

# The Emergence of Social Structure: Employer Information Networks in an Experimental Labor Market

Klarita Gërxhani, Jordi Brandts and Arthur Schram

July 26, 2010

## ABSTRACT

We use laboratory experiments to investigate how employers develop social structures for sharing information about the trustworthiness of job candidates, when worker opportunism is possible. The experimental data show that substantial information sharing emerges. Two types of information networks are observed. One consists of ‘anonymity networks’ where information is anonymously and voluntarily provided as a collective good for all to use. The other type is a ‘reciprocity network’ where information sharing is driven by the rewarding of previously given information by the requestor. In both types, the extent of information sharing depends on the costs of providing it. Moreover, information sharing enables employers to recruit trustworthy workers which creates a high quality of trading, benefiting both employer and worker.

**Keywords:** Social structure, Information networks, Recruitment, Experiments

## Acknowledgements

Financial support by the Spanish *Ministerio de Educación y Ciencia Ministerio*, the Barcelona GSE Research Network Recognition of Research Program and Consolider Ingenio 2010 (CSD2006-00016) and NWO (VENI #451-04-106) is gratefully acknowledged. Remaining errors are ours.

## Authors

Klarita Gërxhani	Jordi Brandts	Arthur Schram
Department of Sociology Amsterdam Centre for Inequality Studies University of Amsterdam Oudezijds Achterburgwal 185 1012 DK Amsterdam the Netherlands phone +31-20-525.4113 fax: +31-20-525.3010 <a href="mailto:k.gerxhani@uva.nl">k.gerxhani@uva.nl</a>	Department of Business Economics U. Autònoma de Barcelona and Institut d'Anàlisi Econòmica, CSIC Campus UAB 08193 Bellaterra (Barcelona) Spain phone +34-93-580.6612 fax +34-93-580.1452 <a href="mailto:Jordi.Brandts@uab.es">Jordi.Brandts@uab.es</a>	CREED Amsterdam School of Economics University of Amsterdam Roetersstraat 11 1018 WB Amsterdam The Netherlands phone +31-20-525.4293 fax +31-20-525.5283 <a href="mailto:Schram@uva.nl">Schram@uva.nl</a>

## INTRODUCTION

Understanding the emergence of social structure is a central issue in sociology (Parson 1937; Cook and Emerson 1978, Granovetter 1985; Coleman 1986; Kollock 1994, Lawler and Yoon 1996). By a social structure we mean any configuration of social relations (Granovetter 1985). The study of social structure is an area in which sociology has significantly contributed to the social sciences. In spite of an increasing interest over the past decade (Brown et al. 2004; Bandiera et al. 2009, 2010; Fehr and Gintis 2007; Karlan et al. 2009) mainstream economists have typically paid less attention to it. Though many economists have now come to recognize that a full understanding of human behavior is impossible without taking the social context into account,<sup>1</sup> its dynamics and the way this affects economic systems such as markets has received much less attention.

The recent award of the economics Nobel prize to Oliver Williamson can be seen as a recognition of the importance of the structure involving traders in hierarchical firms vis-à-vis organized markets. Williamson (1975, 1985) has argued that markets and hierarchical firms represent alternative governance structures which differ in their approaches to resolving conflicts of interest. In his seminal paper, Granovetter (1985) gives credit to Williamson's recognition of structure but emphasizes the lack of focus on the social relations and their dynamics in which both markets and firms are embedded. Uzzi (1997) stresses the need to examine how distinct inter-employer relationships affect the development of different types of transactions.

In this paper we combine the sociological concept of social structure with the economic concept of a labor market. We examine the emergence of a particular social structure, to wit networks for information sharing between employers when hiring new employees. We analyze how, in the process of sharing information, employers develop social relations. We also study in detail the structure of these social relations, as well as how they affect the relation between employers and workers on the labor market. Our study illustrates some of the ways in which material incentives and emerging social relations interact and may therefore be seen as an attempt to contribute to bridging the gap between sociology and economics (Gintis 2008).

Information sharing networks are prominent in a number of areas of social and economic life in which there is uncertainty about certain characteristics of some of the relevant agents

---

<sup>1</sup> There is some indication of an increased influence of sociology in the economics literature. For example, the number of citations to the AJS and ASR in the 2009 volume of the *Quarterly Journal of Economics* was 8, after averaging 3.6 in 1997-2008.

(Rees 1966; Raub and Weesie 1990). Think, for instance, of the sharing of information about the reliability of borrowers in the financial sector (Karlan et al 2007; Brown and Zehnder 2005); about the quality of applicants to higher education institutions; or about the appropriateness of particular individuals as marriage partners. In this paper we focus on the role of information networks in the recruitment process for new personnel.<sup>2</sup> In the hiring process employers are often quite uncertain about particular characteristics of prospective candidates. Recruiting involves, among other things, finding ways to uncover as much of this information as possible. Whereas some characteristics may be derived from information provided directly by a candidate (her education may be informative about her human capital or productivity, for example) other characteristics may be harder to find out about. We will focus on one such characteristic in particular, to wit, the candidate's *trustworthiness* in situations where worker opportunism is possible.

In a stylized representation of the hiring process employers can be considered to recruit workers through two broad channels: on the one hand the 'official' (a.k.a. 'formal') channel which resembles a centralized market and on the other informal networks (Rees, 1966; Montgomery, 1991; Marsden, 2001; Russo et al., 2001). In a centralized market, numerous employers and workers interact and a substantial part of the information about offers and trades is disseminated to all market participants. In many countries, public or private employment agencies provide the services of such centralized exchanges; some of the internet job-matching sites have similar characteristics. The other broad recruitment channel consists of informal networks in which contacts between employers and workers are made in a much more decentralized way.<sup>3</sup> This channel is widely used and for some types of jobs, it generates the most job matches (Granovetter 1974, 1995; Corcoran et al. 1980; Holzer 1987; Boxman and Flap 1991; Montgomery 1991). It is important to note that social relations may play an important role in both channels, though the type of relations and their effect may differ. This will be an important element in the discussion below.

The choice between recruitment channels involves a trade-off between the centralized market's possibility of establishing contacts with a large number of workers and the network's more accurate information about the prospective worker's trustworthiness. In many occupations workers have considerable discretion about their performance at a job (e.g.,

---

<sup>2</sup> The information networks that we study are networks in the sense of Podolny and Page (1998) of a collection of actors that pursue repeated, enduring exchange relations with one another without a legitimate organizational authority to arbitrate and resolve disputes that may arise during the exchange. Many business groups and strategic alliances are instances of such networks without a formal arbiter.

<sup>3</sup> We have in mind contacts between workers and employers that are generated by informal referrals from one employer to another, such as information given in talks on the golf course.

Williamson 1981; Milgrom 1988; Baker 1992; Goldthorpe 2000; Eguchi 2005). In jobs where such opportunism is possible and monitoring is difficult and costly, acquiring information about a candidate's trustworthiness may be a crucial element in the recruitment process. If so, the performance history of prospective workers may be relevant information at the time of the recruitment decision. This information pertains directly to actual work-related behavior in the past and therefore it may indicate how trustworthy a worker may be expected to be in the present. "Better than the statement that someone is known to be reliable is information from a trusted informant that he has dealt with that individual and found him so..." (Granovetter 1985:490). Other employers that have previously employed the worker may be seen as trusted informants in the Granovetter sense.

