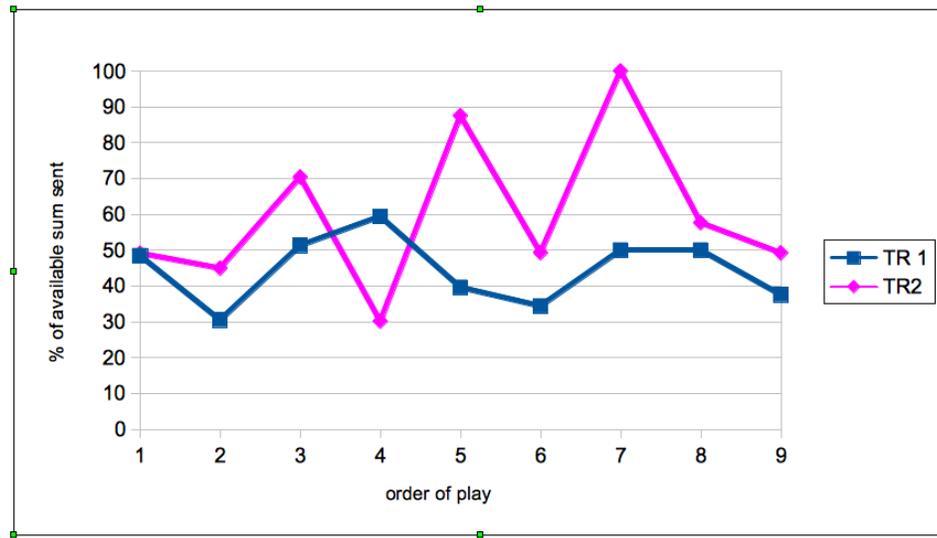


Figure 2.2: Average gift decisions (as percentage of the endowment, player 1 to 9), control experiment

2.2.3 The game with a pre-play communication (PPC) stage

In the anthropological literature discussed above reciprocity as an allocation mode in which trades happen mostly in the form of gifts assumes the presence of a symmetrical grouping. In our experiment, where we cannot assume any such symmetrical grouping to be in place *ex ante*, we prime the norm of symmetry in the players through a well-known experimental manipulation, namely communication.

We ask the experimental subjects to engage in a non-binding and payoff-irrelevant group discussion about three questions, for a period of five minutes.¹⁶ The subjects engage in this discussion before the start of the experiment, unaware of their position within the game. Subjects are at this point *symmetrical* in facing the risk of opportunism by the last players in the decisional chain, and of a potentially meager payoff if players do not transfer points on a consistent basis. We hypothesize that:

Hypothesis 1 *Priming the notion of symmetry in a pre-play communication stage among the participants increases allocative efficiency above the (near-zero) levels observed in the control study.*

¹⁶The experimenters left the room before the start of the discussion, and the discussion was not recorded, as we believe that recording would have produced undesirable confounds on the verbal behaviour of the subjects.

A meta-analysis of the effects of communication¹⁷ in prisoners' dilemma games "points to the emergence of a shared understanding of the situation among participants, and their convergence to a common script" (Bicchieri 2005, p.176). Our experimental design presents the players with a "situation" that is strategically similar to the prisoners' dilemma, in which individual rationality (keeping all the points) clashes with social optimality achieved when each player send all the points in their endowment to the next player. Through the three questions described below we aim to make the notion of symmetry part of the common script with which the subjects approach the experimental game. The three questions read as follows:

1. *If all the players send half of the sum available, how much would each participant win?*
Through this question, we try to prompt reasoning by each player about the benefits arising from generalized transfers of points to the next player.

2. *Do you think that the introduction of a rule of behaviour among yourselves could be helpful in order to raise the payoffs of all participants?*
This question is meant to foster convergence to a common rule of behaviour. We suspect that the rule most groups discussed is one whereby all participants send all of their endowment.

3. *Do you think that the rule of behaviour you just discussed will be adopted by the players during the game, considering that choices are anonymous and free?*
Question number 3 is key to priming the norm of symmetry in the participants, and to promoting conformity to the rule of behaviour that they discussed.¹⁸ Through question 3 we try to raise awareness of the fact that all players are "symmetrically weak", due to everyone's potential noncompliance with the rule in the course of the actual play.

A look at the gift decisions of the players as shown in Figure 2.3 confirms our hypothesis about the effectiveness of introducing pre-play communication.¹⁹ Figure 2.4 shows the gift

¹⁷The literature describes non-binding communication also as *cheap talk*, defined by Farrell and Rabin (1996, p.116) as "costless, nonbinding, nonverifiable messages that may affect the listener's beliefs".

¹⁸Cf. Bicchieri (2005, p.176) and Grimalda and Sacconi (2005) for a discussion of the conditions under which people might exhibit a preference to conform to rules and principles.

¹⁹ $N = 40$ for this experiment, and all four sessions were conducted with treatment 1, i.e. with 16 points available to the first player.

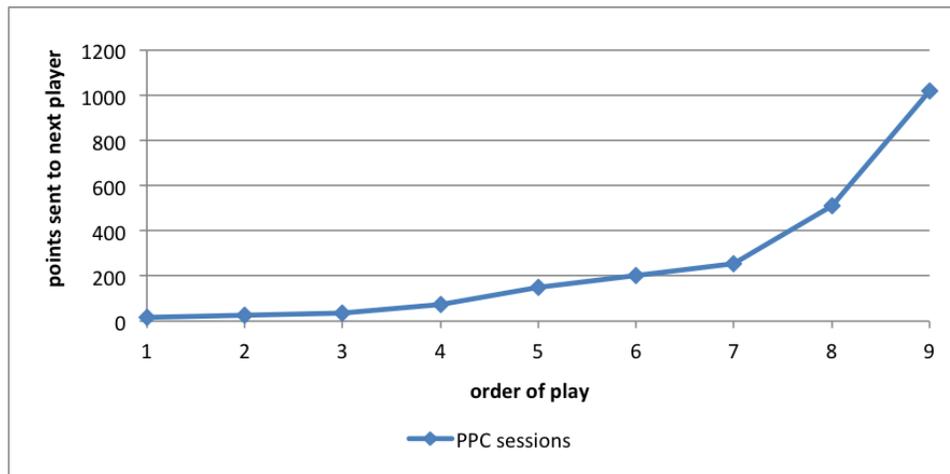


Figure 2.3: Average gift decisions (absolute figures, player 1 to 9), PPC study

decisions of the players as a percentage of their endowment. The average allocative efficiency

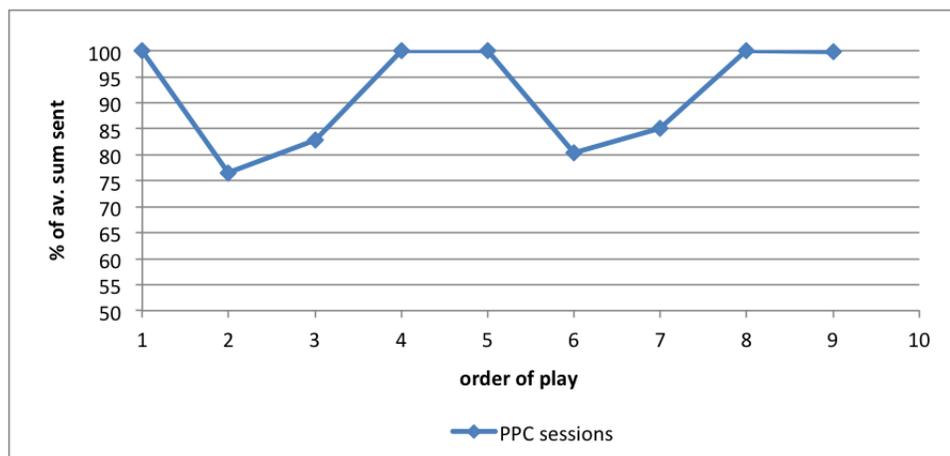


Figure 2.4: Average gift decisions (as percentage of the endowment, players 1 to 9), PPC study

is 28%, versus 1% of the baseline experiment. Players send on average (median) all of their endowment.

Payoffs in the PPC study and in the control study are significantly different using a variety of parametric and non parametric tests (p-values always < 0.001). The median payoff in the PPC study exceeds the median payoff in the control study by a factor of over 200. Finally, no player follows the Nash equilibrium strategy of sending only one point. We find evidence hence in favour of Hypothesis 1.

In the next section we turn to an experimental study of redistribution and of centrality.

2.3 Redistribution

The second allocation mode we examine experimentally is redistribution. In this study a group of peripheral players can deposit some of their endowment into a fund under the control of the central player (CP). The CP then decides how to allocate the resources in the fund between herself and all other players. The hypothesis that we formulate is that:

Hypothesis 2 *The redistribution allocation mode with a central player achieves high levels of allocative efficiency, regardless of the method by which the central player is chosen.*

This hypothesis is of direct economic anthropology, as outlined in the Introduction, claiming that redistribution assumes centrality in order for integration to take place. In Section 2.2 we compared allocative efficiency when we primed the norm of symmetry and when we do not. In the case of redistribution we study different ways of picking the CP. This difference is explained by the fact that in the absence of the CP the experimental design would need to incorporate a fixed rule that determines how resources are to be allocated. In Public Good Games (PGGs) this rule states that the resources in the fund are to be equally split among the players. The rich experimental evidence on repeated PGGs shows contributions steadily declining over time, and allocative efficiency steadily declining as well.²⁰ We take this robust finding in the experimental economics literature as the starting point of our inquiry, and illustrate below that our game of redistribution with centrality features the exact opposite trend, namely ascending contributions and ascending efficiency.

The experimental design in Cox et al. (2013) is related to ours. In their Boss Provision Game (BPG) the Boss observes how much the commoners have contributed to a common fund, and then decides how much to contribute. In their King Provision Game (KPG) the King observes the contributions to the fund of the commoners and decides how much to contribute as well as how much to appropriate from it. What is left in the fund after the King's decisions is divided equally among the commoners. The authors report that the payoffs are systematically higher in the baseline featuring no Boss and no King, with BPG creating the second highest payoffs, and KPG the lowest (Cox et al. 2013, Result 2).

²⁰Cf. Isaac et al. (1985); and Ledyard (1995), a literature review of PGG experiments.

Our design differs from this study’s in that the game is repeated, allowing us to observe the unfolding of the relationship between the peripheral players and the CP. The CP also decides how many points to assign to all players, including to herself.

100 participants took part in our studies, 40 in our study with *earned centrality* (EC), 40 in our study with *random centrality* (RC) and 20 in our study with *earned centrality and high stakes* (ECH). All experimental sessions are divided in two parts. In Part 1, the experimental subjects see 5 sets of 4 images each on their screen, and are asked to pick one image per set. Subjects earn one point if they correctly guessed which image would be the most chosen one by the other players.²¹ In the EC study, it is common knowledge that the subject who earned the highest number of points in Part 1 of the game acts as the CP of the subsequent redistribution game.²²

In the study with RC, the subjects are informed that the CP will be chosen randomly by a computer at the end of Part 1 of the experiment. We carefully instructed the participants that the rating of the images in Part 1 was just a survey with no relevance from the point of view of the functioning of Part 2 of the experiment. The study with ECH was in all regards the same as the EC study, except for the feature that the CP is able to leverage her position even more than in the EC study, as further explained below. The two different ways of identifying the central player are justified by the desire to see whether using a simple task of interpretation of the players’ tastes serves to increase transfers to the central player, compared to the random selection mechanism of the central player. We chose a very simple image-based task of interpretation of the players’ test, instead of a more conventional quiz, to avoid giving the central player any strong form of legitimacy through the task chosen by the experimenter. This gives us the best shot to observe if the central player acquires legitimacy in the eyes of the common players, even in the presence of a very simple task. The variant with high-stakes allows us to verify whether the common players’ transfers are affected by the extent of the central player’s possible subtraction of points.

The task of each common player is to decide how many points to transfer to the CP out of their endowment (10 experimental points, 1 experimental point = 0.70 euro cents), knowing that the amount transferred is multiplied by a factor of 3 by the experimenter.²³The

²¹The images that the subjects saw on each screen were zooms of the same basic image, or variants of one unique theme (e.g., a tree). Images were chosen in such a way as to avoid saliency effects, and were randomly positioned on the screen of each participant.

²² In an attempt to use a neutral language, the instructions refer to the CP as the “responsible player”.

²³A multiplier equal to 3 is used in the redistribution experiments, instead of the multiplier equal to 2 used in the reciprocity experiments, to ensure that, if transfers to the central player take place in a substantial

CP, who has an endowment of zero points, observes everybody's contribution and then redistributes the points at will between herself and all other players. The only constraint on the CP's allocation is that none of the players can receive back from the CP more than 30 experimental points. In the ECH study, the cap of 30 points for the CP is increased to 60 points, while the common players can still only receive back 30 points. The limit on the amount of points the CP can appropriate can be interpreted as a limit resulting from the fear of a "rebellion" among the commoners, a feature that is hard to implement in an experimental setup, and which we therefore introduced in the experiment as a constraint upon the CP's ability to appropriate. Notice also that in our experiment the CP is a kleptocrat²⁴ whose gain is based on a subtraction of points from a fund towards which the CP has not contributed.

The common players and the CP take their respective decisions ten times, with full information on everyone's contribution and payoff in the previous round. Groups are fixed for the entire duration of the experiment.

Figure 2.5 shows that, regardless of the way centrality is acquired, the CPs exploit their privileged position to impose a levy very close to the maximum threshold (30 points in the EC and RC studies, and 60 in the ECH studies). Figure 2.6 shows that the extent of the CP's levy does not seem to have discouraged common players from contributing resources to the funds. Contributions approach 10 points, and players contribute on average their entire endowment in the final rounds of play.

Across all treatments the correlation between the amount given by the common players and the amount they receive in return is 0.90, a sign that CPs have taken contributions into account in deciding on the allocation. Our common players won on average about 22 euros.

A Wald test on the mean amount contributed to the fund by the common players in the three subpopulations rejects the null-hypothesis of equality of the three means (Wald $\chi^2(2) = 48.47$, $p < 0.00$, heterogeneous variances allowed; the results are confirmed by a non parametric test on the equality of the medians). Interestingly, contributions are highest in the ECH study (9.06 points), i.e. the study where the CP's potential subtraction is the highest, followed by the RC study (8.45 points) and finally the EC study (7.36 points).

amount, the average payoff in the redistribution experiments would be roughly the same as the average payoff in the reciprocity experiment, if all players of the reciprocity experiment send ahead most of their points.

²⁴This is in line with the narrative of "how chiefs came to power" in the Hawaii islands proposed by Earle (1997), whereby they exploit episodes of agricultural intensification to acquire a position of power that entitles them to extract a rent.

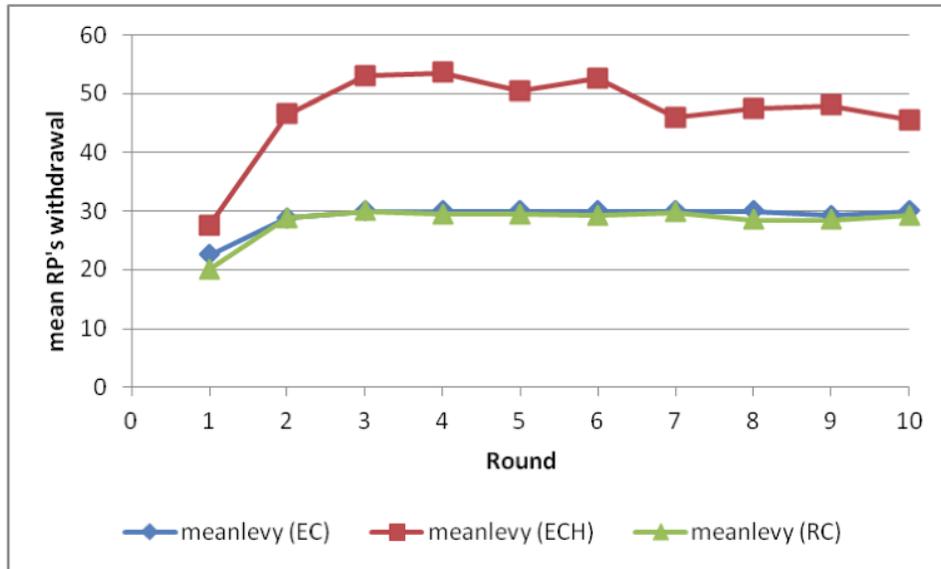


Figure 2.5: Average number of points appropriated by the Central Players in the three redistribution experiments

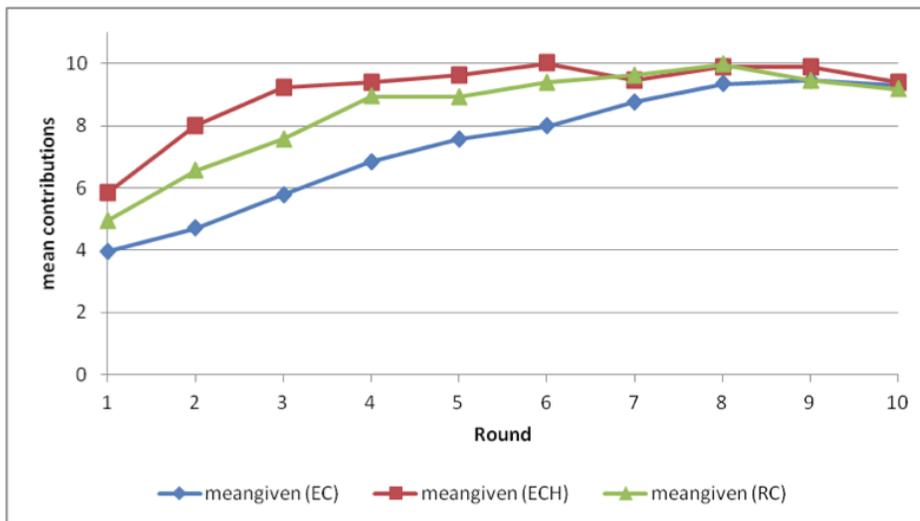


Figure 2.6: Average number of points contributed out of the endowment (10 experimental points) in the three redistribution experiments

Figure 2.7 shows that allocative efficiency approaches 100% in the final rounds of play in all three experiments, although the convergence occurs at different speeds. We find support in favour of Hypothesis 2: the presence of a central player produces near full allocative efficiency levels by the final stages of the game, a finding which is robust to different ways of choosing the central player, and to different bounds imposed on the ability of the central player to leverage his/her position. The fact that the trend is towards full efficiency in all of our redistribution studies should not be read as evidence that this types of games are bound all to the same fate. Rather, the presence of the central player has modified the game form in ways that ensure high levels of allocative efficiency, and this result is robust to variants we introduce.

The mean allocative efficiency levels are significantly different in the three studies, with the highest levels of allocative efficiency to be found in the ECH study, i.e. the study with the highest (efficiency-enhancing) contributions.

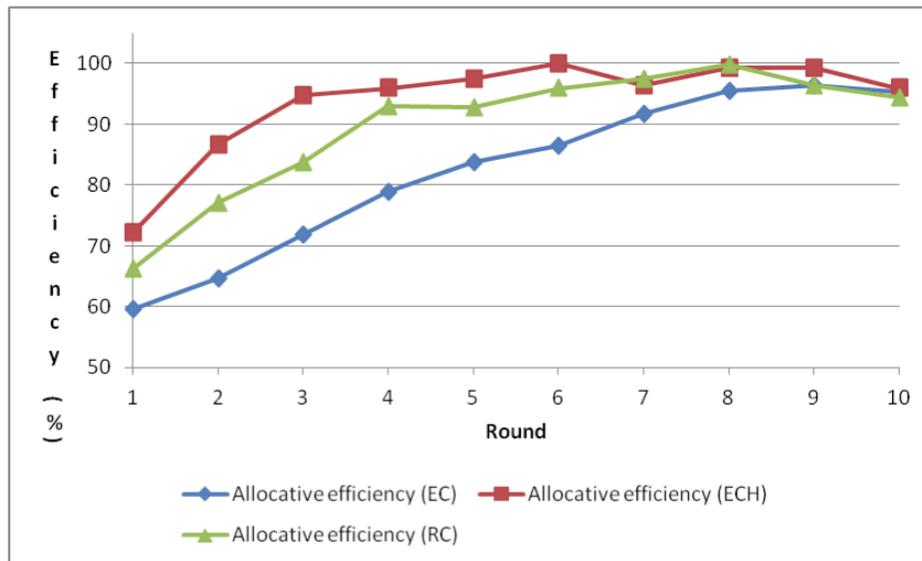


Figure 2.7: Allocative efficiency by round in the three redistribution experiments

In a debriefing survey we conduct at the end of the experiment, 77% of all participants report that the role of the CP is assigned in a fair manner in the experiment. This is remarkable considering the way the CP was chosen in our experiments: through a very simple task in the EC and ECH studies, and randomly in the RC study. Furthermore, subjects who report that the role of the CP was assigned in a fair manner contribute significantly more to the fund. Subjects seem hence to believe that the CP has some sort

of legitimacy, and this belief increases their contributions. We believe our study shows the promising role of centrality in increasing efficiency in a standard game of voluntary contributions.

2.4 Exchange

In our last experiment we hypothesize that market exchange can function well even in the absence of institutional refinements that go beyond the most simple description of the rules of the game. We study a simplified market where several buyers and sellers bargain in an attempt to realize a surplus through trading. Our design admittedly deviates from Polanyi's analysis of market exchange in that it does not rely on prices: our design is meant to capture only one distinguishing feature of market exchange, namely "haggling" behaviour (Polanyi (1957b, p. 267)).²⁵

The sellers (5 per session) take two distinct decisions:

1. The amount to place "on the market", knowing that this amount will be multiplied by a factor 2 by the experimenter;
2. A split of the amount on the market between the proposing seller and a buyer (the "offer").