In Schram et al. (forthcoming) we use laboratory experiments to study an environment in which employers can choose between hiring via a centralized market and hiring via bilateral negotiations with a specific worker. The latter can be seen as an informal recruitment channel.<sup>4</sup> In that previous paper, information about workers' trustworthiness in previous jobs was automatically available to employers. Our focus was on the endogenous emergence of the use of bilateral trading and on its effects on trading quality (e.g., wage and worker performance). We observed that approximately 30% of all job contracts were bilaterally negotiated and that –contrary to what simple economic intuition might suggest– material surplus was higher when trades were bilateral.

The central focus of the present study is the deeper question of how and under what circumstances social relations amongst employers facilitate the dissemination of information about workers' trustworthiness. In addition we establish the effects of such relations on the choice of recruitment channel and the trading quality that results from this. The emergence of information sharing between employers is not a priori obvious. While each individual employer is interested in obtaining information from others, none has a direct material incentive in providing it; sometimes it may even be costly to do so. However, the existence of pro-social motivations, the influence of reputation and the interaction of these two forces may lead to the emergence of stable social relations between employers that give rise to information networks.

We study the effects of two properties of information networks that may affect the way information is shared (as proposed by Raub and Weesie 1990). The first is whether, in the

---

<sup>4</sup> Though the informal recruitment precedes the actual bilateral negotiations, they are completely linked in our setting, in the sense that one negotiates bilaterally with a worker if and only if one receives information about this worker through informal contacts with other employers. We therefore often loosely refer to the informal recruitment channel as bilateral negotiations.

process of information sharing, employers' identities are known or not. We study both the case in which an employer who requests information can identify those other employers who decide to transfer information and those that do not (and vice versa, the employer who asks for information can be identified) and the case where identification is not possible. This distinction will allow us to separate the impact on the formation of social networks of on the one hand reputation building and reciprocity and on the other hand pro-social behavior aimed at anonymous others. The former is impossible without identification.

More specifically, this distinction is important, because closure of networks (Coleman 1988) is only possible with identification. Closure measures the extent to which any two agents connected in a network both have connections to the same third parties (Burt 2005; Karlan et al. 2009). Coleman points out that in a closed network reputation can arise, sanctions are possible and thus effective social norms can emerge. As a consequence, if in creating information networks employers are guided by self-interest, then relatively closed networks will be most effective and therefore identification will positively affect the probability that successful information networks will emerge. On the other hand, if social embeddedness is the main generator of information sharing (Granovetter 1985; Uzzi 1997), then calculative risk and monitoring systems may be less important and closure is immaterial. As argued in Lawler and Yoon (1996), the commitment to a social network would in this case be driven by a moral obligation to contribute to a collective good rather than by utilitarian purposes. In this line of argument, identification is not necessary for the emergence of information networks and may even be harmful (Granovetter 1985).

The second property we focus on is the existence of an information transmission cost. We study both the case without such a cost and the case where employers that accept transmitting information have to bear a cost for doing so (e.g., financial costs or time spent on looking for the information).<sup>5</sup> These costs may limit the effectiveness of stable employer information networks, even in the presence of common interests (Raub and Weesie 1990).

The environment we study is one with more workers than employers, i.e., of excess supply for workers.<sup>6</sup> Together with the fact that the quality of workers' performance cannot be contractually fixed, this creates a certain balance in the social relation between employers and workers. Workers have a market disadvantage in that not all of them can be employed,

---

<sup>5</sup> Note that it can also be costly to maintain networks (see Marsden 2001), but we do not consider this aspect here.

<sup>6</sup> This is empirically the more relevant case to study and it is also the one that has received more attention in previous studies. Kollock (1994) sees this as an important case to study. See Schram et al. (forthcoming) and Brandts and Charness (2004) for studies that also consider the case of excess demand for workers, i.e. the case of more employers than workers.

but have an advantage within the employment relation, because they can independently determine their performance after the wage has been established.

There are no theoretical models that suggest to the analyst what behavior to expect in a study of social exchange in a complex environment like the one used here. The empirical method we apply is that of laboratory experimentation. The laboratory provides an ideal environment to study social structures because one can observe with precision their emergence and the underlying mechanisms. The two main virtues of laboratory experiments are control and replicability. Causal knowledge requires controlled variation (see Falk and Heckman 2009) and the laboratory allows for tight control over the environment in which interaction takes place. At the same time, it is possible to generate sufficient data in a simple way.

There are some other experimental studies in sociology studying the emergence of exchange relations. In his seminal study Kollock (1994) analyzes how the establishment of fixed trading partnerships (e.g., between an employer and employee) depends on the uncertainty about the quality of the good to be traded. Among the lessons for social exchange theory he includes “the need to investigate the emergence of social structure as well as its effects, and the relevance of reputation (and other factors related to the signaling and collection of information) to exchange process” (Kollock 1994:g342).<sup>7</sup> For some more recent examples of experimental research in sociology see Willer and Walker (2007), Webster and Sell (2007) and Bohnet (2009).<sup>8</sup>

Our study combines insights and methods from sociology and economics. Fehr and Gintis (2007) present a strong argument for the need for such interaction. They discuss some of the experimental and analytical foundations of human motivation and social cooperation. Among the issues to be studied they refer to the micro-foundations of emergent patterns of social interactions. Our experiment explicitly allows for such a micro-macro perspective (as in Corten and Buskens 2010). The macro-level conditions we vary are the cost of information transmission and the identifiability of employers. We then analyze the effects of these variations on other macro-level properties such as the resulting information exchange network. Since we can observe all individual decisions (for example, whether or not to give information) we can study in detail how behavior at the micro-level leads to macro-level outcomes.

---

<sup>7</sup> Brown et al. (2004) are an example of economists interested in very similar issues.

<sup>8</sup> To our knowledge, ours is the first experimental study on how employers’ networks for sharing information about trustworthiness arise and evolve. There are some experimental studies on network formation (e.g., Callander and Plott 2005, Corbae and Duffy 2008, Falk and Kosfeld 2003, Goeree et al. 2008 and Corten and Buskens 2010), but these are quite different from ours on many dimensions. One important difference is that they do not deal with information sharing.

The results show some levels of trust and trustworthiness emerging in the social relation between employer and worker even without information sharing. This occurs in a substantial minority of cases (25%-40%) and was previously observed by Fehr et al. (1993). Our main focus however is on the extent to which the social relations between employers facilitate information sharing and the effect that this has on the employer-worker relation. Our results show a considerable level of information sharing. Depending on the properties of the information network, between 50% and 95% of the information requests are met with a positive response. The level of information sharing is considerably higher (more than 90%) when information transmission is costless than when it is costly (50%-60%), but it is unaffected by the possibility of employer identification. With identification, the extent of closure of networks has limited effect on how information networks influence recruitment, but the number of network connections an employer has does positively and strongly affect the trustworthiness of the workers she hires.<sup>9</sup> Specifically, employers that share information hire workers that are more often trustworthy than others (on average in 60%-75% of the cases). As a consequence, employers that recruit through informal channels earn on average 16% more than those who do not. Workers hired informally earn 55% more than those hired through the formal channel.

In short, employers in our experiment are able to develop social relations in which they share information, even when providing information is costly. When they can identify each other, they form stable information networks with varying extent of closure. Without identification, information is shared as a collective good, available to all to use. In both cases, the information generated in the social relations between employers allows them to use the informal recruitment channel to find trustworthy workers and thus create a high quality of trading that benefits both employer and worker.