Five buyers view the offers as the sellers submit them, knowing that:

1. They have four rounds available to conclude a transaction (i.e., to accept an offer);
2. They can conclude only one transaction in the course of the experiment;
3. If they do not conclude any transaction in the course of the experiment they earn a payoff of zero.

Sellers need to have one of their offers accepted in the course of the experiment in order to earn a positive payoff.²⁶ In this regard the game we study here is similar to an ultimatum game, where the buyers and sellers that manage to carry out a successful transaction drop

²⁵The seminal study on double auctions by Smith (1982), and the rich literature that followed, shows that markets achieve full efficiency in conditions of paucity of information on the other players' motivations, compliance with norms, and tastes. These studies incorporate prices, and reach conclusions that are very similar to ours regarding the allocative efficiency of markets.

²⁶This is a typical feature of the ultimatum game first studied by Güth et al. (1982).

from the market and wait for the experiment to end. The payoff of the sellers is determined as the sum of the amount of points the sellers did not place on the market plus the amount they assigned to themselves in the accepted offer. The payoff of the buyers is determined according to the terms of the accepted offer. In this experiment only the sellers have a positive endowment, while buyers start with an endowment of zero.²⁷

We study two different treatments. In one treatment it was common knowledge that buyers saw on their screen the amount initially available to sellers (abbreviated as FI tr., for “full-information treatment”). This is a treatment in which norms of reciprocity and fairness might hinder the convergence to full efficiency traditionally observed in experimental markets.

In the second treatment it was common knowledge that buyers only see on their screen the amount of points offered to them by each seller, without any further information (abbreviated as NI tr., for “no-information treatment”). The game-theoretic prediction for this game is straightforward, assuming no time-discounting by the players. Sellers place the whole endowment E on the market in order to propose a split over $2E$ and offer the buyers in each round the smallest possible amount (1 point). The buyers accept any positive amount, given that the outside option is earning zero. Coherently with our theoretical framework we make the hypothesis that markets allocate resources efficiently even if the players can formulate expectations about each other’s compliance with norms.

Hypothesis 3 *The exchange experiment reaches high levels of allocative efficiency, regardless of the information available to the players.*

Figure 2.8 shows that the great majority of transactions are concluded immediately. There was only one case in which two players did not manage to conclude a transaction within four rounds.

The average allocative efficiency of the market exchange experiment is 75%, regardless of the information package available to buyers (two sample Mann-Whitney test, $p = 0.738$). The availability of information on the sellers’ endowment, which allows buyers to formulate expectations about the sellers’ compliance with norms of fairness, does not seem able to prevent exchange from allocating resources efficiently. Sellers leverage their divider’s advantage to propose divisions that are favourable to them, and consequently earn higher payoffs than the buyers.

²⁷All players earn, as customary in economics experiments, a “show up fee” for their participation.

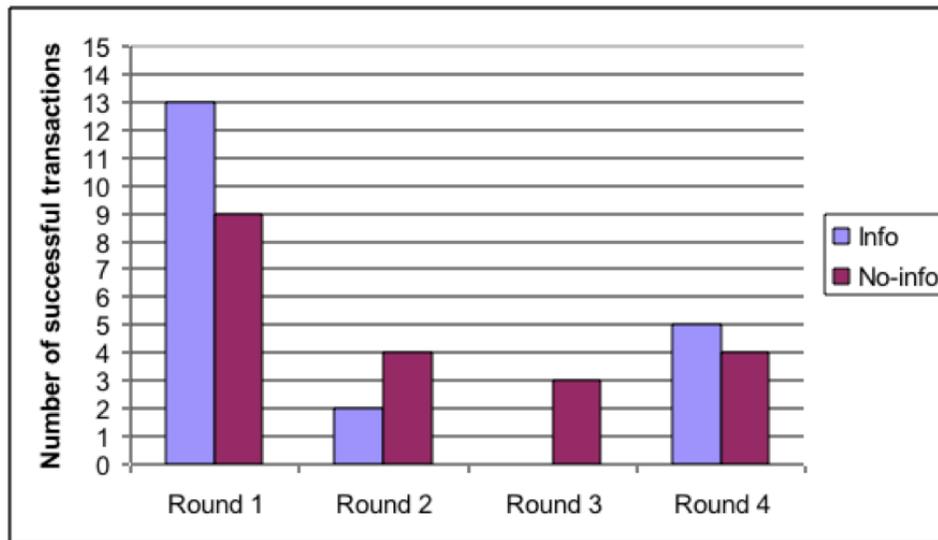


Figure 2.8: Number of transactions concluded per round in the exchange experiments

A debriefing survey shows that expectations about behaviour differ in the two treatments. However, this creates no measurable effect on the subject's behaviour. In the FI tr., 90% of the sellers state that they think they were fair to the buyers. In the NI tr., however, 65% of the sellers answer negatively, showing that sellers have presumably taken advantage of the buyers' lack of information about their endowment to propose what they deemed to be unfair offers. Buyers in the FI tr. report being treated fairly by sellers in 50% of the cases, while in the NI tr. 65% of the buyers believe they were not treated fairly, even though in the NI tr. the fairness of the offer was not fully ascertainable as buyers ignored the amount of the sellers' endowment. Our experimental design does not allow us to conclude, as Polanyi does, that market exchange constitutes an historical exception, in that it does not depend on the presence of particular norms in order to integrate within society. However, we do find evidence of the irrelevance of norm compliance to market exchange from the point of view of its allocative efficiency. This result stands in marked contrast to what we find in the case of reciprocity, where we observe near-zero efficiency levels in the absence of specific norm-priming refinements.

2.5 Final remarks

The experimental investigation presented in this paper was inspired by the intuition that norms of behaviour shape individual decisions and the interplay of individual decisions that gives rise to institutions. In the anthropological literature we review in the paper norms can be either social, the case of symmetry, or “political”, the case of centrality.

In our baseline reciprocity experiment the level of allocative efficiency is close to zero. We observe a dramatic improvement in allocative efficiency when we introduce a stage of pre-play communication, aimed at priming the norm of symmetry among the participants. This result stands in confirmation of the (anthropological) prediction that symmetry is needed in order for reciprocity to integrate within our small fictitious society of players.

The kind of interaction among the participants our pre-play communication design allows is very narrow, for it asks the players to discuss three questions for a short period of time. We believe that the main function communication plays in our experiment is of direct economic anthropology origin, i.e. communication promotes the acknowledgement of symmetry in front of every player’s potential opportunism during the actual play. An alternative explanation that pre-play communication modifies the players’ behaviour because they physically encounter before playing seems less convincing. Each participant meets in fact nine other participants for five minutes, an amount of time that is arguably too short to establish any meaningful bond.

Another possible explanation of our results in the PPC study is that pre-play communication doesn’t simply prime symmetry in the players’ minds, but rather it changes the rules of the game, as perceived by the players by introducing a “communication game” before the actual game, in which players may discuss and agree in somewhat equal terms on a rule of contribution. This rule could become the behavioural norm that players use to solve the ensuing game of indirect reciprocity. The norm, in this alternative line of reasoning, manifests itself as increased contributions.

Ostrom et al. (1992) introduced face to face pre-play communication with “cheap talk” on rules of cooperation, finding that communication increases contributions in an experimental public good game. Sacconi and Faillo (2010) and Sacconi et al. (2011) find that social contracts can emerge even in the absence of external enforcement mechanisms. These studies have the further merit of more clearly linking symmetry with the *ex ante* acceptability of agreements, bringing into the picture a moral dimension of agreements that did not constitute a subject of inquiry in the present study. Subjects in fact communicate in these

studies behind veil of ignorance, rather than in person as in our experiment. This is an interesting alternative way to promote the acknowledgement of symmetry in the group, if players perceive each other as perfectly substitutable behind the “veil of ignorance” (Rawls 1999, p.118).

The different interpretations we have outlined of the same basic finding, namely the ability of pre-play communication to lift efficiency above the near-zero levels observed in our control study, are symptoms of the general difficulty to disentangle whether experimental manipulations like ours modify the rules of the game as perceived by the players, or the equilibrium outcome that the players envisage for their interactions, which in turns shapes their beliefs (see also the Introduction to this Thesis). Rather than inquiring into this important aspect regarding the channel through which symmetry operates in controlled environments, our study aims at clarifying a narrower question, i.e. whether symmetry can improve the institutional quality of an indirect reciprocity mechanism.

In our redistribution game, the presence of the norm of centricity ensures almost full efficiency in the final stages of the game, even when the “chief” is randomly chosen. This result is obtained without the need to resort to communication or other manipulations, which we do not exclude could improve allocative efficiency even further. Efficiency in a society that allocates resources through redistribution seems to be warranted by the political nature of the norm of centricity, based on an asymmetric attribution of powers.

The evidence regarding contributions we find in our redistribution experiment is especially remarkable in light of the robust evidence showing that contributions in public good games steadily decline. Contributions to the central player are highest when the central player’s ability to appropriate resources is most pronounced, i.e. in our ECH study. This finding confirms the validity of the anthropology-inspired experimental manipulation we use, i.e. introducing the norm of centricity into an otherwise standard game of voluntary contributions. The contributors in the ECH study likely believed to be facing a more authoritative “chief”, and a more legitimate source of decision making power, compared to the contributors in the other two studies.

In the case of our redistribution study, the change in the rules of the games interpretation for our result seems the most natural and plausible. The presence of the central player is in fact a change in the “game form”, compared to the game form of the traditional voluntary contribution mechanism with a fixed rule of redistribution.

The final result of the paper, namely that markets allocate resources efficiently regardless

of the compliance of the players, actual or perceived, with norms, is in line with the rich experimental literature on markets.

Among the possible extensions to our reciprocity design, we believe it would be interesting to reproduce the bi-directional nature of trades in the *kula*, by having two objects being exchanged following different routes. Another extension is to study how apparently worthless objects such as those traded in the *kula* can acquire a life of their own and value through exchange that far exceeds the value it acquires through personal use.

Chapter 3

Norms and networks

3.1 Introduction

Two features of our society, the high degrees of diversity in background and interconnect-
edness among people, might have an impact on the level of cooperation we observe. The
question we ask in this paper is whether living in a diverse society creates challenges to
the spreading of cooperation within a network, and to the realization of the gains arising
from forming links within this network. The theoretical network formation model we study
experimentally shares some features with social dilemma games, as collective welfare might
clash with the narrow demands of a cost-minimizing type of rationality, leaving open the
question as to whether subjects will cooperate in the network, and whether cooperation is
influenced by perceptions of similarity with other people’s background.

We study two treatments and one control. All three studies have in common a *repeated*
game in which each player decides whether to link or not to 4 opponents in her group at
a cost, with full information on past choices of the opponents. Links require no mutual
consent, are insensitive to the presence of intermediaries and, once established, benefit both
players, regardless of who has paid to form the link. In our treatment studies, before the
start of the repeated network formation game the players fill in a questionnaire (longer in
Treatment 1, and shorter in Treatment 2) where they can disclose demographic and hobby-
related information on themselves to the other group members. Every player is then shown
the profile of every opponent, and is asked then to express the degree of perceived similarity
between each opponent’s single attribute (e.g., “male”) and the rating player’s attribute.

Our experimental design allows us to test whether heterogeneity along the players’ own

characteristics has an effect on the links they form, and on the efficiency of the network that emerges from the combination of all players' linking decisions. We are also able to investigate empirically whether the subjects are moved by fairness and reciprocity considerations in their linking decisions. Both reciprocity and inequity attitudes might play a role in the formulation of strategies in the repeated game, considering that players have full information on the opponents' past choices and payoffs.

We find that even in the presence of heterogeneity the players achieve a high degree of efficiency in the network. Cooperation is therefore not hindered by the presence of heterogeneity or by a preference to form links with similar players, a behaviour that the literature refers to as "homophily". As a matter of fact, the choices of the players are not influenced by homophily considerations in any measurable way.

We find also: a degree of naive best responses that is incompatible with fast convergence to a Nash equilibrium network configuration in the theoretical model we use; a high degree of repetition of past choices (inertia); a high degree of allocative efficiency. We argue that the exclusive focus of the literature on the frequency of Nash equilibrium networks overlooks the fact that players, at least in our study, come consistently close to achieving a Nash equilibrium network. Our findings also show that inequity considerations play a role in networking choices. Finally, we find a role for reciprocity in discouraging naive best responses, and a carry-over effect of not-so-immediate past choices, two findings that we take as evidence of an attempt of the players to share the burden of linking to each other.

The paper is structured as follows. In Section 3.2 we review the workhorse model of network formation we take as a starting point of our inquiry, Bala and Goyal (2000). The somewhat lengthy discussion of this well-known paper allows us to greatly simplify the exposition of the experimental design later in the paper. In Section 3.3 we review a sample of studies that subjects the Bala-Goyal model of network formation to empirical testing, and the recent empirical literature that finds a role for homophily. Section 3.4 describes our experimental design. Section 3.5 presents our hypotheses. Section 3.6 presents the data analysis. Final remarks follow.

3.2 The Bala-Goyal model of network formation

Bala and Goyal (2000) study a noncooperative network formation game in which players interact repeatedly, with full information on the history of play. A distinctive aspect of Bala and Goyal (2000) is that the costs of link formation are incurred only by the person who

initiates the link. In this environment players typically prefer to be part of a network, but would prefer that other players incurred the cost of establishing the link.

Bala and Goyal (2000) present results regarding four different types of network formation games, depending on:

1. Whether the benefit arising from the link accrues only to the “networker”, or both to the “networker” and the “networked” player. In the case of one-way flow of benefits the link that agent i forms with agent j benefits only i . In the case of two-way flow of benefits the benefits accrue to both i and j , regardless of whether i or j has paid for the link to be established.
2. Whether information flows without frictions from one decision node (i.e., player) to the other, or whether information undergoes some deterioration in quality as it passes between two nodes via other nodes. In the frictionless model, if agent j_1 is linked with some other agent j_s via a sequence of intermediaries $\{j_2, \dots, j_{s-1}\}$, then the benefit that j_1 derives from being indirectly linked to j_s is insensitive to the number of intermediaries. In the model with frictions, the benefit is discounted exponentially at each passage from one node to the next.

The setup with two-way flow of benefit seems to us closer to patterns of information flows in real-world networks, where it is hard to imagine one subject gaining exclusive benefits from another, as it happens in the one-way flow of information setup. Furthermore, the presence of decay complicates greatly the formulation of even naive forms of best response to the past choices of the players (cf. pp. 1185 and ff.). We therefore concentrate in what follows on the two-way flow of benefits model with no decay, which is the setup we study in the experiment presented below.

Let $N = \{1, \dots, n\}$ be the set of players, with $n \geq 3$. A strategy of player $i \in N$ is a vector $g_i = (g_{i,1}, \dots, g_{i,i-1}, g_{i,i+1}, \dots, g_{i,n})$, where $g_{i,j} \in \{0, 1\}$, $i \neq j$. i has a link with j if $g_{i,j} = 1$. In this case of two-way flow of benefits, $g_{i,j} = 1$ allows both i and j to benefit from the link. Denote the set of strategies of player i as \mathcal{G}_i , with $\mathcal{G} = \mathcal{G}_1 \times \dots \times \mathcal{G}_n$ the space of pure strategies of all the players. The strategies of all the players, summarised in the strategy profile $g = (g_1, \dots, g_n)$, give rise to a nondirected network. The closure of g , denoted \bar{g} , is defined by $\bar{g}_{i,j} = \max\{g_{i,j}, g_{j,i}\}$ for each $i, j \in N$. $\mu_i(\bar{g})$ is the number of players i has a path to (the path can have an arbitrary number of intermediaries), not including i himself (differently from the original Bala-Goyal model in which the player always derives at least

the benefit of being connected to herself). $\mu_i^d(g)$ denotes the number of players i has chosen to link to. The payoff function takes the following form in Bala and Goyal (2000):

$$\Pi_i(g) = \Phi(\mu_i(\bar{g}), \mu_i^d(g)) \quad (3.1)$$

strictly increasing in the first argument (the number of other agents player i has access to, directly or indirectly), and strictly decreasing in the second argument (the number of links formed). We assume throughout a linear functional form, such that:

$$\Pi_i(g) = \mu_i(\bar{g}) - \mu_i^d(g)c \quad (3.2)$$

where c is the exogenous cost of forming a link, and the benefit is given simply by the number of agents i has a path to.

Players use an instance of naive best response in order to decide which links to form in the next period. When making the decision at round $t > 1$, i chooses a set of links that maximizes her payoff given the network observed in period t , with probability p . In order to avoid the players experimenting forever, there is a small probability $r \in (0, 1)$ that i simply repeats the choice made at time t , a behaviour Bala and Goyal call *inertia*, with the condition that $p + r = 1$. Furthermore, if more than one strategy is optimal, i randomizes between them.

The three main results of Bala and Goyal (2000, p.1202-1205) read as follows:

1. Let the payoffs be given by Equation 3.2, with $c \in (0, 1)$. A Nash architecture is minimally two-way connected, i.e. it has a unique component (there is an uninterrupted path to every player), no cycle, and no two players hold links to each other.
2. Let the payoffs be given by Equation 3.2, with $c \in (0, 1)$. The only *strict* Nash architecture is the centre-sponsored star, in which player i pays to establish links to all other players $-i$, and no other player establishes any further link.¹
3. Let the payoffs be given by Equation 3.2, with $c \in (0, 1)$. A network is efficient if and only if it is minimally two-way connected. The efficient network is defined as the one that maximises the sum of the players' payoffs.

¹A strict Nash architecture is one in which each player obtains a strictly higher payoff with the current strategy than she would obtain by deviating, given the other players' strategies. An example of a centre-sponsored star can be found in Bala and Goyal (2000, p.1183).

These results hold for any n and for any initial network. Notice that the model cannot make any predictions regarding the specific Nash, or *strict* Nash, network that will emerge. There are, as a matter of fact, 2000 Nash equilibrium networks in the case of 5 players, and as many *strict* Nash equilibrium networks as the number of players. This observation is easiest to grasp for *strict* Nash networks, where every player can function as the central player. As we shall soon illustrate, the emergence of the central player in this environment has proven problematic in experimental studies of the Bala and Goyal model. All *strict* Nash networks can be said to share the same *architecture*, which is a centre-sponsored star in the environment we are currently illustrating (two-way flow of benefits and no decay). We keep referring in what follows to architectures whenever we want to refer to a class of networks that share some features, for example all the centre-sponsored stars that can emerge in a n player game.

Convergence to the *strict* Nash equilibrium architecture, albeit guaranteed for any initial network in the setup described above, does not occur immediately. Table II in Bala and Goyal (2000) shows the results of simulations carried out by the authors (the payoffs are given by Equation 3.2 with $c \in (0, 1)$). When the probability of naively best responding is high (i.e., $p = 0.95$ and $r = 0.05$), with 5 players, convergence occurs in about 13 rounds of play. As the probability of inertia r increases, however, convergence slows down dramatically. With $p = 0.65$, convergence occurs in about 70 periods. When $p = 0.5$, convergence occurs in about 600 periods.

In the Bala-Goyal model, agents are fully homogeneous. A series of recent papers has examined the case of heterogeneous players in a network formation game. In Ballester et al. (2006) heterogeneity is *positional*, in the sense that it is the position occupied by the agent, and measures of her “inter-centrality”², that determine who is the key player of the game. The authors exploit the geometric features of the network to characterize an optimal “network disruption policy”. Haller and Sarangi (2005) introduce heterogeneity in the model by allowing for the probability of link failure to differ across links in the Bala and Goyal (2000) framework. The paper investigates the conditions for the existence of Nash networks, and related optimality questions of those equilibrium networks. Galeotti et al. (2006) extend the Bala-Goyal model to allow for players to have different “worths”, i.e. benefits when linked to, and different cost parameters c_i . The main finding of the paper is that properties such as centrality are “robust features of equilibrium networks” (p. 366).

²Inter-centrality is defined as the count of the total number of paths in g that hit player i .

We turn next to experimental studies of the Bala and Goyal models.

3.3 The experimental literature on network formation

A growing body of experimental literature tests some of the predictions of the Bala-Goyal model, especially those concerning convergence to the *strict* Nash architecture. We summarize here only the papers relevant for our inquiry³.

Falk and Kosfeld (2003) test the predictions of the Bala-Goyal model with no decay. They vary the type of information flow (one-way vs. two-way), and the cost parameter in equation 3.2 ($c = 5, 15, 25$). The marginal benefit of links is fixed at 10. All groups are composed of 4 players. Subjects play the network formation game for 15 rounds, and the groups are reshuffled at the end of the fifth and tenth round.

They find that with one-way flow of information, the Bala-Goyal model predicts outcomes accurately, while it largely fails to do so in the experiments with two-way flow of benefits. In the setup with two-way flow of benefits and $c = 5$, where the *strict* Nash prediction of the Bala-Goyal model is the centre-sponsored star, this architecture is never the outcome of the repeated interaction. In the setup with two-way flow of benefits and $c = 15$, where the marginal cost of linking exceeds the marginal benefit, the *strict* Nash empty network is again never the outcome of the interaction. Nash architectures do emerge, but are not very common.

In order to explain the puzzling absence of *strict* Nash networks in the 2-way flow of information model the authors notice that the central player in equilibrium has to pay for all links established in the game. The equilibrium then entails a high degree of asymmetry between the central player and the idle “periphery”, a feature of the *strict* Nash architecture that can hinder convergence if players are averse to inequities in payoffs. We replicate in this paper the finding in Falk and Kosfeld (2003) that Nash networks are rare in the two-way flow of benefits setup, but provide evidence of players coming often close to forming a Nash network, and achieving high levels of allocative efficiency.