## **METHOD**

### **Design**

In the laboratory, the experimental situation is presented in terms of a market in which an abstract good is traded between buyers and sellers. However, given our focus on recruitment in the labor market, we will henceforth maintain the reference to ‘employers’ and ‘workers’ instead of buyers and sellers, respectively.

---

<sup>9</sup> Streeck (2005) points out that social networks are most often not egalitarian. Indeed, amongst employers, there are two fairness dimensions interacting here; the possible differential access to the employers’ network and the differential access to trustworthy workers.

Our design consists of four separate experimental treatments, varying along two dimensions. The first dimension consists in whether or not employers can identify each other when sharing information.<sup>10</sup> The second dimension along which our treatments differ is in whether information is costless or costly. We ran a full 2x2 combinatorial design. It is a between-subject design meaning that each participant takes part in only one group of one of the treatments. Table 1 summarizes our design and gives the number of experimental groups we ran per treatment cell.

**Table 1: Experimental Treatments**

	Costless information	Costly information
No identification	6 groups	6 groups
Identification	5 groups	9 groups

### **Participants**

The experiment was run in the spring of 2009 at the CREED laboratory of the University of Amsterdam. A total of 234 participants were recruited from CREED's subject pool. This consists of around 2000 individuals who have voluntarily registered. Almost all of these are undergraduate students at the University of Amsterdam. When the experiment was announced, all received an invitation to sign up and participation was on a first-come, first-serve basis. Participants took part in nine sessions, with a total of 26 groups (see table 1). In each group, four participants were employers and five were workers and each participant had the constant role of either an employer or of a worker. Sessions lasted approximately 135 minutes, and participant earnings were performance based, with an average of €29.75 (including a €7 show-up fee).

### **Procedures**

The participants in any session of the experiment interact during a total of 30 rounds, preceded by three practice rounds. The same four employers and five workers interact anonymously in a group throughout the 30 rounds. A labor contract always involves one employer and one worker, so that each trader (employer or worker) can be involved in at most one contract per round, and there can be at most four contracts per group and round. The 30

---

<sup>10</sup> In the experiment, participants take part anonymously. As explained below identifiability is based on fixed participant codes and makes it possible to keep track of another participant's decisions over time. Of course, non-identifiability is not intended to describe actual practice in social relations between employers. Instead, it provides a benchmark that allows us to isolate the role of identification in social relations.



rounds are split into the 10 initial rounds and the 20 subsequent rounds which constitute the central part of our sessions. We first present the workings of the central 20 rounds and later the initial 10 rounds.<sup>11</sup>

The description of the central part of our treatments involves two inter-linked parts: the description of how agreements are reached and the description of how information is disseminated through networks. In the 20 rounds of the central part of our sessions recruitment can take place through two channels: a centralized market or bilateral (private) negotiations. Employers and workers can choose whether to enter the centralized market or the bilateral negotiations. In a way to be described below, either type of interaction between employer and worker may yield a labor contract at an agreed upon wage.

After all trading activity has ended, each worker involved in a labor contract chooses the ‘effort’ she is willing to give. The two possible effort levels are ‘high’ ( $e=1$ ) and ‘low’ ( $e=0$ ). This affects the monetary payoffs of employers and workers in the following way. An employer’s payoff ( $\pi_f$ ) is equal to the revenue resulting from the worker’s effort level,  $r(e)$  minus the wage paid, with  $r(1)=50$  and  $r(0)=10$ .<sup>12</sup> A worker’s payoff ( $\pi_l$ ) is equal to the wage received,  $w$ , minus the cost of effort  $c(e)$ , with  $c(1)=20$  and  $c(0)=0$ . Note that high effort maximizes the joint earnings of the worker and employer, which is 30 francs (50-20) for high effort and 10 francs (10-0) in case low effort is chosen. The wage determines how these joint earnings are divided between the two. Summarizing:

$$\pi_f = r(e) - w$$

$$\pi_l = w - c(e).$$

Workers and employers that are not involved in any labor contract earn zero in that round.

The choice between channels works as follows. At the beginning of each of the 20 rounds each employer has the possibility to express a wish to negotiate bilaterally with a worker. These negotiations represent the outcome of more informal recruitment channels, where employers talk personally to potential workers that have been referred to them by other employers. In the experiment, every employer that indicates a wish to negotiate bilaterally is assigned a different randomly selected worker. Each of the selected workers is then asked whether she wants to enter the bilateral negotiations. After all workers have reacted, the bilateral wage negotiations and the centralized market open simultaneously. All employers and workers that have not been paired for bilateral negotiations – either because the employer

---

<sup>11</sup> In our study each group involves nine participants. For a study involving larger groups see Brandts et al. (2010).

<sup>12</sup> The monetary unit in the experiment is called ‘experimental franc’. Francs are exchanged for euros at the end of the experiment at a rate of 15 francs = € 1.

has not asked for it or because the solicited worker has declined - enter the centralized market.<sup>13</sup>

The centralized market is organized as a standard double auction –first studied experimentally by Smith (1962)– in which both employers and workers are able to make public wage proposals at any time during a market period. In this market there is complete anonymity in trading relations.<sup>14</sup> We chose the double auction, because it is usually considered by experimental economists to be the institution that best embodies the characteristics of markets where prices and transactions come about through an equilibrating process. Bids and asks in the double auction consist of an integer between 0 and 50, inclusive; these wage proposals are public (hence, the centralized character of these markets). If a market wage proposal is accepted then a labor contract is established. Participants have 90 seconds to reach agreements. After all possible contracts have been realized or 90 seconds have passed (whichever comes first), the market closes. For the cases where an agreement has been reached the worker then determines an effort level ( $e$ ), with resulting payoffs as explained above. The chosen effort level is communicated only to the employer and worker concerned. Neither knows the identity of those making or accepting offers, nor do they know the history –of wage or effort levels– of any of the other market participants. Note that the double auction is not intended to precisely represent the markets we observe in the field. Instead, they are what Granovetter (1985:484) calls “idealized markets” that are void of any significant effects of social relations between employers. The only social relations that can occur between any specific employer and worker are those that arise after a wage proposal has been accepted (i.e., a work relation has been established). Taking this idealized market form allows us to experimentally isolate the effects of social relations in the alternative channel, the bilateral negotiations.

In these bilateral negotiations a single employer and a single worker are linked. The employer makes a bilateral wage offer to the worker it is paired with, which – like in the market– consists of an integer between 0 and 50.<sup>15</sup> The worker concerned can then accept or reject this offer. Employers and workers involved in the bilateral wage negotiations can at all times observe the offers made and contract wages agreed upon in the public market. In

---

<sup>13</sup> Note that with five workers and four employers there is always at least one worker not involved in bilateral negotiations.

<sup>14</sup> To ensure this anonymity across rounds, participants’ positions on the monitor are randomly reallocated in every round.

<sup>15</sup> Note that the initiative is on employers’ side in the bilateral negotiations, in the sense that they decide whether to offer negotiations in the first place and also make the wage offers. This asymmetry reflects the basic power relations present in the labor market (Western 1996; Streeck 2005).

contrast, participants in the market are not informed about what is happening in the negotiations; this represents the transparency of a market and the lack of it in bilateral negotiations. The employers whose offers are rejected and the workers that have rejected, immediately enter the idealized market and join the employers and workers that have not engaged in bilateral negotiations. After the bilateral agreements have been reached, the workers choose an effort as described above.

A crucial difference between the idealized market and bilateral negotiations is that in the latter case information about a worker's previous effort choices may be obtained. This is how these negotiations represent the main characteristic of the informal recruitment channels described above. Elsewhere, we have studied the impact of such information on the employer-worker relation and shown that it may benefit both workers and employers (Schram et al., forthcoming). Here we are interested in whether or not a social structure of employers can arise where such information is voluntarily shared in information networks.

After employers and workers have been paired for bilateral negotiations each employer asks all other employers for their information about the effort levels they had experienced by that particular worker in the past. This request is automatically generated in the experiment because our main interest lies in the employers' willingness to share information and not so much in their desire to request it.<sup>16</sup> Each employer that is asked can either say yes or no to the information request. Specifically, the information each employer can give is a truthful revelation of the number of a worker's high effort choices in relation to the total number of previous labor contracts with that employer. This information includes those jobs in which the contract with an employer had taken place through the idealized market but excludes the decisions of the first 10 rounds which will be explained below. Employers are not informed of wages earned previously by the worker. The main reason is that we think that this is the way in which information is shared amongst employers in naturally occurring labor markets. For example, a typical letter of recommendation will provide information about whether the worker concerned is trustworthy but not about the wage this worker had earned in the previous job.

As explained above, our treatments differ with respect to the conditions under which information can be released (see table 1). In the sessions with identification employers are tagged with a code and the code of an employer taking part in information transfers is

---

<sup>16</sup> Because requesting information is costless but useful in our experiment, it is likely that most employers would do so anyway. By automatically generating the request, we reduce the noise in our data. Relaxing this assumption is an obvious extension to be explored in future research.

revealed to the other employer involved in the transfer. Given the dynamic structure of our environment, this makes it possible to keep track of others' behavior over time. In contrast, without identification of employers, both employers that ask for information and those that agree to give it do so without any other participant being able to keep track of this decision.

In the sessions with costly information an employer that decides to give information has to pay a fixed cost of 0.3 francs every time she does so. This reflects the financial costs or time spent on looking for information and putting it into the form that is needed, e.g. writing a recommendation letter (Marsden 2001). Note that these costs are low relative to the joint earnings from any single labor contract (10 or 30 francs). In contrast, in the sessions with costless information there are no charges associated with information flows.

Until now, we have described the 20 rounds that are central to our study. These are preceded by 10 initial rounds that allow participants to establish a clear expectation about the workings of the idealized market. Moreover, they provide us with information about behavior in situations where recruitment takes place only through idealized markets. This will provide us with a benchmark to which we can compare the workings of the idealized market when an alternative recruitment channel exists. In those first 10 rounds there is no possibility of negotiating bilaterally and also no possibility of information sharing between employers. All trading activity takes place through the idealized market, which works just like the one for the following 20 rounds of the sessions. After the 10 market rounds are over, participants receive new instructions in which the new situation is laid out for each of the new 20 rounds. Participants are told at the beginning of a session that there are a total of 30 rounds and that after the first 10 rounds they will receive new instructions.

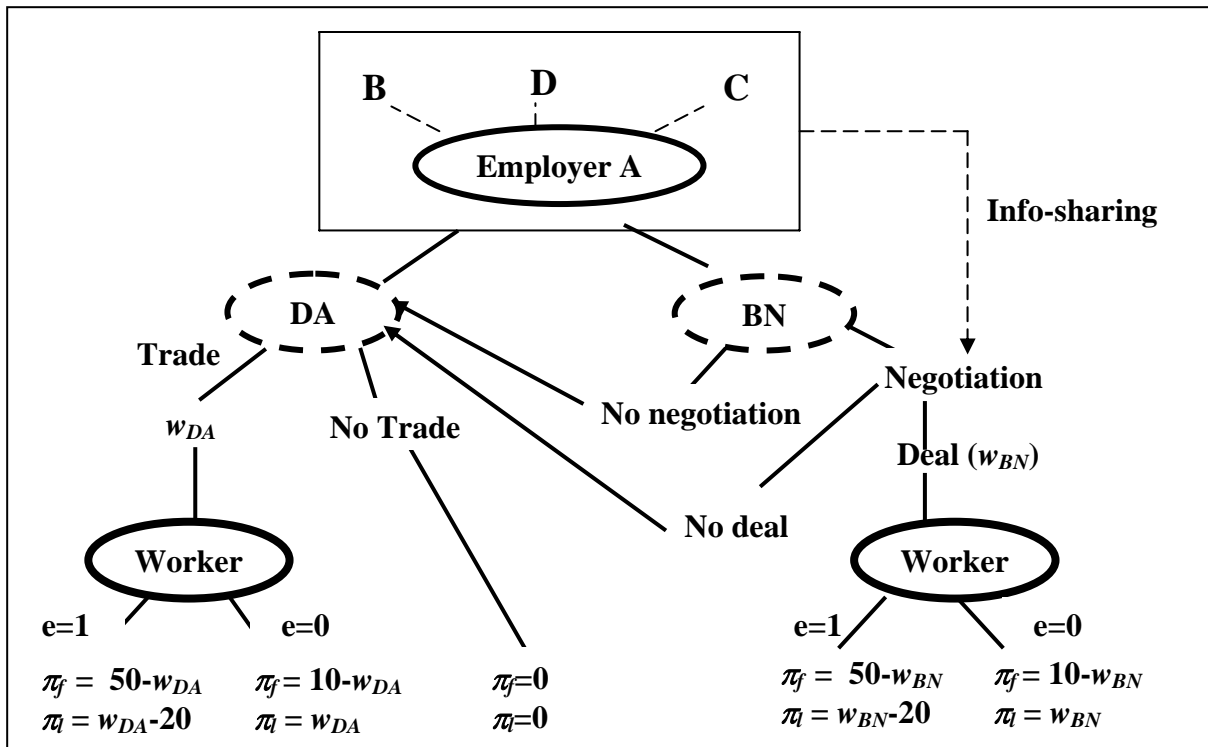
A summary of the experimental design is given in Figure 1. See Appendix A for a translation of the instructions.

## **RESULTS**

We will present our results organized as responses to three fundamental research questions:

1. *How much information is shared and why?*
2. *What kinds of information networks arise?*
3. *What is the effect of information sharing on the employer-worker relations?*

**Figure 1: Experimental Design**



Notes. DA=Double Auction; BN=Bilateral Negotiations; In BN the employer first offers bilateral negotiations to one worker. If this is rejected, the employer and worker participate in DA. The same holds if the offer to negotiate is accepted but the wage offer in BN is rejected by the worker. Before the bilateral negotiations start the employer involved (employer A in this figure) asks other employers (B,C,D) for information about the worker.

The first two questions are concerned with the social relations between employers while the third focuses on the social relations between employers and workers. For all three questions, we will consider the effects of the information network properties identifiability and costs.

### Information Sharing

Table 2 gives a first impression of the extent of information sharing in the different treatments. Recall that every time an employer decides to enter bilateral negotiations, she automatically asks the other employers for information. Table 2 shows the fraction of these requests that are positively responded to.

**Table 2: Information Sharing per Treatment**

Treatment	Fraction of requests honored
No identification, costless	0.91
No identification, costly	0.59
Identification, costless	0.94
Identification, costly	0.52

The results show that, in this very aggregated view, the distinction between costless and costly information is more important than the effect of identification. When information sharing is costless it is high overall. When it is costly just over half of the requests are honored.