Goeree et al. (2009) study a network formation game with heterogeneity introduced as an experimental manipulation. They argue that the low frequency of Nash equilibrium networks in Falk and Kosfeld’s study with two-way flow of benefits is due to the presence of homogeneous agents that aggravates the problem of singling out a centre. This paper

³The interested reader can consult Kosfeld (2009) for a more extensive survey of network experiments.

studies the two-way flow of benefits setup with decay.

The authors study five treatments to test for the effects of heterogeneity. The first treatment is the baseline where all the subjects are homogeneous. The second treatment (C and Ci) features one low-cost agent and is implemented under complete and incomplete information. Incomplete information means in this context that agents are aware of the treatment they are in, but are unaware at the beginning of the experiment of the experimental ID of the “special” player. The third treatment (V and Vi), features a high-value agent, again under complete and incomplete information. The fourth treatment (VV) features two high-value agents. Finally, the fifth treatment features two different special players, a high-value agent and a low-cost agent, under both complete and incomplete information. Each treatment group has a total of six players who play for 30 periods and retain the same characteristics (“special” or not) throughout all 30 periods.

In the baseline treatment players fail to coordinate on the Nash equilibrium architecture. The introduction of heterogeneity significantly increases the likelihood of a Nash equilibrium architecture. Since this is the case of two-way flow of benefits *with decay* and a linear specification of the payoff function, the Bala-Goyal model predicts that the only Nash architecture is some form of star. The authors report that the periphery-sponsored star is the most common architecture. The presence of a high-value agent increases the frequency of equilibrium networks more than the presence of a low-cost agent, a finding explained by the author as an artefact of the different equilibrium architectures in the two cases. Incomplete information has little or no effect on the results except in the case that features both a high-value and a low-cost agent, where the information asymmetry greatly aggravates the coordination problem.

Our study features heterogeneous players, but heterogeneity is, we believe, of a more ecological type than that studied by Goeree et al. (2009), as it is brought into the lab by the experimental subjects. We suspect that in situations where the special player has to emerge endogenously, beyond the trial-and-error discovery process that allows players to figure out who the special player is in the incomplete-information treatments of Goeree et al. (2009), the effect of heterogeneity on convergence might be significantly more nuanced.

Rong and Houser (2013) study a network formation game with homogenous players, but introduce institutional refinements in the environment that reduce period-to-period variability of choice. An example of such refinements is investment limits that constrain the ability of the players to form links. The authors find that investment limits and a “right of

first refusal” favour the formation of star networks.

A series of recent papers has discussed the idea that decision makers tend to congregate with people they perceive as similar (“birds of a feather flock together”, as the saying goes). Currarini et al. (2009) describe the phenomenon of homophily, i.e. our tendency to create aggregations that are homogeneous along some socially valuable dimension like ethnic or religious background. Empirical evidence from American high schools shows this phenomenon to be frequent, especially within the white and black subpopulations. The theoretical model presented in the paper shows that biased preferences are not enough to generate homophilous behaviour for all groups. One needs also a particular type of matching technology, biased towards people we share features with. The paper also discusses an alternative model that produces homophilous behaviour, one that features biased *satiated* preferences.

Goeree et al. (2010) find evidence in an all-girls school in Pasadena, California, that the bigger the social distance between two friends, computed as the length of the shortest path between them, the less the “proposing friend” gives to a “receiving friend”, in a dictator game. Goeree et al. (2010, p. 193) estimate the equation governing dictator giving in terms of social distance, as follows:

$$\text{share given} = \frac{1}{6} \left(1 + \frac{2}{d} \right)$$

where d is the number of steps between any two nodes of the network.

While features of the network are predictive of dictator giving, personal features are not. The authors find that personal features, like ethnicity, that pupils share are instead important predictors of whether two pupils state they are “friends”. We collect information on personal and shared features in our experimental study, even though the features we concentrate upon reflect the nature of our sample of experimental subjects (university students), while Goeree et al. (2010) study high schoolers. We fail to observe an effect of shared characteristics on linking behaviour, a strategic interaction that presents significantly greater cognitive challenges than dictator giving. We turn next to our experimental design.

3.4 The experimental design

We investigate the effect of heterogeneity on network formation, where heterogeneity is given by idiosyncratic features of the experimental subjects. We also investigate the role of behavioural and cognitive considerations, like reciprocity, inequity aversion, and inertia,

in network formation. We are finally interested in exploring not only the frequency of Nash equilibria in our environment, but also how close the subjects came to forming an equilibrium minimally two-way connected network, through an analysis of efficiency. We study two treatments, and one control study.

Treatment 1 (*TG1*) is divided into three phases. In Phase 1, subjects are assigned randomly to groups composed of 5. Subjects interact with the same group members for the entire duration of the experiment. After having read the instructions⁴ the subjects take a test to ascertain their understanding of the way payoffs are calculated in the experiment. Answers were checked individually by the experimenters.

In Phase 2 subjects fill in a questionnaire on a web-based application. Subjects can provide information on their gender, age, languages spoken, Major, favourite sport, political views, favourite singers, whether the subject usually has an impulsive (vs. reflective) attitude when making decisions, whether the respondent devotes time to volunteering activities, length of Facebook use per day, frequency with which the respondent talks to his own family per week, and number of text messages sent. We refer to each answer in the questionnaire as an “attribute” of the subject, and the vector of attributes as her “profile”. Subjects have no possibility to reveal their identity or name, as all their questionnaire answers are picked from a drop-down menu with pre-determined options.⁵ Through their profile subjects can share with the other group members basic information on their demographic characteristics, hobbies, and some proxies for sociability.

Then the subjects are asked to “rate” the profiles of the other group members. For each subject in her group (identified by Experimental ID), the rater has to answer whether each single attribute of the “rated” is shared; the rater expresses also a degree of similarity between the attribute displayed by the opponent they are rating and their own attribute, on a Likert scale from 1 to 5, for each single question of the questionnaire. Figure 3.1 is a screenshot of part of the webpage where subjects perform the rating. The rating of all opponents concludes Phase 2 of the experiment.

In Phase 3 of the experiment, the subjects are asked to choose whether they want to link to other players in their group, with two-way flow of benefits once a link is established, and no decay. The payoff function is given by Equation 3.2. In our experiments, $c = 0.5$ points, which implies that i will always be willing to form a link with agent j if he does not expect

⁴Instructions and questionnaires are available upon request from the corresponding author.

⁵The study was reviewed and approved by the Research Ethics Board of Simon Fraser University

1:45 1 / 4 Next profile >

This is profile of: **555**

Is the answer 555 provided the same you provided?

How similar is 555's answer to yours?

Very similar - Very dissimilar

1). What is your gender?
Male Yes No

2). Which languages are you fluent in (multiple checks permitted)?
English Yes No

3). What is your program (please choose one)?
Economics Yes No

4). What is your age (please choose one)?
18 and under Yes No

5). What is your favorite sport activity (please choose one)?

5 4 3 2 1

5 4 3 2 1

5 4 3 2 1

5 4 3 2 1

5 4 3 2 1

Figure 3.1: Rating of the opponent “555”

to have a path to j . Figure 3.2 provides a screenshot of the interface where subjects make their linking choices.⁶ The subjects are then displayed the strategy profile after all players have made their choices, as illustrated in Figure 3.3. Then subjects manually compute their payoff, and to record it. The manual calculation of the payoffs is a way in which we try to ensure that subjects actually consider the network arising in each period. If payoffs were instead simply presented to the participants, as customarily done in experiments, subjects might have completely ignored the network in the formulation of their next-period response.

The players have a time limit of four minutes to make their decisions, after which the system imputes a “No links” decision to the player. The subjects repeat the linking decisions for 20 periods. At the end of the 20th round, we randomly select one round, and subjects are paid according to their earnings in that round, with the exchange rate set at 1 point = 5 Canadian dollars. A show up fee of \$10 was paid.

Our second treatment ($TG2$) is a variant of $TG1$. The questionnaire we use in Phase

⁶The computer interface asks the subject to create a line between herself and the opponent(s) she wishes to link to through their mouse. Subjects are identified by their Experimental IDs.

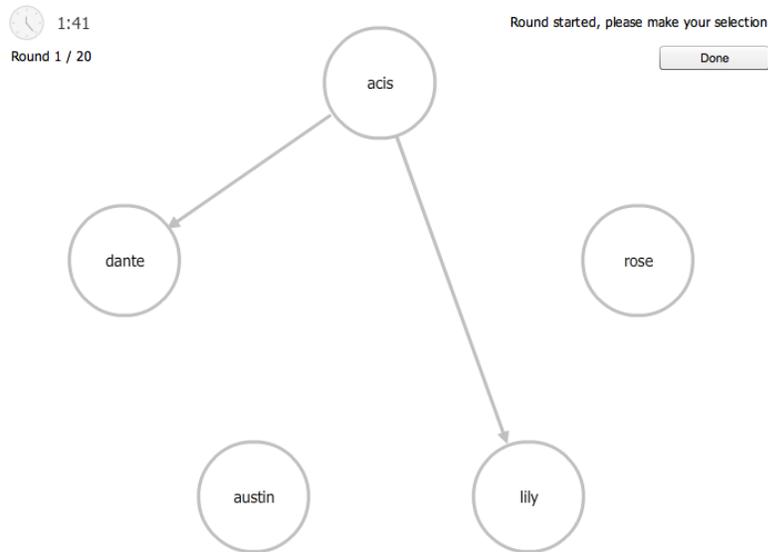


Figure 3.2: The interface where subjects choose to whom (if anybody) they want to link. In this case, subject ‘acis’ has decided to create a link with subjects ‘lily’ and ‘dante’.

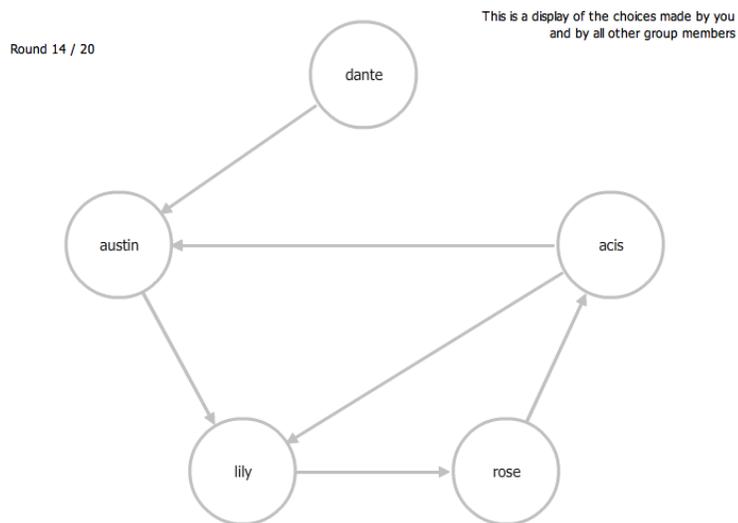


Figure 3.3: A summary of the hypothetical networking choices made by all group members.

2 of the experiment is shorter, and it includes only information on age, languages spoken, gender and Major. The experiment is in all other regards the same as *TG1*. We devised *TG2* to address the concern that the 12-item questionnaire we use in *TG1* might have provided an excessive amount of information that the subjects did not find very valuable. The 4 questions that were included in the *TG2* questionnaire were chosen through a random survey on Simon Fraser University students in which we ask participants ($n = 60$) what are the selection criteria they use in their day-to-day friendship decisions. The 4 answers that appeared most often were used in the *TG2* questionnaire.

Our control study *CG* lacks Phase 2 of *TG1*, i.e. the questionnaire and the rating. After Phase 1, subjects play the network formation game. This study is essentially a replication of one of the studies by Falk and Kosfeld (2003), although with different cost and benefit parameters that do *not* change the theoretical predictions for the game.

3.5 Hypotheses

There are 5 Hypotheses we wish to subject to experimental testing:

Hypothesis 1 *Similarity has a positive effect on the decision to link in TG1 and TG2.*

Picking links on the basis of perceived similarity is a sound strategy if it is true that subjects exhibit homophilous preferences.

Hypothesis 2 *Similarity has a positive effect on the decision to repeat choices in TG1 and TG2.*

Subjects take two kinds of decision: on one side they decide whether to link to each opponent; on the other, they decide whether to simply repeat the previous-period choice. We hypothesize that familiarity with some of the features of the opponents in *TG1* and *TG2* increases the number of decisions to repeat the previous-period choices. We discussed in Section 3.2 how inertia slows down convergence to the Nash equilibrium in the Bala-Goyal setup. If it is true that heterogeneity increases inertia, then heterogeneity should also hinder convergence to a Nash and efficient architecture. Efficiency is defined here as the sum of the payoffs within a certain group at each t , divided by the maximum total payoff.

Hypothesis 3 *Reciprocity considerations play a role in the decision of the players to link, to repeat choices, and to naively best respond (TG1, TG2, CG).*

We hypothesize that subjects might feature a tendency to reciprocate choices in the

network formation game in light of the robust literature on preferences for reciprocation.⁷ Reciprocative behaviour is typically hard to justify in the two-way flow of benefits setup. If subject i believes that subject j will link to i , for example based on previous-period choices, i has no incentive to link to j , and therefore i would rationally *not* positively reciprocate j 's choice. If on the other hand i believes that j will not link to i , and player i expects not to have any path to j , then player i has incentives to link to j , and therefore i would rationally *not* negatively reciprocate j 's choice.

Hypothesis 4 *Fairness considerations play a role in the decision of the players to link, to repeat choices, and to naively best respond (TG1, TG2, CG).*

Falk and Kosfeld (2003) and Berninghaus et al. (2007) find that inequity aversion plays a role in hindering convergence to an equilibrium configuration in the two-way flow of benefits setup of Bala and Goyal (2000).

Hypothesis 5 *Nash networks are rare, but most networks achieve almost-equilibration (TG1, TG2, CG).*

Considering the positive net benefit of creating a link in our setup, we suspect that players will on most occasions err on the side of linking, giving rise to connected networks and achieving high levels of allocative efficiency. We use the result presented in Section 3.2 according to which a network is efficient if and only if it is minimally two-way connected, the same requirement for a network to be a Nash equilibrium. Efficiency then provides a straightforward measure of how close to a minimally two-way connected Nash network subjects have come in each round. We use the expression almost-equilibration as a shorthand notation for the subjects coming close to a Nash network, which is also efficient.

3.6 Data analysis

3.6.1 The dataset

We recruited 90 undergraduate and graduate Simon Fraser University students to participate in our study. 20 participants played our *TG1* (4 groups), 30 the *TG2* (6 groups), and 40 the *CG* (8 groups). No subject participated more than once in any of our experiments. The experiment lasted on average 90 minutes, and subjects won on average 15 Canadian dollars, including a show up fee. We have evidence that the rating was done in a consistent manner in *TG1* and *TG2*, as measured by the correlation between our two measure of

⁷Cf. Fehr and Schmidt (2006) for a review.

similarity (number of attributes shared, and proximity of the rated participant's attributes to the rater's); we have evidence also that the perception of similarity is mutually shared, i.e. there is a high correlation between i 's rating of j , and j 's of i .

The average degree of similarity in each group is approximately equal, and the sample is gender-balanced. For the purposes of data analysis, each participant is considered a "person" (*pers* for short). In each period, each *pers* makes 4 binary choices, i.e. whether he/she wants to link or not to four different opponents. For the purposes of our panel data analysis presented below, in every period each subject can only take *one* decision. To take care of this constraint we assign to every physical *pers* four id_{ij} in each round, where i is each *pers*, and $j = 1, \dots, 4$ is the four opponents every *pers* faces in each round. We illustrate below the ways in which we take care econometrically of the fact that the four *id* all refer to the same participant.

3.6.2 Summary statistics

Table 3.1 shows the descriptive statistics for all the variables we use in the data analysis. At the top of the table, the descriptive statistics for the four main dependent variables: (i) the decision to *link* to another player; (ii) the decision to *repeat* the previous-period choice, a measure of inertia in the game; (iii) the proportion of naive best responses in the last 5 rounds of play, *bestresp*⁸; (iv) the payoff in experimental points. It is apparent that the mean of *repeat* is higher than the mean of *link*, but the measure of dispersion of the two variables is roughly the same. The proportion of naive best responses is quite low, of the order of magnitude that according to the simulations carried out by Bala and Goyal would guarantee convergence to equilibrium only after hundreds of repetitions. The average payoff is quite high (the maximum payoff is 4), with a high coefficient of variation of about 31%.

Figure 3.4 is an histogram of the number of links formed by the players on average during the experiment (variable *totaly*, subpanel 1 is for *TG1*, subpanel 2 for *TG2*, and subpanel 3 for *CG*). The modal choice is to form one link in the three subgroups. Choices of 3 and 4 links are comparatively rarer. Figure 3.5 shows the average number of links at each t , where the mean is only across the players. Although no clear trend is apparent in *TG1*, in *TG2* and *CG* there is a tendency to choose fewer links in the final stages of the game compared to the initial stages. The fact that rounds with a higher average number of links are followed

⁸In the last 5 rounds of play the subjects are likely to have gained considerable knowledge of the opponents' behaviour.

Table 3.1: Summary statistics

Variable	Mean	Std. Dev.	N
link	0.293	0.455	7200
repeat	0.691	0.462	6840
bestresp	0.356	0.479	1800
payoff	2.978	0.939	7200
ashared	2.615	1.994	4000
avsimil	3.023	0.784	4000
crosssimil	8.664	7.303	4000
male	0.646	0.478	3840
nashM1	0.07	0.255	6840
otherlinksM1	0.292	0.455	6838
avpayoffM1	3.001	0.766	6840
ineqM1	-0.023	0.552	6840

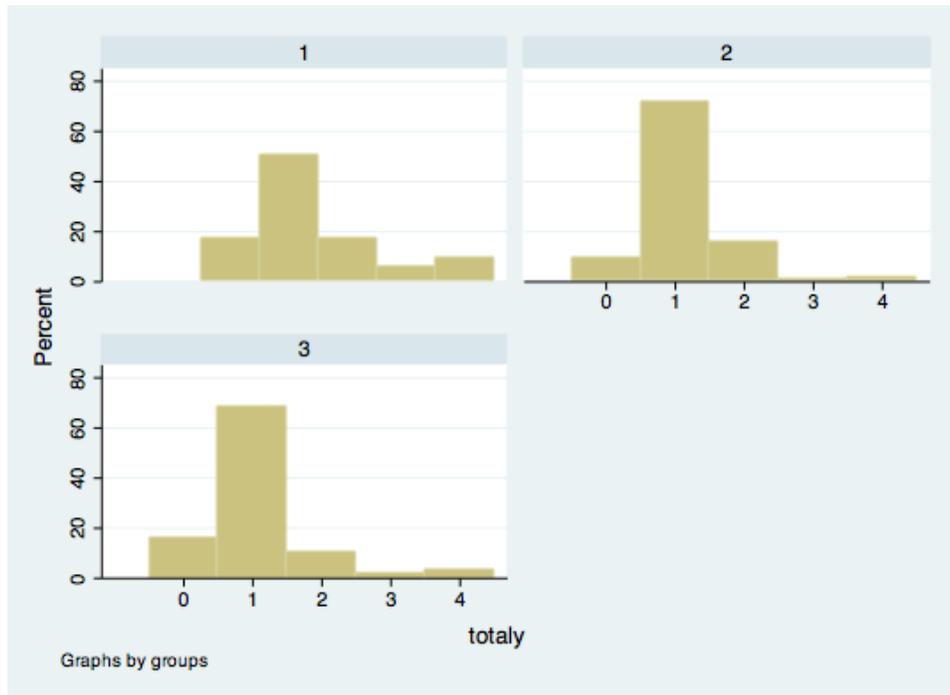


Figure 3.4: Histogram of variable *totaly*. Subpanel 1 is for *TG1*, subpanel 2 for *TG2*, and subpanel 3 for *CG*

by rounds with a smaller average number of links, and vice-versa, can be taken as an initial sign that players experiment throughout the game, and that inertia might be low in our game. Notice, however, that the average number of links always fluctuates between zero links and two links (with the maximum number of links every player can form being four), a sign that although experimentation is taking place, the players are economizing on the number of links.

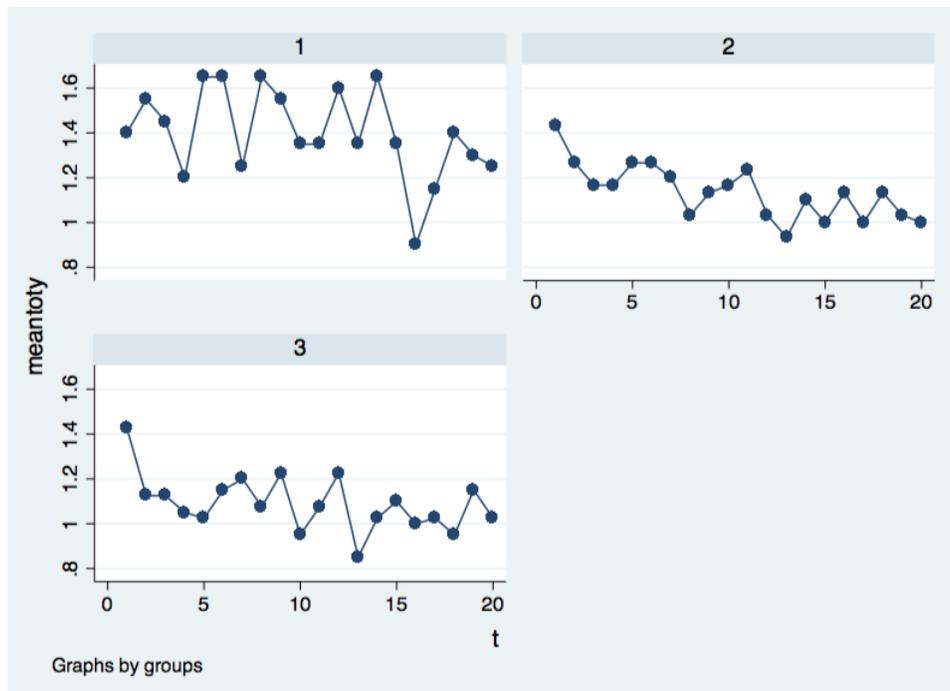


Figure 3.5: Average number of links at each t . Subpanel 1 is for $TG1$, subpanel 2 for $TG2$, and subpanel 3 for CG

The frequency of Nash networks is low in our experiments, in line with previous studies. In $TG1$, about 3% of networks are Nash; in $TG2$, 4%; in CG , 11%. Only one of the Nash networks is a *strict* Nash equilibrium. Subjects did however achieve high levels of allocative efficiency. Figure 3.6 shows average allocative efficiency at each t . Allocative efficiency is defined as the sum of the payoffs within a certain group at each t , divided by the maximum total payoff (18 experimental points, for all t). Efficiency is always well above 70%, with cyclic fluctuations between each round and the next. The fact that average efficiency is cyclic, like the average number of links, can be explained again as a symptom that experimentation is taking place in our game, and that this experimentation typically

does not disrupt the ability of the players to reap most of the (net) benefits arising from being linked in the network.

The high efficiency we observe in our experimental sessions provides also evidence that subjects come consistently close to achieving a Nash network, due to the requirements for a network to be a Nash equilibrium and efficient being the same (cf. Section 3.2). The finding

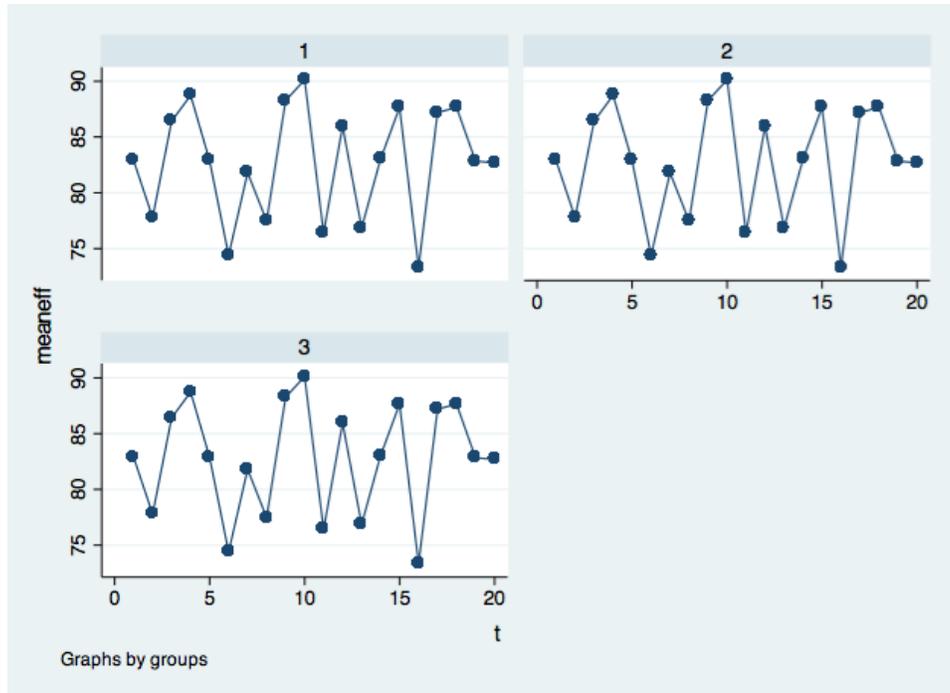


Figure 3.6: Average efficiency at each t . Subpanel 1 is for $TG1$, subpanel 2 for $TG2$, and subpanel 3 for CG

that subjects came often close to achieving an efficient and Nash architecture is confirmed by a computation of the number of links that group members have created in every period *in excess* of the minimum number of links that allows 5 nodes to be minimally two-way connected in a graph.⁹ In 20% of the cases there was only one such (redundant) link, in 17% of the cases two links. If we sum the frequency of Nash networks (7% of all networks) and of networks with one and two redundant links, we obtain that 44% of all our networks are either Nash, or have come close enough to a Nash network.

Next, we try to explain behaviour through the measure of similarity we have collected

⁹The number of links needed for a two-way connected network is four, and the total number of links players can form in every round is 20 (5 players times 4 opponents each player can link to).

in the course of the experiment, as well as other behavioural variables we have information on.

3.6.3 The data generating process (DGP)

We wish to estimate both a static model, and a dynamic model. The static model tries to explain behaviour through time-variant and time-invariant regressors. The dynamic model adds to the previous specification lags of the dependent variable. The static model reads as follows:

$$y_{ij,t} = \alpha_{ij} + \beta_1 \text{ashared}_{ij} + \beta_2 \text{avsimil}_{ij} + \beta_3 \text{crosssimil}_{ij} + \beta_4 \text{male}_{ij} + \beta_5 \text{nashM1}_{ij,t} + \\ + \beta_6 \text{otherlinksM1}_{ij,t} + \beta_7 \text{payoffM1}_{ij,t} + \beta_8 \text{ineqM1}_{ij,t} + \beta_9 \text{tg1} + \varepsilon_{ij,t} \quad (3.3)$$

Where the dependent variables of interest $y_{ij,t}$ are: the decision to *link* by id ($t = 1, \dots, 20$, $i = 1, \dots, 7200$); the decision to *repeat* the previous choice ($\text{repeat} = \mathbb{I}\{y_{ij,t} = y_{ij,t-1}\}$, $t = 2, \dots, 20$, $i = 1, \dots, 6840$); *payoff* ($t = 1, \dots, 20$, $i = 1, \dots, 7200$);¹⁰ whether the *link* decision taken by each id at a particular t was a naive best response ($\text{bestresp} = \mathbb{I}\{y_{ij,t} \in \{BR_{t-1,-i}\}$, $t = 16, \dots, 20$, $i = 1, \dots, 1800$). id is the individual identifier, and the round t is the time identifier.

Consider now the covariates. ashared_{ij} is the number of attributes the two players share, as expressed in the rating; avsimil_{ij} is the average degree of similarity to the vector of attributes of the opponent, expressed also in the rating; crosssimil_{ij} is a multiplicative interaction term of ashared_{ij} and avsimil_{ij} that we insert to account for the high correlation between ashared_{ij} and avsimil_{ij} ; male_{ij} is a gender dummy variable (1 if i is a male); nashM1 is a dummy variable equal to 1 if the network in period $t - 1$ was a Nash network; otherlinksM1 is a dummy variable that is equal to 1 if the opponent j linked to i in period $t - 1$; payoffM1 is the payoff of the player in period $t - 1$; $\text{ineqM1} = (\text{payoffM1} - \text{avpayoffM1})$, i.e. the distance between i 's payoff at $t - 1$ and the average payoff at $t - 1$, a measure of advantageous inequity when positive, meaning how better off i is compared to the average; tg1 is a dummy variable for *TG1*: β_9 captures then the marginal effect of having a longer questionnaire and evaluating the opponent on several extra dimensions.

¹⁰When *payoff* is the dependent variable we set $\beta_7 = \beta_8 = 0$.

In the dynamic model specification we add two lags of the dependent variable:

$$\begin{aligned}
y_{ij,t} = & \alpha_{ij} + \beta_1 \text{ashared}_{ij} + \beta_2 \text{avsimil}_{ij} + \beta_3 \text{crossimil}_{ij} + \beta_4 \text{male}_{ij} + \beta_5 \text{nashmin}_{ij,t} + \\
& + \beta_6 \text{otherlinks}_{ij,t} + \beta_7 \text{payoff}_{ij,t} + \beta_8 \text{ineq}_{ij,t} + \beta_9 y_{ij,t-1} + \beta_{10} y_{ij,t-2} + \beta_{11} \text{tg1} + \\
& + \left[\sum_{l=1}^4 \gamma_l \bar{x}_l \right] + \gamma_5 y_{ij,1} + \varepsilon_{ij,t}
\end{aligned} \tag{3.4}$$

where the dependent variable $y_{ij,t}$ is *link*, and the covariates with a γ coefficient are included for consistent estimation purposes (more on this below). Furthermore, it is assumed that $|\beta_9| < 1$ and $|\beta_{10}| < 1$.

3.6.4 Challenges to consistent estimation

Three of our dependent variables of interest, *link*, *repeat* and *bestresp*, are binary variables. A choice must be made between linear probability models available for panel data, and non-linear estimation methods for panel data (such as probit). The estimated coefficients retain the traditional marginal-effect interpretation only in the case of linear probability models, and thus this is our preferred estimation method. Notice also that some of our key regressors, like the measures of similarity, are time-invariant. The Fixed Effects (FE) specification estimates a transformed model without α_i and the time-invariant regressors, and does not hence allow us to estimate the coefficients of the time-invariant regressors (cf. Cameron and Trivedi 2005, p.750 and ff.). For the estimation of the time-invariant regressors we can only rely on the Random Effects specification (RE).

RE allows us to estimate the coefficients of time-invariant regressors, and allows for different intercept terms for different cross-sectional units. It requires in order to yield consistent estimates of the parameters of interest the familiar assumption of strong exogeneity: $\mathbb{E}[\varepsilon_{it} | \alpha_i, \mathbf{X}_i] = 0$. This assumption can be tested through a robust version of the Hausman test, detailed below. Furthermore, if models 3.3 and 3.4 are correctly specified, then the RE estimator is consistent and asymptotically efficient. The FE estimator is always consistent, possibly though not the most efficient.¹¹

Another challenge is the estimation of the asymptotic variance matrix for the purposes of inference on models 3.3 and 3.4. As we mentioned, every participant (identifier *pers*) has

¹¹Cf. Cameron and Trivedi 2005, p.716-17.

four experimental IDs (identifier *id*) for the purposes of our statistical analysis, demanding clustering in the identifier *pers*¹². We use the bootstrapping method to estimate the asymptotic variance matrix, correcting for clustering in *pers*. Simulation methods for the standard errors are available in STATA[®] for both linear and nonlinear (probit and logit) estimation methods, while clustering is only available for linear estimators in STATA[®], another reason why we concentrate on linear estimators.

Finally, estimating through OLS the dynamic model 3.4 produces inconsistent estimates of the parameters of interest β_9 and β_{10} (cf. Cameron and Trivedi 2005, p. 763). The estimator we use instead is a dynamic RE probit estimator. However, this estimator suffers from an endogeneity problem when applied to model 3.4, as the regressor $y_{ij,1}$ is correlated with the unobserved random effect α_i . Wooldridge (2005) proposed as a solution to this problem to estimate a model where the initial decision $y_{ij,1}$ is one of the regressors, and the time averages of all time-varying regressors are also included in the model, as in equation 3.4. All the coefficients $\gamma_l, l = 1, \dots, 5$ are estimated only to ensure consistent estimation of the coefficients of interest in model 3.4.

As we mentioned above, the RE estimates are consistent only if the strong exogeneity assumption holds. A standard Hausman test is usually carried out to this effect. A shortcoming of this test is that it requires the α_i and ϵ_{it} to be i.i.d., an assumption that does not hold “if cluster robust standard errors for the RE estimator differ substantially from default standard errors” (Cameron and Trivedi 2009, p. 261). A panel bootstrap Hausman test is available and detailed in Cameron and Trivedi (2009, p. 262), a test that takes care of clustering problems. The Hausman test with *link* as the dependent variable rejects the null hypothesis of exogeneity (prob> $\chi_4^2 = 0.000$), and hence the RE model yields inconsistent estimates of the parameters of interest. The test with *repeat* as the dependent variable also rejects the null hypothesis of exogeneity (prob> $F(4, 47) = 0.015$). We instead fail to reject the null hypothesis in the case of *payoff* as the dependent variable (prob> $F(2, 47) = 0.4$). Finally, we reject the null when *bestresp* is the dependent variable (prob> $F(4, 47) = 0.006$).

In light of the test results RE produces inconsistent results when using *link*, *repeat* and *bestresp* as the dependent variables. On the other side, we can only revert to RE for estimation of the time-invariant regressors. We therefore briefly overview the inconsistent results of RE, but use the FE instead for inference purposes.

¹²We do not consider using heteroskedasticity-robust standard errors. Cameron and Trivedi (2005, p.707) observe in fact that in a panel setting it is much more important to correct for correlation in cluster errors, compared to correcting for heteroskedasticity alone.

3.7 Estimation results

3.7.1 Random effects model

Using *link* as dependent variable, all the time-invariant regressors are insignificant (bootstrapped standard errors and clustering in *pers*¹³). The similarity measure is positively correlated with *link*, but insignificantly so (cf. Table 3.2).¹⁴ We have some initial evidence of reciprocity playing a role in the decision to link to an opponent.

Table 3.2: Estimation results : RE with *link* as dependent variable

Variable	Coefficient	Estimate	(S.E.)
ashared	β_1	0.077	(0.055)
avsimil	β_2	0.009	(0.027)
crossimil	β_3	-0.020	(0.014)
male	β_4	0.024	(0.043)
nashM1	β_5	0.011	(0.032)
otherlinksM1	β_6	0.057*	(0.024)
payoffM1	β_7	-0.010	(0.008)
ineqM1	β_8	-0.028	(0.023)
tg1	β_9	0.018	(0.061)
Intercept		0.241	(0.077)

*: The coefficient is significant at 5%

RE yields consistent and asymptotically efficient estimates when *payoff* is the dependent variable. In this case, $\hat{\beta}_5 = -0.68$, $SE(\hat{\beta}_5) = 0.15$ (RE with bootstrapped standard errors and clustering in *pers*), negative, significant at 1%, and of an interesting magnitude. Sign and significance of $\hat{\beta}_5$ are preserved using panel probit (bootstrapped standard errors). Being in a Nash network in period $t - 1$ seems hence to decrease payoffs at t . Notice, however, that since the sum of payoffs is maximized in a Nash network, following the attainment of a Nash equilibrium payoffs can only either stay constant on average, or decrease if subjects abandon the Nash configuration. The negative effect of being in a Nash equilibrium in the previous period on payoffs, coupled with the low frequency of Nash networks, confirms that Nash networks in this setup are unstable, as already discussed in Falk and Kosfeld (2003).

¹³We always perform 100 replications whenever using the bootstrap. The seed is set at 123.

¹⁴As a robustness check, we have also used the single attributes the subjects share (or not) as regressors (for example, if the subjects claim to be of the same gender), instead of the aggregate measure *ashared* that measure the number of attributes the subjects claim to share. These regressors are also not significant in RE estimation.

Possible explanations for the inability of players to reproduce over time Nash networks, once one is achieved, are outlined below with reference to reciprocity considerations and implicit agreements between then players to share the burden of linking.

Regarding the dynamic model 3.4, $\hat{\beta}_{10} = 0.216$, $SE(\hat{\beta}_{10}) = 0.076$, positive and significant at 1%. Linking at period t is therefore positively correlated with linking at period $t - 2$, a finding that we explain in light of the results of the fixed-effect estimation presented next.

3.7.2 Fixed effects

We linearly estimate model 3.3 in the FE framework with *link* as the dependent variable. Results are shown in Table 3.3.¹⁵ The coefficient of *nashM1*, $\hat{\beta}_5$, is significant and positive. All other coefficients are insignificant at 5%. The fact that subjects link more after a Nash equilibrium network is achieved expresses in a different way an earlier finding, i.e. that payoffs decrease following the achievement of a Nash equilibrium. Payoffs are in fact a negative function of the number of links formed (cf. equation 3.2). Participants likely realized the efficiency properties of Nash networks, and responded to the achievement of one by linking more. Why the players did not simply naively best respond to the network observed in the previous period, continuing to replicate a Nash network, is again evidence that best responding behaviour plays a limited role in our experiment.

Table 3.3: FE model with *link* as dependent variable

Variable	Coefficient	(Std. Err.)
nashM1	0.038*	(0.016)
otherlinksM1	0.017	(0.017)
payoffM1	-0.012	(0.006)
ineqM1	0.006	(0.012)
Intercept	0.317	(0.026)

With *repeat* as the dependent variable, the coefficient of *ineqM1*, $\hat{\beta}_8 = 0.03$, $SE(\hat{\beta}_8) = 0.013$, significant and positive. Advantageous inequity favours then inertia in the game, likely in an attempt by the better off players to conserve their margin of advantage.

Using *bestresp* as the dependent variable the coefficient of *otherlinksM1* is $\hat{\beta}_6 = -0.094$, with $SE(\hat{\beta}_6) = 0.039$, significant and negative. Reciprocity considerations seem to influence the naive best response dynamics, a sign that the transition from one round to the

¹⁵We use bootstrapped standard errors with clustering in *pers* for all FE regressions.

next in the network formation game cannot be assumed to simply depend on naive best responses to the network observed in the previous period, and on inertia, as assumed in Bala and Goyal (2000). Rather, the norm of reciprocating links seems to play a role in the players' networking choices, expanding to the field of network formation games the list of environments where reciprocity concerns have been shown to be at play.¹⁶

3.7.3 Discussion

We go back to our hypotheses:

1. We find no evidence in support of Hypotheses 1 and 2. Possible explanations for our failure to observe homophily in our experiment could be that the computational difficulty of the game distorts attention from the attributes of the players; or that the relational aspect missing in the controlled lab environment fatally undermines the possibility to replicate homophily. Becchetti et al. (2010) introduce relational goods in their experimental design by allowing the agents to actually meet after the experiment, a promising approach also for future experimental studies of network formation games.
2. We have found some evidence in favour of Hypothesis 3, in the form of a negative relationship between naive best responses and the opponent's choice in the previous period. We try to rationalize this finding, and the finding that choices at period t are positively correlated to choice at $t - 2$, as evidence that each player i might be trying to share the burden of linking with each player j . She might do so by attempting to start a two-period cycle whereby i forms a link to j in periods $t, t + 2$ etc., believing j will form a link to i in periods $t + 1, t + 3$ etc. Player i might then interpret the fact that player j linked to i in period $t - 1$ as a signal that j is respecting this tacit burden sharing agreement, and i might avoid naive best responses in this case. There is some evidence coming from Table 3.2 that as a matter of fact i not only escapes naive nest responses in the face of an act of "kindness" of j , but that i actually links more to j at t if j formed a link at $t - 1$. A further exploration of rules of thumb of the kind we just described in the cognitively complex environment of network formation games seems to us a promising field of research for future studies.

¹⁶Reciprocity has been widely observed in gift exchange games (Fehr and Gächter 1998) and trust games (Berg, Dickhaut, and McCabe 1995)

3. We have found some evidence for Hypothesis 4, in the form of a significant positive relation between advantageous inequity and the decision to repeat the previous-period choice. We have explained this finding as evidence that the advantaged players might repeat choices in an attempt to conserve their own advantage.
4. We find clear evidence of participants approaching a Nash network in our experiments. The literature's exclusive focus on whether a Nash network was achieved or not overlooks the fact that, although Nash networks are rare, about half of the networks are close to a Nash equilibrium in our study. Unlike in Berninghaus et al. (2007), we do not observe the players moving from one Nash configuration to another with a different central player. When Nash networks are achieved in our experiment, those are unstable because they promote the willingness of the players to link, in excess of the number of links needed to ensure a minimally two-way connected network. We have evidence that reciprocity considerations interfere with best-response dynamic, which would produce a state of permanence in the Nash network formed by the players (if players do not otherwise experiment).

3.8 Final remarks

Amendments to our design that we plan to study in the future are allowing the subjects to buy information on their opponents, and information on the strategy they plan to adopt in the network formation game. In our current experimental design all information was instead provided for free.

In future study we plan to test the conjecture we have advanced in the paper according to which the players are trying to coordinate on a burden-sharing agreement. Possible ways to test this conjecture would be: (i) the introduction of a bargaining stage to determine the division of the cost of linking; (ii) the introduction of side payments among the players, which could also bring further evidence of the presence of reciprocity concerns of the players when making networking decisions.

Lastly, we have noticed earlier that in theoretical models that try to reproduce homophilous behaviour, biased preferences are typically not sufficient to generate homophilous behaviour: one typically requires also a biased matching technology. Coupling the possibly inborn homophilous preferences of the experimental subjects with a biased matching technology seems to us a promising approach to replicate homophilous behaviour in experimental

studies of network formation games.

Chapter 4

Norms and organizations

4.1 Introduction

Trust has been defined as the “willingness to make oneself vulnerable to another, based on the belief that the trusted person will choose not to exploit one’s vulnerability (i.e., will behave trustworthily)” (Blair and Stout 2001b, p.1739-1740). Trustworthiness is then the unwillingness to exploit a trusting person’s vulnerability, even when profitable to do so.

Trust and trustworthiness play an important role in organizations and in markets¹. In respect to business organizations, trust and trustworthiness are important because the discretion accorded to corporate managers by the law under the business judgement rule is wide enough to allow managers to engage in behaviour that we would deem as untrustworthy and opportunistic. There are at least three sources of expectations of trustworthiness that could tilt the motivational balance of managers away from self-interest with guile² and in the direction of trustworthiness. These sources are:

1. The corporate law feature that grants the shareholders the power to monitor the managing bodies of the organization.
2. The regulations against managerial self-dealing.
3. The manager’s adherence to norms, especially fairness and reciprocity. These norms

¹Cf. K. Arrow: “Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time”, cited in Algan and Cahuc (2013, p.522), a literature review of the many studies finding a causal relationship between trust and economic growth.