To better understand what goes on in the different treatments we need to look at information sharing in more detail. Table 3 gives a view of information flows in one particular group – group 1 – of the identification/costly treatment.<sup>17</sup> Each cell shows the fraction of information requests that was honored between each two employers of the total of four employers in the group.

**Table 3: Example of Information Sharing**

	To A	To B	To C	To D
From A	----	1.00	0.38	0.82
From B	0.73	----	0.86	0.43
From C	0.20	0.31	----	0.44
From D	1.00	1.00	0.78	----

*Note.* The number in a cell shows the fraction of information requests by the employer depicted in the column that is positively responded to by the employer in the row.

Inspection of the entries in table 3 suggests the occurrence of reciprocal behavior in the provision of information. For example, employer A responds positively to all information requests by B and most (82%) by D, because employers B and D also provide information to A most of the time. In contrast, employer C provides little information to A (20% of the requests are responded to positively) and A only gives information to C in response to 38% of C’s requests.

To quantify this reciprocity in the provision of information we consider a summary statistic based on numbers such as those reported for group 1 in table 3. Consider pairs of employers, X and Y that are together in a group. Let  $f_{XY}$  denote the fraction with which X gives information to Y and  $f_{YX}$  the fraction with which Y gives information to X. For example, in table 3,  $f_{AB}=1$  and  $f_{BA}=0.73$ . For each treatment we then determine the correlation coefficient between  $f_{XY}$  and  $f_{YX}$  for all possible pairs of employers X and Y (where X and Y are in the same group). A larger positive correlation coefficient indicates a higher level of reciprocation within a treatment. Table 4 shows these correlation coefficients.

---

<sup>17</sup> Appendix B contains the tables corresponding to all groups in all four treatments.

**Table 4: Correlation in Information Sharing**

Treatment	Correlation Coefficient	Two-sided Significance
No identification, costless	-0.20	0.233
No identification, costly	0.31	0.068
Identification, costless	0.13	0.527
Identification, costly	0.56	<0.001

First consider the treatment without identification where information is given costlessly. Here, the correlation between information given and information received is  $-0.20$  with a two-sided significance of 0.233. This lack of statistically significant correlation has an intuitive explanation. From table 2 we know that the general levels of information sharing are high in this treatment (91% of the information requests are honored). Given that providing information is costless, employers are happy to do so if requested, without requiring reciprocal behavior. In fact a reciprocal response directly to the sender is impossible because in networks without identification one cannot determine who the sender of information is.

Similarly, in the treatment with costly information and no identification, one cannot determine who the sender of information is. Yet, the correlation is 0.31 with a two-sided significance of 0.068. In this case, the marginally significant positive correlation is the result of the fact that groups as a whole vary in their behavior. In some groups employers abundantly share information and in other groups the employers hardly provide information at all. What appears to be happening is a kind of reciprocity at the group level where employers respond positively (negatively) to high (low) overall levels of information provision in their group. Differences across groups then yield the (marginally) significant correlation coefficient across all groups in this treatment.

In the treatment with identification where information is costless the correlation coefficient is 0.13 with a two-sided significance of 0.527. Again, no reciprocal behavior is observed, even though identification allows one to reward the sender of information. With costless information provision employers are again generous in providing it, however (table 2 shows that 94% of the requests are honored in this treatment cell).

Finally, in the treatment with costly information and identification the correlation is 0.56 and highly significant with a two-sided p-value smaller than 0.001. When employers know who gives them information and that this giver made costs to do so, reciprocal behavior in the form of sharing the own information with that other employer does emerge.

To further explore the reasons for sharing information, we explain the individual decision whether or not to respond positively to an information request by a set of explanatory

variables. For this purpose we use a random effects probit regression. We apply this only to the treatment with identification and with costly information, because this is the case where a variation in responses (it is given in 52% and withheld in 48% of the cases) is combined with a variety of independent factors that may influence this decision (including previous choices of the employer asking for information). Table 5 gives the results of this regression.

**Table 5: Employer’s Response to Information Request**

	Coefficient	Absolute z-value
Constant	1.53	3.71**
Round	-0.08	5.09**
Type of channel giver is in <sup>1</sup>	-0.33	2.50*
Most recent decision of requestor <sup>2</sup>	0.68	5.03**
Most recent earning from contract <sup>3</sup>	0.01	2.10*

*Notes.* The table presents the results of a random effects probit regression model where the dependent variable is a dummy indicating whether or not employer  $i$  in group  $g$  gave information requested by employer  $j$  in round  $t$ . Formally, it gives the estimated maximum likelihood coefficient vector  $\beta$  in  $\Pr_t^{ijg} = \Phi(X_t^{ijg} \beta + \mu^g)$  where  $\Pr_t^{ijg}$  gives the probability that  $i$  of  $g$  gives information to  $j$  in  $t$ .  $\Phi$  denotes the cumulative normal distribution and  $X$  is the vector of independent variables described in the first column of the table.  $\mu^g$  is a (white noise) group-specific error that corrects for the dependencies across individual decision in the same group.

<sup>1</sup>The employer asked for information may be active in the idealized market or in bilateral negotiations. This variable is a dummy equal to 1 in the former case.

<sup>2</sup>The requestor’s history in the personal relationship with the employer asked for information is represented by her decision the last time she was asked for information by this same employer.

<sup>3</sup>Earnings (in francs), the most recent time the decision maker traded, no matter in which channel.

\* (\*\*) denotes statistical significance at the 5% (1%)-level.

Note that all of the estimated coefficients in table 5 are statistically significantly different from zero at the 5%-level or better. There is a clear intuitive explanation for the sign of each of them. First, employers tend to decrease their willingness to participate in an information network as the rounds proceed. This may be explained by the fact that these networks are no longer important after the experiment has ended. Second, an employer active in the idealized market is less likely to provide information. Such an employer is more likely to prefer this channel than the average employer and therefore less likely to have any use from information sharing. Third, the large positive and strongly significant coefficient for the information requestor’s most recent decision is direct evidence of reciprocal behavior. Finally, having earned more in a previous contract makes it relatively easier for an employer to bear the costs of providing information.



## Information Networks

Across treatments, distinct kinds of information networks can arise. A main distinction is between those that can be formed when no identification is possible and those that can occur when employers can identify one another. Without identification, employers cannot commit to sharing information (only) with specific others and only networks can occur, in which employers remain anonymous to each other. In these ‘anonymity’ networks, information provision is in nature a collective good from which no one can be excluded. One can distinguish between such networks based on the extent to which information is actually provided. At one extreme, if no employer gives any information whenever asked to, the result is a ‘no-information network’. At the other extreme, a ‘full-information network’ occurs when every employer gives information, whenever asked. In the 12 groups without identification, we observe no no-information networks and only one full-information network (one of the groups with costless information). All other groups are in between these extremes and can be characterized as ‘partial-information’ networks. There is a difference between the case where information is costless and that where it is costly, however. As shown in table 2, the amount of information given is higher (91%) in the former case than when information provision is costly (52%). This difference is statistically significant at the 5%-level using group averages as cases (Mann-Whitney  $U=3.00$ ,  $N=12$ ,  $p=0.016$ ).

If the employer that requests or gives information can be identified, a large variety of networks can be formed. In our treatment without costs of information provision we basically observe only one kind, however. This is an almost complete network where information is always given when asked (in aggregate it is given 94% of the time; see table 2). Note that these networks are almost completely closed in the sense that every employer is connected (through information provision) to every other.<sup>18</sup> We only observe in one group (out of 5) that the network is completely closed in this sense, however. The 6% of the information requests that are not honored are equally spread across the other groups.