²Williamson (1975, p.7) uses these words to define the concept of opportunistic behaviour.

are reinforced by legal provisos³ that describe the manager as a “fiduciary”, or trusted party in a relation that typically involves the administration of some assets.

While the ability to prosecute managers that is essential to item 2 above is hard to reproduce in the lab, in this paper we study the effects of monitoring (item 1) and of the law’s provisos concerning fiduciaries (item 3).

In this paper we present the results of a real-effort, real-leisure 3-trustor trust game, manipulated to include noise, moral suasion and punishment. We try to replicate an organization in which three investors repeatedly decide the extent to which they wish to trust the manager. Trust is operationalized as a decision regarding the fraction of the endowment that investors wish to pass along to the manager. We use the word investor throughout this paper to describe the vulnerable player of the trust relation, i.e. the player exposed to the risk of the manager’s untrustworthiness. One of the investors in some of our treatments plays the role of a monitoring “principal”. Notice that the principal is an investor, with some extra powers detailed below. These investors are a representation of anybody who contributes capital to the firm, be they shareholders (equity capital), workers (human capital), or customers (the capital of expectations of satisfactory products). In our experiment the capital that is invested is an amount of Experimental Currency Units (ECUs). We use the word manager for the trusted party of the trust relation. Depending on the treatment, the manager can be differently interpreted as being an agent or a trustee. These different portraits of the managers our treatments possibly build in the eyes of the manager himself/herself and of the investors should not be a source of confusion, as the manager plays always the same function and takes always the same decision in *all* of the experiments detailed below.

All players (investors and manager) then earn their endowment through an actual exercise of effort. Once each player’s endowment is determined, an amount of ECUs is transferred from each investor to the manager. We call the amount of points that each individual investor transfers to the manager his/her *entrustment*. The investors keep the remainder of their endowment for themselves. The experimenter then multiplies each entrustment by a multiplier equal to 3. The manager finally distributes the sum of all ECUs he/she has available between himself/herself and all investors, without any constraint placed on his/her ability to appropriate the points available to him/her. In this game the investors’ decision

³I use the word “proviso” to mean a statement in the statutory or case law that clarifies the content of a duty, in this case the duties that managers owe the shareholders and the corporation.

to entrust ECUs to the manager is both rewarding and risky at the same time. It is rewarding because of the multiplier effect that boosts the value of their entrustments. It is risky because the manager might choose to be untrustworthy, returning little (or nothing) to each investor.

We manipulate the basic structure of the game we have just described in several ways. In the trusteeship treatment, it is common knowledge among all players that the manager is “a fiduciary. A fiduciary is held to a behaviour that is more rigorous than the one that would be acceptable in the marketplace; and to an honourable behaviour”. This statement originates in the U.S. law on fiduciary duties. We call this statement the *trusteeship proviso* throughout the paper.

In the agency treatment with the ID of the principal unknown to the manager (*IDPU*), it is common knowledge that one of the investors will monitor the manager at the end of the basic game described above. We call the investor with monitoring powers the principal. Monitoring in our experiment is a bundle of four rights:

1. The principal sees the manager’s payback to the principal;
2. The principal sees the manager’s payback to the two non-monitoring investors;
3. The principal sees the manager’s appropriation of points (*levy* for short), i.e. the number of ECUs that the manager has kept for himself/herself;
4. The principal can punish the manager at a small cost.

The manager is unaware of who in his/her group will monitor him. From the point of view of the manager, hence, any investor in his/her group could monitor him/her with equal probability. This is why we refer to this setup as featuring *shared* monitoring rights.

In the agency treatment with the ID of the principal known to the manager (*IDPK*), it is common knowledge that one of the investors will monitor the manager, and that the manager *knows* the identity of his/her principal. This setup features then *exclusive* monitoring rights.

We also study the effects of the degree of accuracy with which each investor’s entrustment is observed by the manager. We study all treatments described above in both a low-noise setup, where entrustments as seen by the manager mirror closely what was originally sent by the investors; and a high-noise setup in which with high probability the entrustments are reduced by a percentage amount of what originally sent.

In this paper we use measures of trust and trustworthiness that follow closely our definitions. Trust is measured as the investors’ entrustments to the manager. Trustworthiness is

defined as the strength of the relation between points entrusted by each investor and points returned by the manager to that investor.

Regression analysis shows that virtual organizations exposed to the trusteeship proviso feature higher trust by investors. Shared monitoring also increases trust. We do not find any effect of exclusive monitoring rights on the trust decisions, a likely sign that the non-monitoring investors did not feel safeguarded by this feature, and that the principal did not feel the need to trust more, expecting a payback simply because of his special role in the experiment.

Managers are trustworthy, in that they return more ECUs to those investors who entrust them with more ECUs. We find that the manager's trustworthiness is not changed by the trusteeship proviso, the monitoring rights (shared or exclusive), or noise. Trustworthiness seems rather a behavioural trait of our experimental managers.

We find a modest positive effect of noise on trust and a small (at best) positive effect of noise on effort. Finally, we find that leisure time was unattractive for the participants; and that punishment is frequent, but usually of a small, and probably only symbolic, magnitude.

We believe our results point to an interesting, and underexplored, feature of corporate governance regulations. Our results show that the moral suasion of the law, and the rules concerning the accountability of managers to certain constituencies, only affect the beliefs of the investors about the manager. The managers, on their side, seem mostly insensitive to these regulations, although we do find in our study that they make a modest attempt to "please" their principal, when they are aware of his/her identity.

Trust has been the subject of a rich experimental literature. Berg et al. (1995) study a two-player game in which an investor's assets can be entrusted to a manager; the manager can then decide whether to abuse the trust of the investor, or be trustworthy and reward him. This game has become popular under the name of *investment (or trust) game*. This study finds a substantial amount of trust and trustworthiness, neither of which can be justified on the grounds of Nash equilibrium analysis. Our findings in this paper provide further evidence that trust and trustworthiness play an important role in a modified investment game that is meant to reproduce some features of business organizations, like for example real effort.

Fischer et al. (2013) have questioned the purpose of organizational forms like the US benefit corporation, an organizational form adopted by several US jurisdictions that explicitly allows managers to take into consideration the interests of non-shareholder constituencies.

This organizational form is puzzling in light of the fact that only the shareholders can *de jure* hire and replace the managers, and hence we would expect the managers to feel pressed to work in the shareholders' interest only.

The manager of the virtual organization in Fischer et al. (2013) plays a dictator game where, rather than allocating resources between himself and a second player, the manager allocates resources between his principal and a charity. The authors find that the introduction of a market for managers decreases transfers to a charity, and that the introduction of a proviso taken from the German self-regulation corporate governance code does not produce any statistically significant effect on giving behaviour. As in Fischer et al. (2013), we find that provisos originating in the law do not affect the behaviour of the manager, but we find evidence that a similar proviso affects the investors' trust in the behaviour of the manager, an aspect that Fischer et al. (2013) are unable to investigate due to the non-strategic nature of the dictator "game".

Rubin and Sheremeta (2012), Corgnet et al. 2011 and Corgnet, Hernán-González, and Schniter 2013 use a real-effort platform that is very similar to the platform we use in this paper. Rubin and Sheremeta (2012) find that gift exchange contracts without shocks encourage effort and wages well above standard predictions. The introduction of random shocks that can bias effort both up or down, reduces wages offered by the principal, effort exercised by the agent, the probability of fulfilling the contract by the agent, the payoff of the principal, and total welfare. Our experimental design features noise that erodes the value of the investors' entrustment to the manager. We find a modest positive effect of noise on trust, and a small (at best) positive effect on effort.

Monitoring can be viewed as an offspring of the agency approach to corporate law, known in economics as the principal-agent model. We survey this approach in Section 4.2. We then move to a discussion of the law on fiduciaries in Section 4.3. Section 4.4 presents our design, followed by our hypotheses (Section 4.5), and the results of our empirical analysis (Section 4.6). Final remarks follow.

4.2 Agency

The institutional analysis of the firm has greatly benefited from the principal-agent model, which has opened to study the "black box"-firm of neoclassical theory, unveiling in the process the conflicting interests of principals and agents within the firm (Hart 1995).

The principal-agent model is not explicitly concerned with the promotion of trust and

trustworthiness within the firm, and any trust that does arise can be viewed as a secondary effect of the compensation-design process that constitutes the essence of this model.

Outside economics, the weight that the principal-agent model has on corporate law scholarship is pervasive, to the point that Hansmann and Kraakman (2004b, p.33) state that “corporate law prototypically deals with the basic agency problem between the firm’s owners and its managers by providing for a multi-member board of directors that is elected (at least in major part) by the firm’s shareholders and that is distinct both from the body of shareholders and from operational management”.

There are at least two different levels in agency analysis. The first one is descriptive in nature: an agency relationship arises when one party grants discretion in decision-making to a second party, who is given incentives to take decisions in the principal’s interest. The second is normative, in the sense that it concerns the attribution of the appellation of *principal*, which in turn determines in whose interest the agent should act. At the descriptive level, the corporate law scholarship has discussed *several* agency problems within the modern corporation. The first (and most studied) agency problem is the one between shareholders and managers.⁴ Other agency relationships are the one between minority stockholders (the principal) and controlling ones (the agent), and the one between managers (the agent) and other non-shareholder constituencies (all principals), such as employees and creditors (Hansmann and Kraakman 2004a). Agency relations entail two types of costs, first studied by Jensen and Meckling (1976). First, the principal will incur costs to monitor the conduct of the agent. Second, the agent will incur bonding costs, i.e. resources he will expend in order to create credible guarantees that he will not undertake actions detrimental for his/her principal.

We focus in what follows on some of the most controversial features of the agency approach. The first feature is the divergence of programs of the principal and agent. The standard claim is that the right payment scheme ensures that the agent acts similarly to the way in which the principal would like him to. The existence of diverging interests calls for continuous and professional monitoring of managerial actions. Having several principals, instead of a single one, results in an inefficient multiplication of agency costs (Lee 2006), and it increases the power of real control holders (the managers) with respect to formal control holders (usually, the shareholders, cf. Aghion and Tirole 1997).

⁴Most models do not distinguish between directors and officers, even though the roles of the two types of “managers” are quite different, and covered by different legal provisions.

The second feature of the model is the peculiar assumptions that are made on the motivational structure of the players. Both the agent and the principal are expected-utility maximizers, with the agent averse to both risk and effort, and (usually) a risk neutral principal. By focusing on the maximization of each player's *own* utility, agency theory has been blamed for creating a corporate atmosphere centred on greed and personal interest, where social norms of fairness, reciprocity and trustworthiness play no role (Gintis and Khurana 2010).

The third feature is the notion of a “principal”, i.e. of someone who enjoys the authority to draft the contract offered to the agent, in the form of payment schemes and *ex post* accountability mechanisms. We analyze this feature in light of Delaware law, the foremost jurisdiction in the United States for corporate law. Over half of the Fortune 500 companies are incorporated in Delaware (Black 2007), and the Court of Chancery of Delaware has ruled on some of the most controversial lawsuits against corporate managers of the last few decades⁵.

Delaware law grants shareholders the right to bring derivative suits, vote on extraordinary operations, and appoint the Board of Directors. Several papers have found economic rationales for such powers: Dow and Skillman (2007), for example, point out that because the “exit” option is easily available to capital investors, capital markets induce unanimity. The Delaware jurisprudence has produced rulings in which the term “principal” has been explicitly used, for example in *Unisuper*:⁶ “...the board’s power—which is that of an agent’s with regard to its principal—derives from the shareholders, who are the ultimate holders of power under Delaware law”.

4.3 Trusteeship

A minority tradition in corporate law interprets the prerogatives of corporate managers as fitting the trusteeship paradigm.⁷ The word trusteeship originates in the English jurisprudence, and stands for the appropriate standard of conduct of an individual, the trustee (or fiduciary), who controls or manages assets that he does not beneficially own (Kay 1996,

⁵Blair and Stout (1999) survey a number of these cases, some of which are quoted also in Section 4.3.

⁶*Unisuper Ltd. v. News Corporation*, C.A. No. 1699-N (January 2006). This case involved the reincorporation of News Corporation, the media company controlled by Rupert Murdoch, in Delaware from Australia.

⁷Cf. Clark (1985) and Blair and Stout (1999).

p.114). These assets are instead owned by the trustor (or beneficiary, or *cestui que trust*), who entrusts them to the trustee for different sorts of reason (e.g., lack of competency, as in the case of foundations, or death, as in the case of estates).⁸ US Courts have often found that managers are trustees of the shareholders and of the corporation itself.⁹

An analysis of the language used in the case law on fiduciaries suggests that the motivational structure trustees are expected to assume is richer than the one we find in the standard principal-agent model. The trustee is supposed to exercise a disinterested and independent judgement in relation to the assets entrusted to him. Another authoritative opinion on this matter comes from Judge Cardozo's ruling in *Meinhard*¹⁰:

Many forms of conduct permissible in a workaday world for those acting at arm's length are forbidden to those bound by fiduciary ties. A trustee is held to something stricter than the morals of the market place. Not honesty alone, but the punctilio of an honor the most sensitive, is then the standard of conduct.

Cardozo continues by pointing out that the fiduciary relationship requires of business partners renunciation of self and abnegation. Blair and Stout (2001a) claim that to satisfy Cardozo's standard the fiduciary would need to be endowed with, or assume, an other-regarding utility function. Frankel (1998, p.129) argues instead that fiduciary law requires honesty and not altruism.

Regardless of such differing opinions on the motivations that these rulings assume, when it comes to trustees Courts often indulge in psychological portraits that are hard to find in other areas of the law, creating "an aura faintly resembling that which churches try to put around the duties of ministers to their congregations or of parents to their children" (Clark 1985, p.75).

This type of language might be an instance of the expressive function of the law, i.e. the function of law in " 'making statement' as opposed to controlling behavior" (Sunstein 1996, p.2024). These statements seem able to motivate people who could be "crowded out" by the presence of monitors,¹¹ by possibly creating conformity to the standard of behaviour

⁸The leading case is *Learoyd v. Whiteley* (House of Lords, August 1st, 1887): "as a general rule the law requires of a trustee no higher degree of diligence in the execution of his office than a man of ordinary prudence would exercise in the management of his own private affairs".

⁹Cf. *Pepper v. Litton* (208 U.S. 295, 84 L.Ed. 281 60 (S.Ct., 1939)): "A director is a fiduciary, [...] so is a dominant or controlling stockholder or group of stockholders. [...] Their powers are powers in trust".

¹⁰*Meinhard v. Salmon*, 164 N.E. 545 (N.Y. 1928).

¹¹Frey (1993) is an early discussion of the distrust effects of monitoring of the agent by a principal. Falk and

described in the law.¹²

Not all business relationships possess the features of trusteeship, which leads us to the question of when it is efficiency-enhancing to carry out transactions through trustees. Blair and Stout (2001b, p.55) argue that “fiduciary relationships are created by the law in situations where it is efficient or otherwise desirable to promote other-regarding, trusting and trustworthy behaviour”. We argue that one such situation is the trust game played by a group of investors who entrust assets to a manager, who can appropriate the assets without bounds. This is the experimental design we present in the next section.

4.4 Experimental design

Our aim is to investigate the effects of two types of constraints on the manager’s behaviour that are suggested by the agency and trusteeship approaches: monitoring in the first case, and the language according to which the manager is a “fiduciary”, or trusted one, in the second. We study the effects of these constraints on investors and managers of a virtual organization that features real effort and leisure opportunities. The virtual organization is modelled as a trust game with four different investors, and one manager receiving the trust of the investors.

In the trusteeship design before the Trustor (TR) and the Trustee (TE) start playing, the experimenter announces the trusteeship proviso. This states that TE “is a fiduciary”, and that “a fiduciary is held to a behaviour that is more rigorous than the one that would be acceptable in the marketplace; and to an honourable behaviour”, as authoritatively stated in the case *Meinhard v. Salmon*. After the announcement, TR and TE play a standard investment game. This is a sequential game in which TR decides whether to entrust (*E*) TE with an investment, or not (*OUT*). TE, after having observed the decision of TR, can either abuse (*AB*) the trust, or be trustworthy (*NO*). The initial announcement is irrelevant from the point of view of the material payoffs earned by the players in the game, and is an example of cheap talk. The equilibrium predictions for our modified investment game are then the same as those in the traditional investment game. The only Subgame-Perfect Nash equilibrium is (*OUT*, *AB*), with associated payoff (δ, δ) , a Pareto inefficient result. This

Kosfeld (2006) find evidence that the principal’s decision to exercise control rights over the agent negatively affects the agent’s motivation, and find that most principals anticipate the rise of “hidden costs of control” by not exercising their control rights in the first place.

¹²On preferences to conform to principles of distributive justice, cf. Grimalda and Sacconi (2005).

equilibrium entails that TR will not invest, out of the (justified) fear that TE might abuse his/her trust. Notice in fact that, if given the possibility to choose, TE always chooses *AB* as $\beta > \alpha$. Anticipating TE's choice, TR chooses then *OUT* as $\delta > \gamma$.

The agency design we study does not feature the trusteeship proviso, and it is represented in its broad features in Figure 4.1. As in the previous case, the Principal (P) can decide whether to entrust (*E*) the Agent (A) with an investment, or not (*NO*). The Agent then decides whether to abuse the trust (*AB*), or not (*NO*). After A has made his/her decision, P can impose a penalty $p > 0$ upon TE at a cost $c > 0$ (P or P' , depending on A's choice), or abstain from punishing and simply accept A's choice (NP or NP').¹³

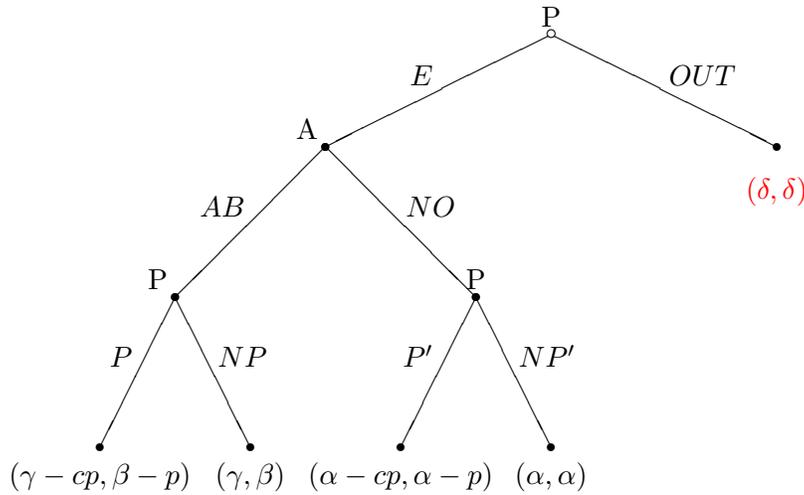


Figure 4.1: Trust Game between a principal with monitoring powers (P) and an agent (A).

Punishing is never on the equilibrium path as long as the cost of punishing c is greater than zero for the punisher. The Subgame-Perfect Nash equilibrium is (*OUT/NP/NP', AB*), with payoff, again, (δ, δ) . The strategic features of the two games are therefore equivalent from the point of view of the equilibrium payoffs, predicting that the investor, as trustor

¹³A question we do not address here is who should be the subject in charge of monitoring. Easterbrook and Fischel (1993) argue that there is no need for such a monitor to be a specific class of people, as the market can monitor managers effectively. Alchian and Demsetz (1972) argue that the monitor should be an external figure, a “meter” for the members of the corporate team. An influential case, *In re Caremark Intl Derivative Litig.* (698 A.2d 959, 967, Del. Ch. 1996), has invested the board of Directors with monitoring functions of the officers and employees of the organization. Hansmann (1996) views monitoring costs as a component of the costs of ownership, incurred by the contributors of equity capital in the capitalist form of organization. As further described below, in our experiment the principal with monitoring functions is one randomly extracted participant.

or principal, does not trust the manager, as trustee or agent, in either setup. However, we will show below that investors typically do entrust the manager with a substantial share of their endowment, against the equilibrium predictions for this game.

We modify both the trusteeship and agency designs in two main ways. First, we have 3 players entrusting resources to a manager. In the agency treatments, only one of the three investors acts as the principal with monitoring powers (principal for short), while the other 2 investors do not enjoy such powers. Having three investors, instead of only one, allows us to observe how the manager trades off one player's payoff against another's. At the same time, we wanted to keep the number of investors small enough to make it possible for the manager to balance the interests of different investors, if the manager so wishes, without incurring burdensome computations. In the agency game, the fact that there is only one principal in each group allows us to check for differences in trusting behaviour for the monitoring and non-monitoring investors.

The second modification is that both the trust and trustworthiness decisions are continuous, in the sense that, rather than giving each player two choices, investors can decide exactly how many points to entrust to the manager, and the manager can decide exactly how many points to return to each investor (including himself). This modification allows us to have a finer measure of both trust and trustworthiness.

We now describe the details of our experimental design, starting with the control study 1 (simply, Control), which is the common design of all our experiments. We then illustrate the several ways in which we manipulate this design.