The treatment with the highest divergence of information networks formed is with identification and costly provision. For this case, we discuss the information networks observed in more detail. The precise patterns of information provision in each group in this treatment are presented in appendix B. To study structures of information networks, we need to define what we mean by a network connection between two employers. We measure this by the regularity of information sharing. To keep the analysis tractable, we dichotomize the

---

<sup>18</sup> Recall that closure measures the extent to which any two agents connected in a network both have connections to the same third parties (Karlan et al. 2009).

relationship between any two employers and define them as either having a network connection or not (as in Goeree et al. 2009). Specifically, we will say that an employer has a 50%-network connection with another employer if these two employers give each other information in at least 50% of the opportunities.<sup>19</sup> If one or both employers in a pair was never asked to provide information (which may occur if an employer always hires via the idealized market), we consider them not to be connected in this sense. Note that a maximum of six 50%-network connections are possible for each group (because there are 4 employers per group). Appendix B gives for each group all 50%-connections that we observe. Across the nine groups in this treatment, the average number of such connections is 1.7, varying between 0 (groups 5 and 9, cf. appendix B) and 5 (group 4).

Using the concept of 50%-network connections, we can consider the extent of closure in the information networks. For this analysis, we disregard the two groups without connections. There are three groups (6,7,8) with only one connection. These have complete closure in a trivial sense, because neither of the two connected employers connects to any third party. The two groups with two connections are by definition completely open information networks (because the two employers in either connected pair do not both connect to the third party). Group 3 has three connections and turns out to be a completely open network. Finally, group 4 (with five 50%-network connections), is a partially closed network, where connected employers on average connect to the same third party in 60% of the cases. By and large, the network structures are stable across rounds. If we define 50%-network connections based on the final 10 rounds only, results very similar to the ones described here are obtained.

### **Employer-Worker Relations**

We now turn to an overview of the effects that information networks have on the employer-worker relations, specifically the recruitment channel used, wages, worker trustworthiness and earnings of employers and workers. Table 6 shows average values of key variables for all four treatments.

The second and third rows of the table show that the fractions of overall realized contracts are quite similar across the four treatments. Moreover, in all treatments almost all contracts are established. The fourth row shows that recruitment through bilateral negotiations is considerable, the lowest value (and the only case where a majority of contracts is made in the

---

<sup>19</sup> To check the robustness of our classification, we will also (in the next subsection) investigate the effects of using a stricter definition of a network connection. Specifically, we will say that an employer has a 80%-network contact with another employer if these two employers give each other information in at least 80% of the opportunities.

**Table 6: Key Statistics**

	No-identification & costless	No-identification & costly	Identification & costless	Identification & costly
% contracts realized R1-10	94.2	95.4	95.5	96.1
% contracts realized R11-30	95.0	95.0	95.5	92.9
% contracts in BN R11-30	52.4	54.4	62.3	37.7
Average wage (IM) R1-10	19.20	21.83	18.90	15.09
Average wage IM R11-30	21.41	16.82	15.88	17.19
Average wage BN R11-30	32.12	31.02	32.27	29.10
Fraction high effort (IM) R1-10	.23	.34	.18	.31
Fraction high effort IM R11-30	.41	.28	.26	.35
Fraction high effort BN R11-30	.67	.65	.73	.66
Average employer earnings (IM) R1-10	0.19	1.62	-1.77	2.83
Average worker earnings (IM) R1-10	14.50	15.10	15.34	13.30
Average employer earnings IM R11-30	5.18	4.33	4.6	6.72
Average worker earnings IM R11-30	13.12	11.25	10.64	10.24
Average employer earnings BN R11-30	4.82	5.11	6.80	7.41
Average worker earnings BN R11-30	18.65	17.95	17.74	15.84

*Notes.* R1-10=rounds 1-10 (only centralized market); R11-30=rounds 11-30; IM= idealized market; BN=bilateral negotiations. Employer earnings do not take information provision costs into account. These are relatively small and taking them into account does affect any of the conclusions.

idealized market) being the one for the treatment with identification and costly information.<sup>20</sup> Comparing across treatments the fraction of labor contracts made through these informal recruitment channels to the level of information sharing (table 2), note that distinct levels of information are not the sole cause of differences in channel choice. For example, without identification, much more information is provided when it is costless than when it is costly, but fewer contracts are made via the informal channel. Hence, to understand the effects of information we need to take the information network and its structure into account.

<sup>20</sup> In Schram et al. (forthcoming) trading through bilateral negotiations is 28%. There, excess supply is higher (5 workers vs. 2 employers) so employers may be less inclined to forgo the favorable odds in the idealized market.

Rows 5-16 show averages for workers' wages, their effort levels and the earnings of workers and employers. By comparing values in rounds 1-10 to those in rounds 11-30, one can see the difference that the existence of the bilateral negotiations recruitment channel makes. Rows 5-7 show that in all four treatments wages are considerably higher in the bilateral negotiations than in the idealized markets. Rows 7-9 reveal that the fractions of worker's high effort choices after having been recruited through the informal channel are also substantially higher for all four treatments than after a contract has been established in the idealized market. In other words, recruitment via informal channels leads to more trustworthy behavior in all treatments. In contrast, the comparison between wages and effort levels in the idealized market when it is the only recruitment channel (rounds 1-10) to when there is also an alternative (rounds 11-30) shows only small differences and in different directions for distinct treatments. In other words, trustworthiness in jobs recruited via the idealized market is not systematically affected by the fact that one's choice may be reported to other employers in the future.

The last six rows of table 6, rows 11-16, give the earnings' patterns for both employers and workers. Comparing first the earnings levels in rounds 1-10, when recruitment is only possible via the idealized market, to earnings in contracts that result from bilateral negotiations in rounds 11-30, one can see that both employers and workers earn more after bilateral negotiations. Hence, the emergence of recruitment via informal channels is economically beneficial for both sides of the market.

Comparing earnings in more detail, the results show that employers' earnings increase from rounds 1-10 to rounds 11-30, regardless of whether recruitment takes place via the idealized market or bilateral negotiations in the latter case. In three out of four treatments these earnings are higher for contracts following bilateral negotiations than for those that are made in the idealized market. For the workers the comparisons are different. Their earnings increase from rounds 1-10 to rounds 11-30 if in the latter case they engage in contracts following bilateral negotiations. However, earnings from contracts in the idealized market are lower in rounds 11-30 than in rounds 1-10. We will discuss explanations for this phenomenon in the next section.

Now we turn to studying what occurs in the networks with costly information sharing. For these treatments we found positive correlations in information sharing indicating reciprocal patterns between particular employers. We start with the case without identification, for which we concluded above that this reciprocity was at the group level. We want to further

explore the heterogeneity across groups in this treatment. Table 7 shows averages for trading activity in each of the six groups, ranked from most to least information shared.

**Table 7: Key Statistics per Group**

Group	Average fraction info given	% contracts in BN	Average earnings employer in BN	Average earnings worker in BN	Average earnings employer in IM	Average earnings worker in IM
3	0.99	62.2	9.87	15.35	5.93	12.64
1	0.70	56.9	3.54	19.15	7.13	9.32
5	0.62	59.0	7.54	18.11	8.88	8
2	0.49	50.6	6.49	14.79	6.65	6.5
6	0.49	50.6	1.78	19.82	-3.24	21.52
4	0.14	47.4	-0.77	21.54	1.4	11.4

*Notes.* Data are based on rounds 11-30 only. Groups are identified in first column and ranked by average fraction of information requests responded to positively (second column). IM=idealized market; BN=bilateral negotiations. Employer earnings do not take information provision costs into account.

One can see by inspection how the average fraction of information given is directly and positively related to the percentage of contracts that agreed upon in the informal recruitment channel. Observe also that in group 3, where the percentage of information given is very high, recruiting through bilateral negotiations leads for both employers and workers to much higher earnings than in the idealized market. For workers this holds in all groups. Employers, however, earn less in the idealized market than from informally recruited contracts in a majority of cases. In four out of six groups they do earn more on average than in the first ten rounds, however (this is not shown in the table). It appears that a very high level of (anonymous) information sharing is needed for trades in bilateral negotiations to be profitable for employers. We will further discuss this issue in the following section.

Next, turn to the case of costly information and employer identification, where there is a rich variety of information networks. We ask whether endogenously formed information networks benefit those involved in the network. We do so by investigating whether employers that share information regularly recruit more through the informal channel and whether they earn higher earnings than those that do not. To study this issue we need a measure for the regularity of information sharing. For this purpose the 50%-network connection criterion and the 80%- variant thereof as defined above are used. For each of these measures we count the number of connections that each employer has, which for each employer will be an integer number between 0 and 3.

Table 8 shows the results of two random-effects GLS regressions of employer earnings on a number of exogenous variables; the earnings variable is net of the costs of providing information (i.e., does not correct for these costs). Both regressions include the same dummy for use of the informal recruitment channel, but differ in the connection variable as well as in the interaction term between connections and informal recruitment. In one case the number of 50%-network connections is used and in the other case the number of 80%-network connections is used.

**Table 8: Employer Earnings**

Independent variable	Regression with 50%-network connections	Regression with 80%-network connections
Constant	7.15 (6.40)**	6.83 (7.72)**
Informal channel	-1.93 (1.18)	-0.93 (-0.71)
# Network connections	-0.65 (0.71)	-0.54 (-0.41)
# Network connections*BN	2.55 (2.09)*	3.38 (1.94)*

*Notes.* The table presents the results of a random effects generalized least square regression model where the dependent variable is the employer earnings in the case with costly information and employer identification. Formally, it gives the estimated GLS coefficient vector  $\beta$  in  $\pi_t^{ig} = X_t^{ig} \beta + \mu^g + \varepsilon_t^{ig}$  where  $\pi_t^{ig}$  gives employer  $i$ 's earnings in round  $t$ ;  $X$  is the vector of independent variables described in the first column of the table;  $\mu^g$  is a (white noise) group-specific error that corrects for the dependencies across individual decision in the same group and  $\varepsilon_t^{ig}$  is white noise error. Z-values are in parentheses,

\* (\*\*) denotes statistical significance at the 5% (1%)-level

In the environment that we study connections can only be useful if an employer recruits through the informal channel, so that our *a priori* prediction is that the coefficient for the (un-interacted) dummy for the number of connections will not be significantly different from zero. The same zero-prediction applies to the (uninteracted) informal channel variable, since in the absence of connections there is little difference between recruiting via the idealized market or via the informal channel. In contrast, we expect the interaction effect to be significantly positive; with connections, recruiting via the informal channel should be advantageous (and *vice versa*).

The regression results are consistent with our predictions: for both levels of connections there is a positively significant effect of the interaction term but not of the separate variables. In other words, employers that have built up a strong information sharing network benefit from recruiting through informal channels. One implication is that employers are able to create profitable networks for information sharing using reciprocal relations.

One can also compare employer earnings for distinct levels of closure. To do so, we consider the seven groups where we could define the extent of closure, as described above.

Recall that we determined for four of these groups that they were open, while three were closed and one was partially closed. Employers in the open networks earned on average 5.9 francs per contract, those in closed networks earned 7.2 on average and employers in the one partially closed group earned on average 1.4. The difference between earnings in the open and closed groups is statistically significant ( $Z=-1.96$ ,  $N=6$ ,  $p=0.05$ ).<sup>21</sup> We conclude that, in addition to our previous finding that the number of network connections has a positive effect on earnings when recruiting in the informal networks, closed networks also yield higher earnings than open ones. Though we have only one (group) observation for a partially closed network, it is noteworthy that employers in this group earn less than in either open or closed networks. It is interesting that closure benefits participants in a network. Traditionally, closure is beneficial to network participants because it enables effective punishment of bad reputations (Coleman 1988). In our networks, reputations are only privately known (i.e., not shared in the network) so the effectiveness of punishment is not enhanced by closure.

## **DISCUSSION**

We structure the discussion of the implications of our results along the lines of the three fundamental research questions distinguished above.

### *How much information is shared and why?*

First, note that –by design– information is only shared in the informal recruitment channel. When an employer is bargaining with a candidate in this channel, she can ask other employers for information about that worker’s trustworthiness in previous jobs. The other employers can decide whether to give this information or not. The reason that we decided not to enable information sharing in the idealized market is that access to other employers’ information is much more difficult when recruiting through more formal, impersonal channels. The key element in our analysis is that recruitment through the idealized markets is more anonymous than through bilateral negotiations so that information through networks is more likely to play a role in the latter case. Laboratory control allows us to isolate this difference between the two channels by not allowing for information sharing in the idealized market.

We can summarize the information sharing we observed as follows. First, the costless/costly distinction has a more important effect on the overall level of information sharing than whether or not identification is possible. Second, when information is costless, it is given very often.

---

<sup>21</sup> One should keep in mind, however, that this significance is based on asymptotic properties, while we have only 6 (group) observations.

This implies the following. If identification is not possible, a norm of information provision as a contribution to a collective good appears (Lawler and Yoon 1996). When provision is costless, almost every employer adheres to this norm. Even when it is costly, a majority of the employers are willing to share their information with anonymous others, even though anonymity prohibits future reciprocal responses. This finding provides more support for the social embeddedness line of reasoning (Granovetter 1985; Uzzi 1997) than for Coleman's argument (Coleman 1988) that reputation building is an important precondition for exchange within a social structure. In our experiments without identification, employers' willingness to share information is clearly not an outcome of reputation building.<sup>22</sup> The type of reciprocity we observe is in response to the other group members at the aggregate level. A typical employer is willing to bear the costs of sharing information if enough others are willing to do the same. This yields considerable differences across groups. In some groups the result is a complete information network where employers manage to reap the benefits of information sharing, while in others sharing breaks down completely. One can thus conclude for the former groups that the commitment to sharing information is not driven by pure utilitarian purposes but by a general belief "that transaction partners will behave properly for reasons that transcend pure self-interest" (Granovetter 1992:40).

When identification is possible and provision is costless, information is almost always shared. Employers do not want to be recognized as being unwilling to share it. Importantly, in the case with identification and costly provision a similar level of information sharing is reached as in the case without identification, but through a different mechanism and leading to a completely different social structure. Now, information sharing is based on direct reciprocation of others' choices to provide it. When employer A is deciding whether or not to honor an information request by B, the most recent response by B to a request by A is one of the most important factors. Here, (private) reputation building enables reciprocity and the combination of the two yields information sharing. Reputation does not matter for employers who prefer to recruit through formal channels (because in our experiment they do not request information). Indeed, our data show that they are less likely to share information when asked. This is especially the case when information is costly. For the employers that do use the informal recruitment channel, the interaction between reputation and reciprocity yields an

---

<sup>22</sup> This is because reputation requires identification. Importantly, in our treatment with identification reputation is private, in the sense that one only knows if a particular other employer provided information in response to one's own requests. Responses to requests by other employers remain unknown. A different notion of reputation is one where some indication of the willingness to share information is publically known. It would be easy to extend our experiment by allowing for public information on all responses to information requests.



interesting variety of information networks across groups. This shows that employers are able to endogenously form social structures that meet the specific needs and characteristics of their group.