1. Instructions are read by the experimenter aloud. Each participant is informed that he/she will be repeatedly interacting with 3 other players, chosen randomly at each round among those participants present in the room. The participants learn in the instructions that they will decide in the experiment how many experimental points they wish to entrust¹⁴ to a manager, one of the group members *randomly* extracted to assume this role. The exact way in which the participants decide how many points to entrust to the manager is described in detail below. These entrustments are subject to error in the transmission process. With probability $n = 0.01$, the manager observes each investor's entrustment diminished by $s = 40\%$. With probability $(1 - n) = 0.99$ the manager observes it accurately. Each entrustment is then an i.i.d. random variable from the point of view of the manager. Notice that in our study noise always erodes

¹⁴The more neutral word "transfer" was actually used in the experimental instructions.

entrustments, and we do not allow the possibility that noise can also increase their value. This simplifies the interpretation of our results because we do not have to account for differences in responses to the type of noise participants believe they are facing. We set the investment erosion parameter s at 40% in an attempt *not* to make it obvious to the manager whether he is observing an entrustment noisily or not.

After reading the instructions, the subjects complete a comprehension test that is individually checked by the experimenter.

2. In every round of play, the participants can either be an investor or a manager. Participants are privately informed on their screen about their role in each round. The two roles are randomly attributed to the participants in each round of play.¹⁵
3. Investors and manager make a decision regarding a share $r_i \in [0, 1]$, $i = (1, \dots, 3, M)$, of their endowment that they wish to entrust to the manager. r_i is our measure of each player's trust. It is common knowledge that the points entrusted by each participant are multiplied by a parameter $m = 3$ by the experimenter.
4. All participants are informed of all the trust decisions r_j of their group members.
5. All participants earn their endowment e_i through an exercise of real effort: they are presented with a 14 rows \times 10 columns matrix of 0 and 1, and they earn one ECU for every correct sum of the 1's appearing in each table (as in Abeler et al. 2011). If their sum is incorrect, they earn no credit for that table, and a new table appears. The subjects can also enjoy a leisurely alternative: they can press a button that takes them to an Internet browser (as in Corgnet et al. 2011 and Corgnet, Hernán-González, and Schniter 2013). They can revert to summing numbers at any point in time, and return to Internet at later points in time. The effort exertion period lasts for 10 minutes for all players in each session.

We chose to elicit the participant's trust decision r_i before the endowment is determined in order to capture the players' level of trust in complete absence of information regarding the features of the other participants.

6. Each participant's entrustment, including the manager's own transfer to himself/herself, is computed as $r_i * e_i$. This entrustment is subject to noise that erodes its value in

¹⁵In our actual experiment, we never use the words "manager" and "investor". The investors were simply referred to as "participants", and the manager as the "blue participant".

1% of the cases ($n = 0.01$), and leaves its value unaltered in 99% of the cases. We write from now on $r\tilde{e}_i$ for each investor i 's entrustment as seen by the manager, who cannot distinguish whether he is observing effort accurately or not.¹⁶ Each investor's entrustment $r\tilde{e}_i$ is then multiplied by $m = 3$ by the experimenter. The value of the multiplier, equal to 3, is the one most commonly found in the literature on Voluntary Contribution Mechanisms. The manager's own transfer is also tripled, but is not made subject to noise. Applying noise to the manager's effort would not be sensible, as the manager is obviously aware of his/her own effort level.

7. The manager observes each investor's entrustment, without knowing if he is observing it accurately or not (but aware of the parameter n). He is also reminded of every investor's trust decision $r_i, i = 1, \dots, 3$. The sum total of points available to the manager is $3[\sum_{i=1}^3 r_i\tilde{e}_i + r_M e_M]$, an amount we call *treasure*. The manager then decides how to divide *treasure* between himself and all other players. The payback to every investor $i = 1, \dots, 3$ is denoted $transf_{M,i}$. The manager's appropriation of points for himself/herself is denoted as $levy_M$. No bound is placed on $transf_{M,i}$ or $levy_M$. The only constraint for the manager is that $3[\sum_{i=1}^3 r_i\tilde{e}_i + r_M e_M] = \sum_{i=1}^3 transf_i + levy_M$, i.e. he must exhaust the *treasure*.
8. Subjects are informed of their payoffs, thus calculated. For the investors, $p_i = (1 - r_i)e_i + transf_i$. For the manager, $p_M = (1 - r_M)e_M + levy_M$.
9. The experiment restarts from point 2 above. Subjects are aware that the groups are randomly formed at the beginning of every round of the game, and that new endowments are earned in the course of every round. The participants were not told the exact number of rounds of play they were going to be involved in. We hoped in this way to avoid end-game effects.¹⁷
10. Subjects were paid according to their earnings in one randomly extracted round of play. The exchange rate was set at 0.5 euro cents for each ECU.

Our control study 2 differs from the control study 1 described above in that it features a higher noise parameter $n = 0.4$. Effort in control study 2 is observed noisily in 40% of the

¹⁶In the case in which noise decreases the value of actually exerted effort, the difference $r_i(e_i - \tilde{e}_i)$ returns to the experimenter.

¹⁷The number of rounds is actually 3 in all our sessions—this ensures we have the same number of observations per participant in every experimental session.

instances.

Treatment 1 is our trusteeship proviso experiment. The participants are informed in the instructions that the manager is a fiduciary, before they learn their role in the experiment. The experiment then unfolds exactly as in control study 1, with $n = 0.01$.

Treatment 2 is equivalent to Treatment 1, with the only difference of a higher noise parameter $n = 0.4$.

Treatment 3 is our agency experiment, with unknown principal ID. The instructions inform the participants that one of the investors, randomly chosen, will “observe” the conduct of the manager after the manager has made his/her decision regarding $transf_{M,i}$ and $levy_M$, i.e. after step 7 of the control study described above.¹⁸ The principal observes every investor’s and the manager’s r_i ; the noisily observed entrustments ($n = 0.01$), including the principal’s own and the manager’s; $transf_{M,i}$, i.e. the number of points each player received back from the manager; and the manager’s appropriation $levy_M$. The principal can then decide to punish the manager at a cost.¹⁹ In Treatment 3 the manager is unaware of the experimental identity of the principal: it is common knowledge only that there is a principal in the group, and that punishment has a cost $c = 0.1$ ECU. Every investor enjoys then an equal probability of $\frac{1}{3}$, from the point of view of the manager, to have monitoring power over the manager. The payoff of the principal is $p_P = (1 - r_P)e_P + transf_P - 0.1punish_P$. The payoff of the manager is now $p_M = (1 - r_M)e_M + levy_M - punish_P$. We kept the cost of punishment c as low as possible, at 0.1 ECU for every ECU-worth of punishment imposed upon the manager.

Treatment 4 is equivalent to Treatment 3, save for a higher noise parameter $n = 0.4$.

Treatment 5 is equivalent to Treatment 3 ($n = 0.01$), apart from the feature that now the manager is informed, when allocating points at stage 7 of the experiment described above, of the experimental ID of the principal.

Treatment 6 is equivalent to Treatment 5, save for a higher noise parameter $n = 0.4$.

Particular care was taken not to frame the exchange in specifically business-like terms, although the organizational features of the environment were possibly apparent to the participants due to the presence of real effort. Also, in all treatments we avoided mentioning explicitly in whose interest the manager should work. In the agency treatments, we only

¹⁸The principal with monitoring functions is referred to as the “red” participant.

¹⁹We did not use the word “punishment” in the instructions, stating simply that the principal can subtract points from the manager at a cost.

	Trusteeship proviso	Monitoring (ID of principal unknown, IDPU)	Monitoring (ID of principal known, IDPK)	Control
Low noise ($n = 0.01$)	Treatment 1 “Trustee” $P = 20$	Treatment 3 “IDPU” $P = 20$	Treatment 5 “IDPK” $P = 20$	Control 1 “Control” $P = 20$
High noise (H) ($n = 0.4$)	Treatment 2 “H-Trustee” $P = 20$	Treatment 4 “H-IDPU” $P = 20$	Treatment 6 “H-IDPK” $P = 24$	Control 2 “H-Control” $P = 16$

Table 4.1: Summary of all treatments and controls, and number of participants for each study (P).

brought to the players’ attention the existence of the principal, but refrained from stating explicitly that the manager was supposed to work in the interest of, or on behalf of, the principal.

Table 4.1 summarizes all the treatments we studied, and the number of participants in each treatment and control study. In the next section we formulate theoretical hypotheses regarding the ways in which the trusteeship proviso, shared and exclusive monitoring, and noise affect trust, trustworthiness and effort in organizations. Table 4.2 summarizes all the relevant parameters and decisions in the experiment.

4.5 Hypotheses

The coexistence in the law of instruments akin to the agency and trusteeship approaches is indicative that corporate law uses several instruments to promote trust and trustworthiness in organizations. In such environments it is typically too costly or cognitively impossible to agree *ex ante* on a way to distribute the cooperative surplus produced by the organization. On one side we have the “moral suasion”²⁰ of the trusteeship proviso, and on the other

²⁰We do not address here the question regarding which channels the law uses to shape preferences. Different possibilities include conformity, authority, and normative expectations. We use moral suasion in what follows as a catch-all term for these different aspects of the complex relationship between rules and human psychology.

Parameter	Explanation	Type
r_i	Trust	Decision
e_i	Endowment (earned through real effort)	Decision
$Internet$	Internet time	Decision
\tilde{e}	Noisily observed effort	Controlled by n
$treasure$	Sum of all entrustments	See text
$transf_{M,i}$	Payback (absolute)	Decision
$transfperc_{M,i}$	Payback (percentage)	Decision
$levy_M$	Points kept by the manager (absolute)	Decision
$levyperc_M$	Points kept by the manager (percentage)	Decision
$steal_M$	Points kept by the manager (percentage), net of manager's own transfer	Decision
$payoff$	Payoff in each round	See text
$punish$	Punishment	Decision
$return$	Return on investment	See text
$pMINE$	$(p - e)$	See text
n	Noise level	Parameter
m	Multiplier	Parameter
s	Erosion of the investment	Parameter

Table 4.2: Summary of all the decisions and parameters of our experiment.

the monitoring rights enjoyed by the principal.²¹ These two instruments can be viewed as safeguards meant to decrease the frequency of Nash equilibria in the trust game, and increase the frequency of trusting/trustworthy, and efficiency-enhancing, behaviour.

We briefly consider the incentive effects of these two instruments, using the distinction drawn by Williamson (1998, Ch.6) between high-powered and low-powered incentives. High-powered incentives are typical of, but not exclusive to, markets, where the efficiency gains from a particular transaction flow directly to the parties transacting, who have strong incentives to monitor performance. Low-powered incentives are typical of firms, where changes in effort exercised have little immediate effect on outcomes for the worker.

Williamson's analysis provides rationales for the existence of organizations featuring both types of incentives. High-powered incentives exacerbate opportunism in the pursuit of

²¹This mix of instruments is likely superior to the traditional remedy proposed by the New Institutional Economics literature (e.g. Hart and Moore 1990), i.e. authority. Dow (1987, p.20) notices that: "Transaction cost theorists tend to see authority primarily as a remedy for opportunism, rather than as a device which might be abused in an opportunistic fashion", pointing out the perverse effects of any residual-control structure on non-controlling constituencies. The same point has been made by Sacconi (2006), who discusses the problem of the abuse of authority and argues in favour of a multi-fiduciary governance structure.

increasing one's share of the gains from trade, but usually increase efficiency. Low-powered incentives can entail an efficiency loss, but are more effective if opportunistic behaviour would be very costly for the organization, or if the managers have intrinsic motivations that could be crowded out by high-powered incentives.²²

We take the monitoring powers of the principal as an instance of high-powered incentives offered to the manager, as the principal has voice over the rents the manager appropriates. We take the moral suasion of the trusteeship proviso as an example of low-powered incentives, as the investors have no direct voice over the manager's decisions. The investors rely on the trusteeship proviso alone in order to constrain the self-interest of the manager, and promote his/her trustworthiness. We formulate three testable hypotheses regarding the way in which our manipulations affect trust, trustworthiness, and effort.

Hypothesis 1 *The trust decision r_i is bigger in magnitude in the trusteeship treatments, and in the treatment with a principal of unknown ID, compared to a control with the same noise level.*

We hypothesize that the investors will entrust assets to the manager in the presence of low-powered incentives. We hypothesize that high-powered incentives might produce the same result, but only when the manager cannot attempt to establish a tacit agreement with the principal. The terms of this tacit agreement between the manager and the principal of known ID likely entail that the manager divides *treasure* between himself and the principal, abusing the trust of all the other investors in the process. We expect the trust level in the agency setup with a principal of known ID, and the trust level in the control, to be close.

We suspect that in the treatment with a principal of known ID not even the principals' trust might be increased by their special role in the game. To the contrary, principals might try to maximize their payoff by keeping all their endowment for themselves, and expecting the managers to assign points to them simply because of their role in the game. Managers might assign points to their principals, even in the presence of low entrustments by the principals, in the fear of being otherwise punished.²³

Hypothesis 2 *The manager is more trustworthy in the treatments compared to a control.*

We expect that some form of incentive is needed in order to promote the manager's

²²Intrinsic motivation "involves people doing an activity because they find it interesting and derive spontaneous satisfaction from the activity itself" (Gagné and Deci 2005, p.331).

²³Rajan and Zingales (1998) study a similar scenario, in which an entrepreneur who owns an asset may not invest optimally in the organization that employs the asset. This is because the entrepreneur may threaten the other contributors of organization-specific investments to sell his stake to a third party.

trustworthiness. Depending on the motivational structure of the manager, low-powered or high-powered incentives might perform better in increasing the manager's trustworthiness. The literature has in this regard found an heterogeneity of responses of managers to high-powered incentives. Dickinson and Villeval (2008) find that principals frequently engage in costly monitoring, and most participants react to monitoring by increasing effort. Effort decreases, however, when monitoring passes a certain threshold.

Notice that the trustworthiness of the manager cannot involve a single parameter as in the case of trust. Trustworthiness is tied to the strength with which the manager reciprocates the investor's trust with a payback to that investor, in the treatments versus the control study. We describe in further details our measures of trustworthiness in the next section.

Hypothesis 3 *Noise depresses effort e_i , trust r_i and trustworthiness.*

We believe we might replicate the finding in Rubin and Sheremeta (2012) that noise depresses effort. We also hypothesize that noise might discourage trustworthiness, as the manager might feel he does not have adequate information to be trustworthy; and that noise might also discourage trust, if trust is based on the expectation of trustworthiness.

4.6 Results

160 subjects participated in total in our experimental sessions. All sessions took place at the Cognitive and Experimental Economics Laboratory of the University of Trento (Italy), using a computerized interface. The subjects were all undergraduate students of the University of Trento, all majoring in one of the Social Sciences. We ensured all the sessions were gender balanced upon enrolment of the participants. The participants won on average 14 euros, including a 3 euro show up fee. The top earning manager won about 100 euros in the course of the experiment. The experiment lasted on average 1 hour and 10 minutes. No participant took part more than once in our study. Instructions for all treatments and controls are available from the corresponding author upon request.

Table 4.3 shows the descriptive statistics for all the variables of interest in our study. The mean of the trust decision r_i is 50%. The variable features a high coefficient of variation $c_v = 0.65$. e_i is the endowment, with $c_v = 0.39$, and subjects earning on average one ECU per minute. *Internet* measures the seconds participants spent browsing the Internet. At 5 seconds on average out of 10 minutes, the mean of *Internet* is a clear sign that the leisure option was rarely used in our experiment. *treasure* is the number of points available to the manager for redistribution, equal on average to 73 ECUs, highly dispersed with $c_v = 0.44$.

The variables $transf_{M,i}$ and $transfperc_{M,i}$ show the number of points, in absolute and in percentage terms of *treasure*, that individual investors receive back from the manager. Both variables are highly dispersed, with coefficients of variation equal to 1 in both cases. Individual investors receive back on average 15% of the *treasure*. $levy_M$ and $levyperc_M$ are the amount of points, in absolute and in percentage terms of *treasure*, that the manager keeps for himself/herself. Managers keep on average about 50% of the points available, well below the pure self-interest scenario in which they keep all points for themselves. The difference between $levyperc$ and $transfperc$ amounts to about 37%. We find first evidence then that the managers have assigned more ECUs to themselves than to investors. When we subtract from $levyperc_M$, however, the fraction of points that were directly transferred by the manager (i.e., $\frac{(3*r_{MeM})}{treasure}$), managers appropriate about 20% of the points on average (variable $steal_M$). p is the payoff, also highly dispersed.

Table 4.3: Summary statistics

Variable	Mean	Std. Dev.	N
r	0.571	0.371	460
e	11.23	4.655	453
Internet	4.643	25.327	460
treasure	72.922	32.431	456
transf	10.99	10.711	342
transfperc	0.154	0.141	342
levy	39.207	31.369	114
levyperc	0.528	0.258	114
steal	0.198	0.304	111
payoff	22.779	21.081	456
punish	3.873	8.528	63
return	-6.46	11.92	338
pMINE	5.11	8.82	339

Punishment occurs in about 50% of the sessions, but it is usually of a small magnitude, about 4 points on average. Principals seem almost to be making a symbolic gesture, rather than a decision able to impact the payoff of the manager. Figure 4.2 shows that no punishment at all is the modal choice in our experiment, both in the sessions with high noise and with low noise. The variable *return* is computed as the difference between $transf_{M,i}$ and the number of points entrusted by every investor to the manager, multiplied by 3 (i.e., $3 * r_i * e_i$). This return is on average negative, both in the low noise and the high noise sessions. We observe that only 27% of all investors earn a positive return on their investment

(cf. also Figure 4.3). $pMINE$ is an alternative measure of return on investment, computed as the difference between the payoff p actually earned by the investors and their endowment of points e_i . $pMINE$ measures the extent to which the players have been better off investing what they actually invested, compared to the alternative (counterfactual) scenario in which they would have chosen the OUT strategy, setting $r = 0$, and keeping all their endowment e_i for themselves. Using this measure of return, the investors have earned a modest positive return on their investment of about 5 points, in absolute terms.

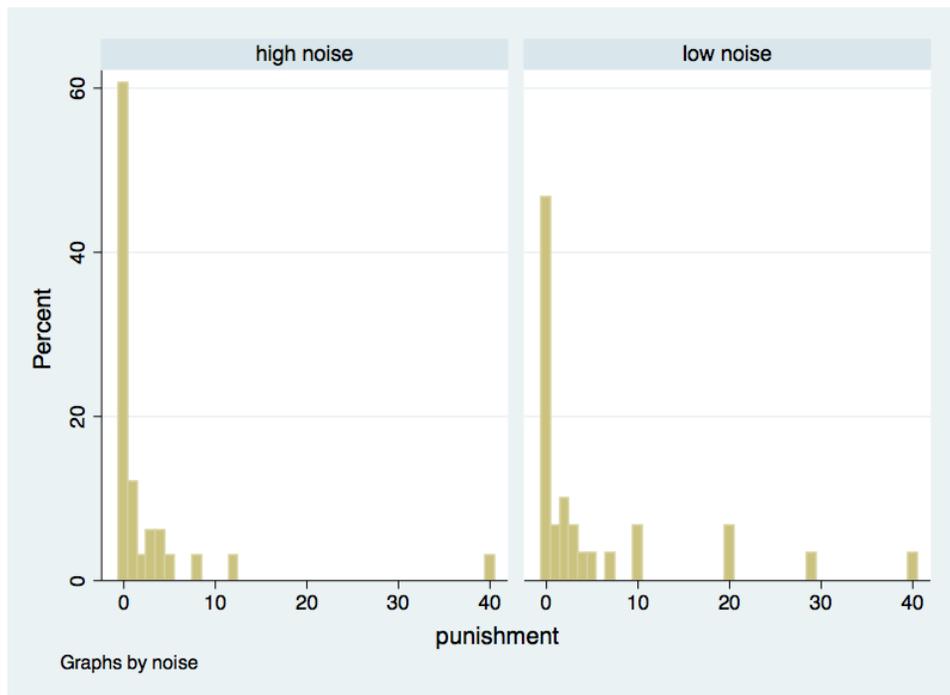


Figure 4.2: Histogram of the punishment decision $punish$

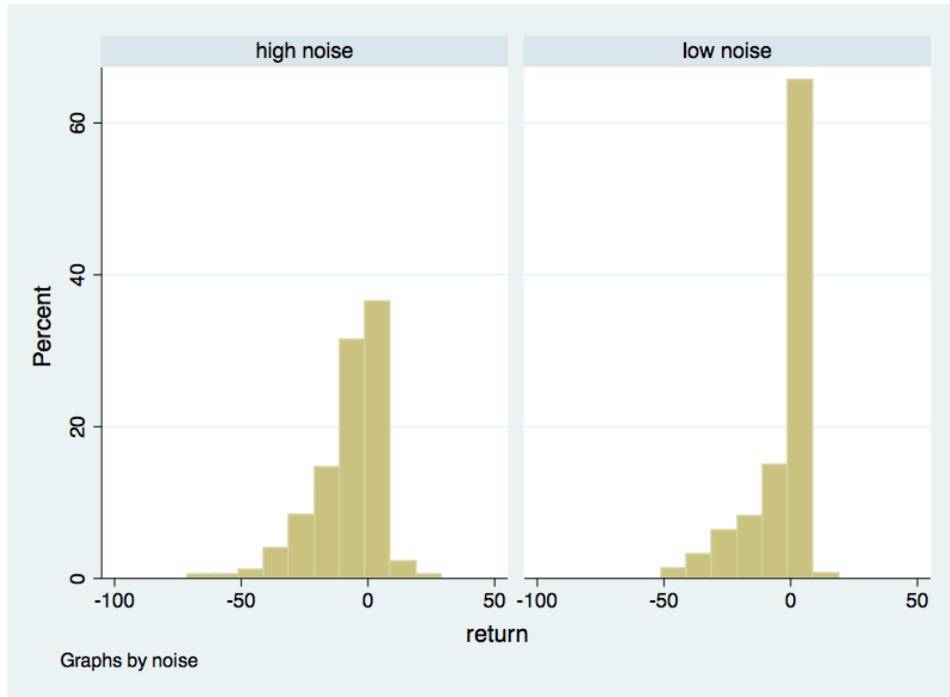


Figure 4.3: Histogram of the return on the investors' investment

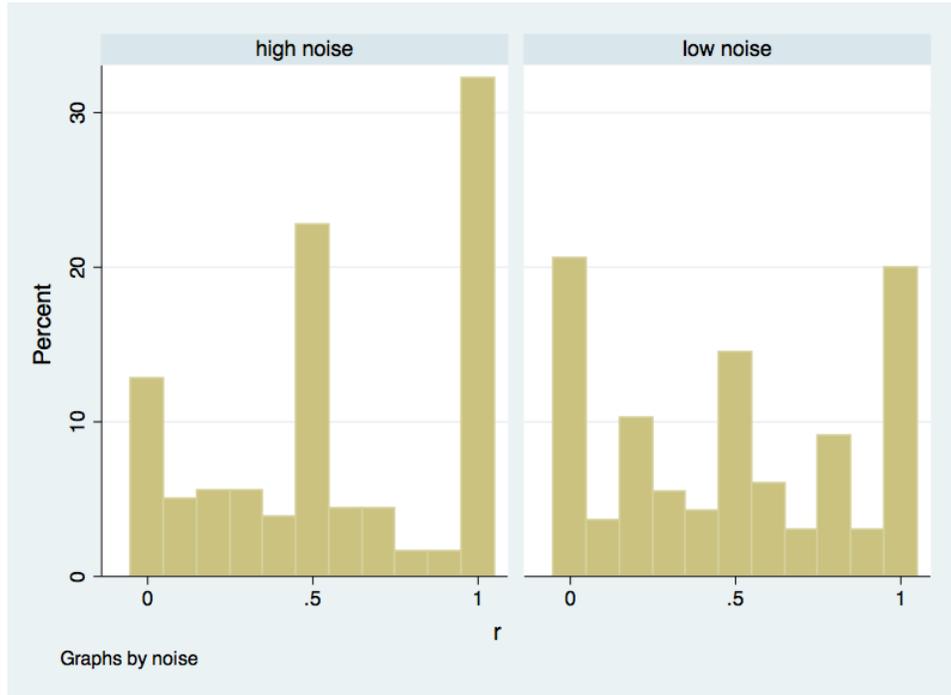
We turn now to the analysis of the trust of investors.

4.6.1 Trust

Investors rarely choose the *OUT* option in our experiment, setting $r = 0$ only in 16% of the cases. Investors²⁴ instead set $r = 1$ in 25% of the cases, making themselves completely vulnerable to the trustworthiness of the manager. Figure 4.4 is a histogram of the variable r_i , which shows that $r = 1$ is the modal choice in the high-noise sessions, and close to the modal choice in the low-noise sessions.

Figure 4.5 shows the mean of the investors' trust decision r_i in all our treatments and controls, using the notation for the different treatments and controls introduced in Table 4.1. An initial visual inspection of the panel shows that trust decision r_i is highest in

²⁴Although managers also choose r_M in the game, knowing their role in the experiment, we exclude their r_M from the analysis in this section. The managers' choice cannot in fact be viewed as an expression of trust, being instead simply a transfer of points from the manager to the manager. We choose to let the managers pick r_M , as the other investors, to avoid confusions in the participants as to the working of the experiment and the computation of the payoffs, considering that the players play the game for several rounds, and can assume different roles (manager/investor) in the course of the experiment.

Figure 4.4: Histogram of the trust decision r_i

the trusteeship-proviso treatments, followed closely by the treatments with a principal of unknown ID.

Motivated by this finding, we look for further evidence of the effectiveness of our manipulations through regression analysis. We first regress the trust decision r_i of every investor $i = 1, \dots, 3$ on the variable *trustee*, a dummy equal to one for treatments 1 and 2 where the trusteeship proviso is used; on the variable *principunknown*, equal to one for treatments 3 and 4, where there is a principal of unknown ID; on the variable *principknown*, equal to 1 for treatments 5 and 6 where there was a principal of known ID; and on the variable *noiseshigh*, equal to 1 for treatments 2, 4, 6, and for control 2, where $n = 0.4$. The dummy variables capture the marginal effect of our trusteeship, agency, and noise manipulations on trust, compared to the baseline control study with low noise (Control). We also include in the regression time dummies for the second and third repetition of the game. We estimate the coefficients through ordinary least squares, and always cluster the standard errors at the level of the group of players interacting in a particular round, in order to correct for correlation of the error terms within a cluster. Table 4.4 displays the estimation output.

We find that trust decision r_i is significantly higher when the trusteeship proviso is used,

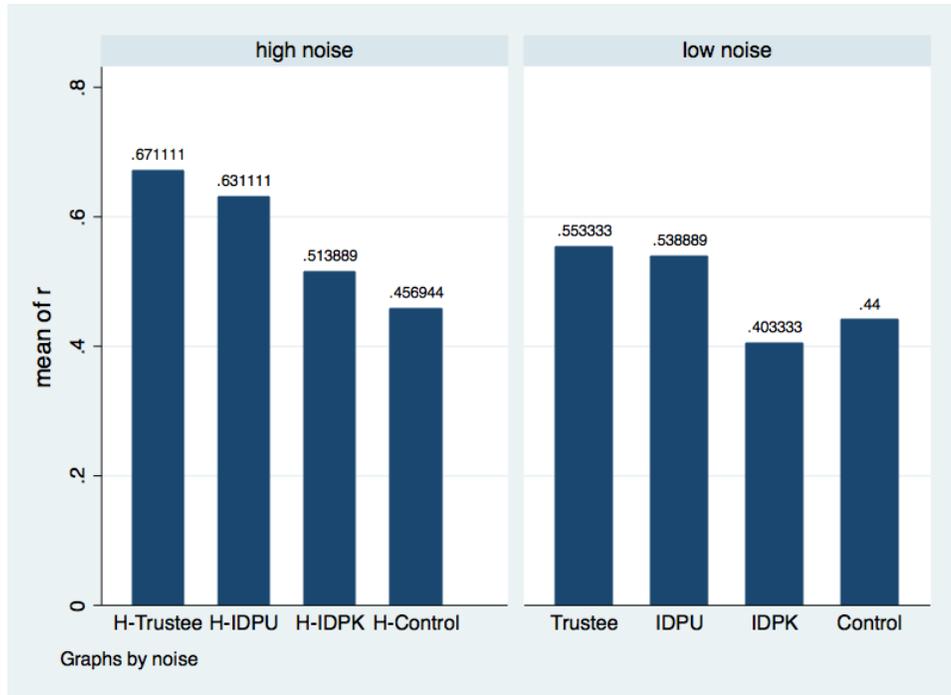


Figure 4.5: Mean trust decision r_i in all treatments and controls. The labels of each column are explained in Table 4.1

Table 4.4: Estimation results : regressand is trust decision r_i

Variable	Coefficient	(Std. Err.)
trustee	0.163***	(0.049)
principknown	0.011	(0.050)
principunknown	0.136**	(0.056)
noiseshigh	0.088**	(0.036)
t2	0.055	(0.043)
t3	0.052	(0.045)
Intercept	0.369	(0.045)

*** significant at 1%; ** significant at 5%; * significant at 10%;

compared to the Control. We find also that r_i is higher when there was a principal whose ID was not known to the manager, compared to the Control.²⁵ The marginal effects are of an interesting magnitude, higher than 10% in both cases. r_i in the treatments with a principal of known ID is no different than in the Control, a likely sign that the investors did not feel safeguarded by this type of safeguard. The investors seem to have felt differently in the case of shared review rights, where the manager cannot attempt to tacitly collude with the principal. This finding suggests that making the conduct of the manager accountable to the broadest set of investors might effectively foster trust in organizations. The trusteeship proviso commonly found in the case law on managerial duties is able to increase trust in the behaviour of the manager, likely in the belief that the manager will be sensitive to the moral suasion of the law, and behave trustworthily.

We find also evidence that noise increases trust, by a modest amount.²⁶

A non-parametric Jonckheere-Terpstra test confirms that r_i is higher in the trusteeship treatments compared to the control, for both the low and high noise sessions (p-values=0.041 and 0.001, respectively).

We next explore whether noise had an effect on the effort through which all the participants (investors and managers) earn their endowment. In this case we use $e_i, i = 1, \dots, 3, M$, as the dependent variable, i.e. the effort exerted by both the investors and the manager. We regress effort e_i on each player's own r_i , on the mean r_i chosen by the other three group members ($meanr_{-i} = \frac{\sum_{j \neq i=1}^3 r_j}{3}$), on treatment, manager and time dummies. The estimation results are displayed in Table 4.5.

Participants who entrust a higher share of their endowment to the manager exert significantly less effort. Conversely, participants that entrust a smaller share of their endowment to the manager decide to work significantly more, appropriating hence to a larger degree the fruits of their own labour. We interpret this finding as a result of the loss of control over their endowment of the participants, once a share of their endowment is entrusted to the manager. This loss of control might be bigger for those investors who trust the manager more, depressing the effort level of these participants.

The finding that a higher level of the other participants' mean r_j significantly depresses

²⁵We find *no* evidence that r_i in the trusteeship proviso sessions is higher than r_i in the sessions with a principal of unknown ID.

²⁶Estimating the standard errors through bootstrapping, 200 repetitions, leads to equivalent inferences. We also estimate the same model through a random effect panel estimator with robust standard errors. All coefficients and signs are unchanged, the only difference being that the standard errors of the coefficients of *principunknown* and *noischigh* become larger, making the coefficient significant only at 10%.

Table 4.5: Estimation results : regressand is effort e_i

Variable	Coefficient	(Std. Err.)
r	-1.599**	(0.654)
meanr	-3.509***	(1.146)
manager	-0.035	(0.481)
trustee	-0.105	(0.649)
principknown	0.000	(0.646)
principunknown	-0.234	(0.575)
noisehigh	0.764*	(0.411)
t2	2.245***	(0.464)
t3	3.717***	(0.508)
Intercept	11.949	(0.913)

*** significant at 1%; ** significant at 5%; * significant at 10%;

e_i , by a magnitude that exceeds the marginal effect of the participant's own r_i , is puzzling. In a standard Voluntary Contribution Mechanism, in which the *treasure* is divided in equal shares among all participants, this finding could be interpreted as an example of free-riding behaviour. In our setup, where no contractual rule of redistribution exists, we did not expect to find this attempt to free-ride on the other player's trust. Our hypothesis is that participants belonging to groups with higher $meanr_{-i}$ expected a larger payback from the manager, who would reward the (generally trustful) investors. In creating this expectation, a higher level of trust in the group might have reduced the incentives of the participants to exert higher effort.

We have weak evidence at 10% significance that high noise slightly increases effort, possibly in an attempt of the investors to neutralize the effect of noise, which erodes the value of their entrustments to the manager. An alternative explanation, i.e. that the investors picked a higher trust decision r_i knowing they would perform slightly worse than the others, seems unlikely considering that the subjects picked their r_i not knowing exactly the nature of the effort exertion task. Finally, the subjects seem to have become more expert at the task in the course of the experiment. ²⁷

²⁷It is possible that both the dependent variable e_i and the player's own r_i are expression of some underlying characteristic of the players that determines both their trust and their productivity. If this is the case, r_i would not be an exogenous regressor. In light of this possibility we carry out the same regression, but without r_i as a regressor. The coefficient of $meanr_{-i}$ in this regression is still negative and significant at 1%, and of a magnitude very similar to the one shown in Table 4.5. The coefficient of *noisehigh*, still positive, becomes less precisely estimated and becomes insignificant at all conventional levels.

4.6.2 Trustworthiness

While three investors in each group, in each round, are relevant for the purposes of trust analysis, only the manager's choices are relevant for the analysis of his/her trustworthiness. As we have mentioned in Section 4.5, trustworthiness is concerned with the strength with which the manager returns more ECUs to those players who entrusted him/her with more ECUs, in the treatments versus the control studies. Figure 4.6, a scatterplot of points sent by each investor versus points received back by the same investor, shows that managers have been generally trustworthy. The relation appears less strong in the treatments featuring high noise ($n = 0.4$). The first measure of trustworthiness we use is the strength of the correlation between $transfperc_{M,i}$ on one side, and e_i and r_i on the other, with $i = 1, \dots, 3, M$. We also include in the regression $meanr_{-i}$, treatment and time dummies. The estimation output is reproduced in Table 4.6.

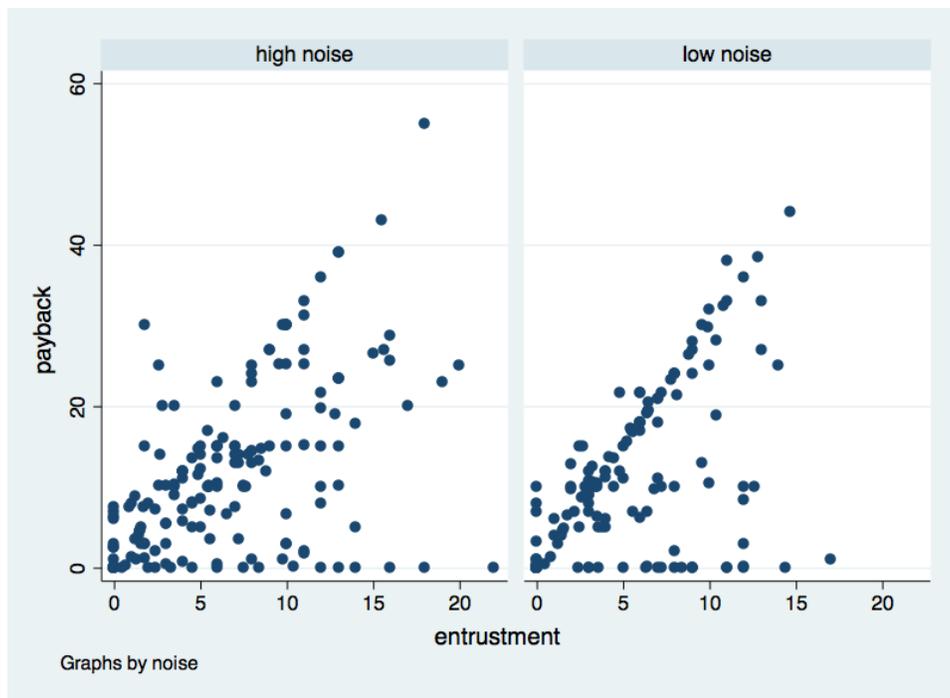


Figure 4.6: Scatterplots of points sent by each investor versus points received back from the manager, for the sessions with high and low noise.

The manager reciprocates higher trust with a richer transfer back of ECUs. The coefficients of e_i and of the time dummies are significant, but of a small magnitude. This finding can be taken as further evidence of the pervasive role of reciprocity in strategic interactions.

Table 4.6: Estimation results : regressand is $transfperc_{M,i}$, no cross-interaction terms between r_i , e_i and the treatment dummies

Variable	Coefficient	(Std. Err.)
e	0.006***	(0.001)
r	0.189***	(0.022)
meanr	-0.048	(0.049)
trustee	-0.004	(0.025)
principknown	0.035	(0.022)
principunknown	0.011	(0.025)
noisehigh	-0.005	(0.015)
t2	-0.050***	(0.018)
t3	-0.073***	(0.019)
Intercept	0.039	(0.042)

*** significant at 1%; ** significant at 5%; * significant at 10%;

The manager's baseline trustworthiness, as observed in the Control, seems not to have been modified by our manipulations.

Our second measure of trustworthiness builds on the first, and it tries to measure not only the strength of the relation between $transfperc_{M,i}$ on one side, and e_i and r_i on the other, but also whether this relation is stronger in the treatments compared to the baseline control with low noise (Control). We regress $transfperc_{M,i}$ on e_i , r_i , $meanr_{-i}$, treatment and time dummies, and 8 interaction terms between r_i , e_i on one side, and the treatment dummies and the high noise dummy on the other. The estimation output is shown in Table 4.7. We find strong evidence of a strong positive relation between the participant's trust in the manager r_i and the participant's payback. The magnitude of the coefficient is very similar to the one shown in Table 4.6. Also in this specification we find no evidence of our manipulations having an effect on the strength of the manager's trustworthiness. A non-parametric Jonckheere-Terpstra Test, for the low noise sessions, confirms that $transfperc_{M,i}$ is not higher, nor lower, in our Treatment 1 (trusteeship proviso, $n = 0.01$), compared to the Control ($n = 0.01$). The same test finds that $transfperc_{M,i}$ is significantly higher in Treatment 2 (trusteeship proviso, $n = 0.4$) compared to the Control with $n = 0.4$ (p-value=0.007). Non-parametric testing therefore provides some evidence of the trusteeship language increasing the average payback, but only for the high noise sessions.

Finally, a regression of payoffs on manager, treatment and time dummies provides only strong evidence of players doing better in rounds 2 and 3, and of the manager doing better compared to other investors (Table 4.8).

Table 4.7: Estimation results : regressand is $transfperc_{M,i}$, with cross-interaction terms between r_i , e_i and the treatment dummies

Variable	Coefficient	(Std. Err.)
e	0.002	(0.004)
r	0.220***	(0.060)
meanr	-0.045	(0.050)
trustee	-0.044	(0.060)
principknown	-0.032	(0.054)
principunknow	0.017	(0.069)
noisehigh	0.013	(0.037)
t2	-0.047**	(0.019)
t3	-0.072***	(0.019)
rIDPU	-0.002	(0.064)
rIDPK	0.006	(0.069)
rtrustee	-0.039	(0.065)
eIDPU	-0.001	(0.005)
eIDPK	0.006	(0.004)
etrustee	0.006	(0.004)
noiser	-0.038	(0.043)
noisee	0.001	(0.003)
Intercept	0.065	(0.052)

*** significant at 1%; ** significant at 5%; * significant at 10%;

Table 4.8: Estimation results : regressand is $payoff$

Variable	Coefficient	(Std. Err.)
blue	24.416***	(3.291)
trustee	1.899	(1.947)
principknown	-0.982	(1.701)
principunknow	-1.283	(1.762)
noisehigh	0.498	(1.270)
t2	5.938***	(1.376)
t3	8.138***	(1.475)
Intercept	12.005	(1.882)

*** significant at 1%; ** significant at 5%; * significant at 10%;

4.6.3 Behaviour of the principal

We look for differences in behaviour between the principal, in those treatments where his/her ID is known to the manager, and the other investors without monitoring rights. Jonckheere-Terpstra tests find that principals do not trust the manager more, and they do not exert higher effort. Principals enjoy, however, a higher *transfperc* compared to the other players, by a magnitude of about 8%. This difference is significant according to the Jonckheere-Terpstra test. Considering that principals have not invested more than other investors, it seems that this (modest) extra payback was the result of the manager's fear of being punished by the principal.

The same nonparametric tests find that principals whose ID is not known to the manager do not trust the manager significantly more, do not work significantly more, and they do not have a significantly higher payback compared to the investors without monitoring rights.

4.6.4 Discussion

The introduction of a mere sentence in the trusteeship treatments increases significantly the willingness of the stakeholders to contribute to the manager. Shared, as opposed to exclusive, monitoring rights by the investors produce similar effects. We find evidence then in support of Hypothesis 1 from Section 4.5. In line with the past literature (Berg, Dickhaut, and McCabe 1995), we find a substantial amount of trusting behaviour. The fact that the trusteeship proviso significantly increases trust can be taken as evidence that the proviso has modified the expectations of the players regarding the behaviour of the manager. Abeler et al. (2011) manipulate the reference point in a simple effort provision game, finding ample evidence that reference points play a role in effort provision. The finding that exclusive monitoring rights do not increase the investors' trust, not even the investor/monitor's, can be considered as a case in favour of an open corporate governance system, whereby all stakeholders can potentially challenge the behaviour of the manager, in the perspective of the manager.

Regarding Hypothesis 2, we find strong evidence that the manager is trustworthy, i.e. he returns more points to those investors who entrust him with more points. The finding that managers are trustworthy is in line with previous studies by Berg, Dickhaut, and McCabe (1995) and Fehr and Gächter (1998). The strength of the manager's is trustworthiness, however, is not enough to guarantee a positive return on investment to most of the investors. This is due to the fact that the manager appropriates about 50% of the available points,

and the remaining 50% of the points are not enough to guarantee most players a positive return on investment. We could summarize this articulated answer to the question whether managers are trustworthy or not by saying that managers are “50% trustworthy”.

We do not find any effect of our manipulations on the managers’ trustworthiness. The finding that the manager’s behaviour is not affected by the trusteeship proviso we introduce is similar to the finding in Fischer et al. (2013) that the introduction of a multi-stakeholder clause in the manager’s contract does not significantly modify transfers to a charity. We would like to caution the reader, however, against taking this finding to mean that corporate governance institutions are in general irrelevant in the promotion of the managers’ trustworthiness. In our environment managers faced two simple forms of incentives, while managers of real world business organizations face a mix of different high-powered and low-powered incentives, often reliant on monetary, status, reputation, honourability and career concerns managers typically exhibit.

A further concern is that simply reading the trusteeship proviso to the players, stating that the manager is held to an honourable behaviour, might not be enough to change the nature of the interaction for the manager, who could still view himself as unbound to any specific notion of fairness and trustworthiness to the investors. At the moment, the correct interpretation of our findings regarding the managers’ trustworthiness is that in an environment characterized by one-shot interactions, and complete anonymity, the managers are trustworthy but not sensitive to moral suasion and costly *ex post* monitoring. It will be a subject for further research to isolate minimal requirements for institutions to effectively play a role in leveraging the managerial trustworthiness. We suggest in the final remarks section one possible, conservative avenue through which this could be achieved.

Regarding Hypothesis 3, we find that noise has at best a modest positive effect on trust and a small positive effect on effort, the latter only significant at 10%. This finding goes against our expectations in Hypothesis 3, based on the recent literature on noise in virtual organizations. It seems that the players have made an attempt to neutralize the effect of noise that erodes the value of their investments, by trusting the manager more, and working slightly more. Overall, our findings confirm that noise plays a role in behaviour observed in virtual organizations, albeit in a direction that we did not expect. The increased willingness of the players to trust and exert effort in the face of high noise that we uncover is likely an artefact of the particular type of noise we use, which *negatively* affects the entrustments of the investors. It will be interesting to verify in future research whether the introduction

of positive and negative shocks to entrustments changes the direction of the effect of noise on trust and effort.

We do not find any effect of noise on trustworthiness. We believe this to be an interesting finding, in its own way: the manager does not take advantage of the noise in effort provision to return fewer ECUs to each investor, and most likely uses each investor's r_i as guidance in deciding how to redistribute points.

In our study leisure seems to have been an unappealing option for participants. Corgnet et al. (2011) and Corgnet et al. (2013) find that in the presence of individual-incentive schemes leisure loses appeal compared to the treatments with team-incentive schemes, even though subjects spend on average about 15% of their time browsing the Internet even with individual-incentive schemes, well above our finding (less than 1% of time spent on average browsing the Internet).

Participants who trust the manager more earn smaller endowments than groups who entrust less ECUs to the manager. Punishment is frequent, but of a very small magnitude. We estimate that principals enjoy a premium, in the redistribution process, of about 7%. Managers seem hence not to feel pressed to reward the principal in any sizeable way, in the likely expectation of small punishments. The finding that punishment is often of a symbolic amount is striking in light of the previous literature on punishment in Public Good Games (cf. Fehr and Gächter 2000). One possible explanation is that the roles of principal and agent were actually flipped in the mind of the two categories of players, i.e. the principal framed himself as subordinate to the manager, because the latter had decision making power over the distribution of points. This framing might have made punishment of a smaller magnitude than we would have expected.²⁸

In our study, the trusteeship proviso and the *ex post* monitoring rights of the principal mostly produce their effects through the beliefs of the investors regarding the behaviour of the manager. A potential implication of this finding is that the law concerning the governance of corporations seems to be perceived as a bigger constraint on managerial behaviour by the stakeholders of the firm, rather than by the managers themselves. The investors could be viewed as playing an incomplete-information version of the trust game with the manager. In this game, the investor is uncertain as to the sensitivity of the manager to the trusteeship proviso. In particular, the trusteeship proviso increases the desirability, from the point of view of the manager, of the trustworthiness outcome in the trust game

²⁸Milgram (1963) was among the first to document the pervasive role of obedience in decision-making.

with probability q . The proviso does not change the preferences of the manager with respect to this outcome with probability $(1 - q)$. This setup can possibly accommodate an analysis of the investors' beliefs that are consistent with actual play, and with equilibrium analysis.

4.7 Final remarks

Notice that in the agency treatment studied here principals cannot offer reward schemes to agents, and there is no bargaining between the two sides over the appropriation of quasi-rents arising from the relationship, as customary in principal-agency models. Our experimental game of choice to study the two types of constraints outlined above cannot easily capture those contractual features of the relationship between principals and agents. At the moment, therefore the agency study captures only one aspect of the complex relationship between principals and agents, namely the accountability of the agent to the principal.

It would be interesting to verify if the possibility to form a non-binding agreement between investors and managers about the rules of redistribution of the entrustments could increase the managers' trustworthiness.

A limit of the experimental design presented here is the lack of a market for managers, and of a market for the ownership of the business organization (corporate control). Untrustworthy managers can typically expect a reputation loss if future business owners can observe the manager's past trustworthiness accurately. Similarly, poorly managed organizations can expect a loss in market value, and be subject to takeovers, and to a change in management. We hypothesize that in the presence of a market for managers or for corporate control the beliefs of the investors about the manager, and the observed behaviour of the manager, would be more closely aligned than we observe in this paper.

Chapter 5

Conclusions

The results of the three experimental inquiries presented in this Thesis confirm the important role of institutions and norm-compliance in different strategic environments.

Chapter 2 evaluates how norms of symmetry and centricity affect the functioning of two ways to allocate resources described in the economic anthropology literature, namely reciprocity and redistribution. The baseline reciprocity study, with no explicit priming of the norm of symmetry, features near-zero levels of allocative efficiency. Consistent with the anthropological framework we use throughout, we find that priming the norm of symmetry among the players through pre-play communication dramatically increases efficiency. Next we study a game of redistribution and find that in the final stages of the game allocative efficiency levels consistently approach 100%, regardless of how the chief comes to acquire centricity in the group. We conclude that reciprocity and redistribution can seldom allocate resources efficiently in the absence of norms of symmetry and centricity in the institutional design. By way of comparison, we confirm a robust finding in the experimental economics literature that a simple market exchange game reaches near-full efficiency.

Chapter 3 presents the results of an experimental investigation of the network formation game described in Bala and Goyal (2000), for the setup with no decay of links and two-way flow of benefits. We reexamine the role of heterogeneity in network formation games by allowing players to share personal information with their opponents. We find no evidence that heterogeneity and perceived similarity influence networking choices. We find a low degree of naive best responses, high inertia in the game, and a high degree of efficiency—showing that although Nash networks are rare in this setup, subjects have often come very close to achieving an equilibrium network. The results also show the instability of Nash

networks in this setup, and the role of inequity considerations. We find a role for reciprocity in discouraging naive best responses, and a carry over effect of not-so-immediate past choices, two findings that we take as evidence that players try to coordinate on a burden-sharing arrangement, whereby each player takes alternately charge of forming a link to the other player.

Chapter 4 discusses two instruments through which corporate law attempts to promote trust and trustworthiness in business organizations: (i) monitoring of the manager by a principal, as in the agency approach; (ii) moral suasion, as in the approach according to which managers are “fiduciaries”. We are interested in gaining insights on the effectiveness of these two instruments in promoting: (i) profitable, but at the same time risky, entrustments of assets to a manager from a group of investors earning their endowment through real effort; (ii) a higher payback for those investors who entrust more assets to the manager. The first is a measure of trust of the investors in the manager, while the second is a measure of the manager’s trustworthiness. We use a real-effort, real-leisure 3-trustor trust game, manipulated to include noise, moral suasion and punishment. We find that moral suasion increases the investors’ trust. Monitoring also increases the investors’ trust, but only in the case in which the manager is not aware of the experimental identity of his/her principal. The manager is trustworthy up to a certain degree, regardless of the governance structure of the organization and of the accuracy with which she observes each investor’s entrustment. Finally, we find a modest positive effect of noise on trust, but no strong effect of noise on effort or trustworthiness.

The findings presented in this Thesis are evidence of the pervasive effect of institutions and norm compliance on individual decisions. The findings also confirm that the methodology of laboratory experiments is a privileged instrument to study institutions and compliance with social norms, due to the possibility to easily and effectively manipulate the “rules of the game” to which experimental participants are exposed.

References

- Abeler, J., A. Falk, L. Goette, and D. Huffman (2011). Reference points and effort provision. *The American Economic Review* 101(2), 470–492. 64
- Acemoglu, D. and J. Robinson (2012). *Why nations fail: the origins of power, prosperity, and poverty*. Random House Digital, Inc. 5
- Aghion, P. and J. Tirole (1997). Formal and real authority in organizations. *Journal of political economy*, 1–29. 58
- Alchian, A. A. and H. Demsetz (1972). Production, information costs, and economic organization. *The American economic review* 62(5), 777–795.
- Alesina, A. and G.-M. Angeletos (2005). Fairness and redistribution. *American Economic Review*, 960–980. 5
- Alexander, R. (1984). *The biology of moral systems*. New York: Aldine de Gruyter.
- Algan, Y. and P. Cahuc (2013). Trust and growth. *Annual Review of Economics* 5(1), 521–549.
- Bala, V. and S. Goyal (2000, September). A noncooperative model of network formation. *Econometrica* 68(5), 1181–1230.
- Ballester, C., A. Calvó-Armengol, and Y. Zenou (2006, 09). Who’s who in networks. *Econometrica* 74(5), 1403–1417.
- Becchetti, L., G. D. Antoni, and M. Faillo (2010). Let’s meet up! the role of relational goods in promoting cooperation. *The Journal of Socio-Economics* 39(6), 661 – 669.
- Berg, J., J. Dickhaut, and K. McCabe (1995). Trust, reciprocity, and social history. *Games and Economic Behavior* 10(1), 122–142. 50, 81
- Berninghaus, S., K.-M. Ehrhart, M. Ott, and B. Vogt (2007, June). Evolution of networks - an experimental analysis. *Journal of Evolutionary Economics* 17(3), 317–347.
- Bicchieri, C. (2005). *The grammar of society: The nature and dynamics of social norms*. Cambridge University Press. 15
- Black, L. S. (2007). Why corporations choose Delaware. Technical report, Delaware Department of State Division of Corporations. 59
- Blair, M. and L. Stout (2001a). Director accountability and the mediating role of the corporate board. *Washington University Law Quarterly* 79, 403.

- Blair, M. M. and L. A. Stout (1999). A team production theory of corporate law. *Virginia Law Review*, 247–328.
- Blair, M. M. and L. A. Stout (2001b). Trust, trustworthiness, and the behavioral foundations of corporate law. *University of Pennsylvania Law Review* 149(6), 1735–1810. 53
- Bowles, S. (2009). *Microeconomics: behavior, institutions, and evolution*. Princeton University Press.
- Boyd, R. and P. Richerson (1989). The evolution of indirect reciprocity. *Social Networks* 11(3), 213–236.
- Cameron, A. C. and P. K. Trivedi (2009). *Microeconometrics using STATA*, Volume 5. College Station, TX: Stata Press. 47
- Cameron, A. C. and P. Trivedi (2005). *Microeconometrics: Methods and Applications*. New York: Cambridge University Press. 46, 47
- Clark, R. (1985). Agency costs versus fiduciary duties. In J. W. Pratt, R. Zeckhauser, and K. J. Arrow (Eds.), *Principals and agents: The structure of business*. Cambridge, MA: Harvard Business School Press. 60
- Corgnet, B., R. Hernan-Gonzalez, and S. Rassenti (2011). Real effort, real leisure and real-time supervision: Incentives and peer pressure in virtual organizations. Technical report, Chapman University WP. 57, 64
- Corgnet, B., R. Hernán-González, and E. Schniter (2013). Why real leisure really matters: Incentive effects on real effort in the laboratory. Technical report, Chapman University WP. 57, 64
- Corriveau, L. (2012). Game theory and the kula. *Rationality and Society* 24(1), 106–128.
- Cox, J. C., E. Ostrom, V. Sadiraj, and J. M. Walker (2013). Provision versus appropriation in symmetric and asymmetric social dilemmas. *Southern Economic Journal* 79(3), 496–512. 17
- Currarini, S., M. O. Jackson, and P. Pin (2009, 07). An economic model of friendship: Homophily, minorities, and segregation. *Econometrica* 77(4), 1003–1045.
- Dickinson, D. and M.-C. Villeval (2008). Does monitoring decrease work effort?: The complementarity between agency and crowding-out theories. *Games and Economic Behavior* 63(1), 56–76.
- Dow, G. K. (1987). The function of authority in transaction cost economics. *Journal of Economic Behavior & Organization* 8(1), 13–38.
- Dow, G. K. and G. L. Skillman (2007). Collective choice and control rights in firms. *Journal of Public Economic Theory* 9(1), 107–125.
- Earle, T. (1997). *How chiefs come to power: The political economy in prehistory*. Stanford University Press.
- Easterbrook, F. H. and D. R. Fischel (1993). Contract and fiduciary duty. *Journal of Law and Economics* 36, 425.

- Falk, A. and M. Kosfeld (2003, May). It's all about connections: Evidence on network formation. IZA Discussion Papers 777, Institute for the Study of Labor (IZA).
- Falk, A. and M. Kosfeld (2006). The hidden costs of control. *The American Economic Review*, 1611–1630.
- Farrell, J. and M. Rabin (1996). Cheap talk. *The Journal of Economic Perspectives* 10(3), 103–118.
- Fehr, E. and S. Gächter (1998). How effective are trust-and reciprocity-based incentives? In A. Ben-Ner and L. G. Putterman (Eds.), *Economics, values and organizations*, pp. 337–63. Cambridge University Press. 50
- Fehr, E. and S. Gächter (2000). Cooperation and punishment in public goods experiments. *The American Economic Review* 90(4), 980–994. 83
- Fehr, E. and K. M. Schmidt (2006). The economics of fairness, reciprocity and altruism—experimental evidence and new theories. *Handbook of the economics of giving, altruism and reciprocity* 1, 615–691.
- Fischer, S., S. J. Goerg, and H. Hamann (2013, February). Cui bono, benefit corporation? Technical report, MPI Collective Goods Preprint, No. 2013/04, Available at SSRN: <http://ssrn.com/abstract=2226382> or <http://dx.doi.org/10.2139/ssrn.2226382>.
- Frankel, T. (1998). Fiduciary duties. In *The new Palgrave dictionary of economics and the law*, Volume 2, pp. 127–132. London: McMillan.
- Frey, B. S. (1993). Does monitoring increase work effort? the rivalry with trust and loyalty. *Economic Inquiry* 31(4), 663–670.
- Gagné, M. and E. L. Deci (2005). Self-determination theory and work motivation. *Journal of Organizational behavior* 26(4), 331–362. 69
- Galeotti, A., S. Goyal, and J. Kamphorst (2006, February). Network formation with heterogeneous players. *Games and Economic Behavior* 54(2), 353–372.
- Gintis, H. and R. Khurana (2010). Corporate honesty and business education. In M. C. Jensen and P. J. Zak (Eds.), *Moral markets: The critical role of values in the economy*. Princeton University Press. 59
- Gode, D. and S. Sunder (1997). What makes markets allocationally efficient? *The Quarterly Journal of Economics* 112(2), 603–630. 8
- Goeree, J. K., M. A. McConnell, T. Mitchell, T. Tromp, and L. Yariv (2010, February 2010). The 1/d law of giving. *American Economic Journal: Microeconomics* 2(1), 183–203.
- Goeree, J. K., A. Riedl, and A. Ule (2009). In search of stars: Network formation among heterogeneous agents. *Games and Economic Behavior* 67(2), 445 – 466.
- Gray, K., A. F. Ward, and M. I. Norton (2014). Paying it forward: Generalized reciprocity and the limits of generosity. *Journal of Experimental Psychology*.
- Greif, A. (2006). *Institutions and the path to the modern economy: Lessons from medieval trade*. Cambridge University Press. 2

- Greiner, B. and M. Levati (2005). Indirect reciprocity in cyclical networks: An experimental study. *Journal of Economic Psychology* 26(5), 711–731.
- Grimalda, G. and L. Sacconi (2005). The constitution of the not-for-profit organisation: Reciprocal conformity to morality. *Constitutional Political Economy* 16(3), 249–276. 5
- Guala, F. and L. Mittone (2010). How history and convention create norms: An experimental study. *Journal of Economic Psychology* 31(4), 749–756.
- Güth, W., R. Schmittberger, and B. Schwarze (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior & Organization* 3(4), 367–388.
- Haller, H. and S. Sarangi (2005). Nash networks with heterogeneous links. *Mathematical Social Sciences* 50(2), 181 – 201.
- Hansmann, H. (1996). *The ownership of enterprise*. Cambridge Mass: Harvard University Press.
- Hansmann, H. and R. Kraakman (2004a). Agency problems and legal strategies. In R. Kraakman (Ed.), *The anatomy of corporate law: A comparative and functional approach*, pp. 33–70. Oxford University Press. 58
- Hansmann, H. and R. Kraakman (2004b). The basic governance structure. In R. Kraakman (Ed.), *The anatomy of corporate law: A comparative and functional approach*, pp. 33–70. Oxford University Press.
- Hart, O. (1995). Corporate governance: some theory and implications. *The Economic Journal* 105(430), 678–689. 57
- Hart, O. and J. Moore (1990). Property rights and the nature of the firm. *Journal of Political Economy*, 1119–1158. 68
- Isaac, B. (2005). Karl Polanyi. In J. Carrier (Ed.), *A handbook of economic anthropology*. Cheltenham, UK.: Edward Elgar Publishing. 7
- Isaac, M., K. F. McCue, and C. R. Plott (1985). Public goods provision in an experimental environment. *Journal of Public Economics* 26(1), 51–74.
- Jensen, M. C. and W. H. Meckling (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3(4), 305–360.
- Johnson, A. W. and T. Earle (2000). *The evolution of human societies: from foraging group to agrarian state*. Stanford University Press.
- Kandel, E. and E. P. Lazear (1992). Peer pressure and partnerships. *Journal of political Economy* 100(4), 801. 5
- Kay, J. (1996). *The business of economics*. Oxford: Oxford University Press. 60
- Kosfeld, M. (2009). Network experiments. Iew - working papers, Institute for Empirical Research in Economics - IEW.

- Ledyard, J. (1995). Public goods: A survey of experimental research. In A. Roth and J. Kagel (Eds.), *The handbook of experimental economics*, Volume 1. Princeton: Princeton University Press.
- Lee, I. (2006). Efficiency and ethics in the debate about shareholder primacy. *J. of Corp. L* 533(31). 58
- Lee, J. (2011). Kula and relation capital: Rational reinterpretation of primitive gift institution. *Rationality and Society* 23(4), 475–512.
- Lévi-Strauss, C. (1965). Introduzione all’opera di Marcel Mauss. In M. Mauss (Ed.), *Teoria generale della magia e altri saggi*. Torino: Einaudi.
- Malinowski, B. (1978). *Argonauts of the Western Pacific: An account of native enterprise and adventure in the archipelagoes of Melanesian New Guinea*. Routledge.
- McKelvey, R. and T. Palfrey (1992). An experimental study of the centipede game. *Econometrica: Journal of the Econometric Society*, 803–836.
- Milgram, S. (1963). Behavioral study of obedience. *The Journal of Abnormal and Social Psychology* 67(4), 371.
- Niskanen, W. (2009). The undemanding ethics of capitalism. *Cato J.* 29, 559. 7
- North, D. (1977). Markets and other allocation systems in history: the challenge of Karl Polanyi. *Journal of European Economic History* 6(3), 703–716. 7
- North, D. (1994). Economic performance through time. *The American Economic Review* 84(3), 359–368.
- Nowak, M. and K. Sigmund (1998). Evolution of indirect reciprocity by image scoring. *Nature* 393(6685), 573–577.
- Ostrom, E., J. Walker, and R. Gardner (1992). Covenants with and without a sword: Self-governance is possible. *American Political Science Review* 86(02), 404–417.
- Polanyi, K. (1944). *The great transformation: the political and economic origins of our time*. Rinehart. 5
- Polanyi, K. (1957a). Aristotle discovers the economy. In K. Polanyi, C. Arensberg, and H. Pearson (Eds.), *Trade and market in the early empires*. New York: The Free Press.
- Polanyi, K. (1957b). The economy as instituted process. In K. Polanyi, C. Arensberg, and H. Pearson (Eds.), *Trade and market in the early empires*. New York: The Free Press. 5, 6, 7
- Rajan, R. G. and L. Zingales (1998). Power in a theory of the firm. *The Quarterly Journal of Economics* 113(2), 387–432.
- Rawls, J. (1999). *A Theory of Justice, rev. ed.* Cambridge, MA: Belknap Press. 26
- Rong, R. and D. Houser (2013). Growing stars: A laboratory analysis of network formation. Technical report, <http://faculty.weber.edu/rongrong/>.
- Rubin, J. and R. Sheremeta (2012). Principal-agent settings with random shocks. Technical report, Available at SSRN 2152623.

- Sacconi, L. (2006). A social contract account for csr as an extended model of corporate governance (i): Rational bargaining and justification. *Journal of Business Ethics* 68(3), 259–281.
- Sacconi, L. and M. Faillo (2010). Conformity, reciprocity and the sense of justice. *Constitutional Political Economy* 21(2), 171–201.
- Sacconi, L., M. Faillo, and S. Ottone (2011). Contractarian compliance and the ‘Sense of Justice’. *Analyse & Kritik* 33(1).
- Schotter, A. (1981). *The economic theory of social institutions*. Cambridge: Cambridge University Press. 1
- Silver, M. (1983). Karl Polanyi and markets in the ancient Near East: The challenge of the evidence. *Journal of Economic History* 43(04), 795–829.
- Smith, V. (1982). Markets as economizers of information: Experimental examination of the “Hayek Hypothesis”. *Economic Inquiry* 20(2), 165–179.
- Sunstein, C. R. (1996). On the expressive function of law. *University of Pennsylvania Law Review* 144(5), 2021–2053. 60
- Uberoi, J. (1971). *Politics of the Kula ring: an analysis of the findings of Bronislaw Malinowski*. Manchester University Press.
- Valensi, L. (1974). Anthropologie économique et histoire: l’œuvre de Karl Polanyi. *Annales*, 1311–1319. 6
- Williamson, O. E. (1975). *Markets and hierarchies: antitrust analysis and implications*. New York: The Free Press.
- Williamson, O. E. (1998). *The economic institutions of capitalism*. New York: Free Press.
- Wooldridge, J. M. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. *Journal of Applied Econometrics* 20(1), 39–54.
- Yamagishi, T., N. Mifune, J. H. Liu, and J. Pauling (2008). Exchanges of group-based favours. *Asian Journal of Social Psychology* 11(3), 196–207. 5