*What kinds of information networks arise?*

A consequence of the distinct ways across treatments that employers decide on whether or not to give information, is that we can classify the networks that emerge in two general categories: (i) those where information is anonymously and voluntarily provided as a collective good; we call these ‘anonymity’ networks; and (ii) reciprocity-based information sharing networks, which we call ‘reciprocity networks’. The extent to which information is actually provided in either type of network varies with the costs of providing it. The lower these (material or non-material) costs are, the larger the network of employers willing to share information. Interestingly, reciprocity networks seem to crowd out anonymity networks in the sense that unconditional provision becomes rare and employers look to form networks of mutual information sharing. In the end, when identification allows for reputation formation the result is a large variety of reciprocity networks across groups, varying from completely open to completely closed. Once again, groups are able to structure their social relations in a way that meets their needs for sharing information.

To conclude, the level of information sharing is similar in both types of networks. The key distinction is the social structure (anonymity versus reciprocity networks) and the mechanisms driving the willingness to share information. This distinction has important implications regarding social equality and fairness (Bourdieu 2000; Streeck 2005). While in the anonymity networks every employer can contribute to and benefit from the information provision as a collective good, in the closed social structure of reciprocity networks some employers are excluded from the benefits of information sharing. In this sense, our findings contribute to the literature on social capital theory (Lin 1999; Burt 1997; Portes 1998; Flap 2004) which defines social capital as the social resources (e.g., information) that are potentially valuable to individuals (e.g., employers) accessed and utilized in a social network. The exclusion of some employer’s access to information in our reciprocity networks is an example of differential access to this social capital (Lin 1999). This implies differential access to and thus social inequality among employers in finding trustworthy workers. Note however that in our case this differential access emerges endogenously and is based on employers’ own choices to provide or not provide information to others.

*What is the effect of information sharing on the employer-worker relations?*

The information networks formed lead to higher wages and more trustworthiness in contracts made in the informal recruitment channel than in the idealized market. The possibility of recruiting through an informal channel also affects wages and trustworthiness in the idealized market, however. This can be seen by comparing wages in the idealized market in rounds 1-10 (when it is the only recruitment channel) to those in rounds 11-30 (when the informal alternative exists). Table 6 shows how the outcome of this comparison depends on the network properties.

These observed patterns for the idealized market can be explained as resulting from two counteracting forces. First, there is a selection of trades in bilateral negotiations compared to the idealized market. Employers are aware of the fact that untrustworthy workers (those unwilling to provide high effort) will not go to bilateral negotiations, or at least will not be successful there if information sharing amongst employers reveals their past record. Aside from the direct effect that trustworthiness in the idealized market will be lower in rounds 11-30 than before, this puts downward pressure on wage offers in the market. This is because employers will not want to offer a high wage to an untrustworthy worker. On the other hand, given the possibility that recruitment may take place through the informal channel in the future, workers also need to build up a positive reputation of trustworthiness to obtain future high wage offers. In rounds 11-30 they will therefore be less inclined to exploit a high wage by giving low effort and this tendency may lead to employers offering high wages in the idealized market.

The net effects of these two forces on wages and trustworthiness in the idealized market may be positive or negative. What we observe in our data is that the net effect on trustworthiness is positive in three out of four cases: only when identification is not possible and information provision is costly does the introduction of an informal recruitment channel lead to lower trustworthiness in the idealized market. In this case, wages in the market are also lower than in the first ten rounds. In the case with identification and costless provision, wages in the idealized market are also lower after introduction of an informal channel (in spite of higher trustworthiness). In the other two cases, both wages and trustworthiness in the idealized market increase after the new recruitment channel has been introduced.

The comparison between the formal and informal recruitment channels is more straightforward. The higher wages and trustworthiness in the informal channel lead to higher worker earnings in all treatments. The driving force here is that in the informal recruitment channel, employers can selectively offer high wages to trustworthy workers. As for

employers' earnings, in three out of four cases, these are higher when recruiting through the informal channel than through the formal channel. This is driven by reciprocation by trustworthy workers who were offered a high wage in the first place. In all cases, however, when there are two channels to choose from employers earn on average much more in either channel than when they can only recruit through the formal channel. The fact that they benefit can be attributed to the information sharing after round 10.<sup>23</sup> Whereas their higher earnings in the market may be attributed to workers' fear for a bad reputation, their even (much) higher earnings in bilateral negotiations is due to employers ability to pinpoint trustworthy workers using the information shared. This is the important way in which the social relations between employers strongly affects the relations between employers and workers, and in fact benefits both.

## CONCLUSIONS

We have used experiments to create a setting in which we can systematically study how social structures between employers emerge that increase the quality of the worker-employer relation in recruitment. Laboratory control has allowed us to link observed patterns at the macro-level to the features of the interaction between individuals at the micro-level.

In particular, we have shown how information sharing and the fruitful use of informal recruitment channels emerge from individuals' choices and how, in turn, the resulting social structures condition the behavior of the same individuals. Our experimental results demonstrate that the existence of employer information networks can benefit both employers and workers. Our results also illustrate how specific network properties affect the functioning of information networks. When information transmission has no cost, one can say that a norm of sharing information appears. When providing information is costly, reciprocal behavior explains information sharing. The type of reciprocal behavior depends on whether or not employers in the network can identify one another. If they cannot, the reciprocal response is collective. If they can, it is in response to the reputation of the employer requesting information.

We have focused on the case of employer information networks, and one may ask to what extent our insights apply to other cases. Indeed, problems of information sharing like the ones we study are present in other areas of society. For example, in the relations between debtors

---

<sup>23</sup> It is important to note that it is really the information sharing that causes the effects we observe after round 10. In Schram et al (forthcoming) we added a treatment where bilateral negotiations were introduced after round 10 but no information was provided whatsoever. The result was that there was no difference between the first 10 and final 20 rounds (in fact, bilateral negotiations were barely used at all).

and creditors on the credit market similar issues of information transmission exist (Brown and Zehnder 2005; Karlan et al 2009). In this case, potential information sharing between financial institutions is affected by third parties, like credit rating agencies. The labor market is surely different from the credit market, since the nature of social relations is not the same in the two spheres. However, the fact that the access to information is heavily influenced by social structure is common. Modification of our experimental environment can be used to fruitfully study such other cases.

Many other new directions for future work are possible, and can be based on various changes in the experimental procedures. For example, one could add communication and/or face-to-face contact to the information sharing phase of our experiments. This could lead to various types of sanctioning of employers that do not share their information. This may strongly affect the nature of the social relations that develop. In addition, exogenously imposed asymmetric access to the information network could lead to important inequality issues. Finally, one could create a possibility of information sharing on the supply side of the labor market by letting workers share their experiences with specific employers.

## REFERENCES

- Baker, G.P. (1992), "Incentive Contracts and Performance Measurement," *The Journal of Political Economy* 100-3, pp. 598-614
- Bandiera, O, I. Barankay and I. Rasul (2009), Social Connections and Incentives: Evidence from Personnel Data, *Econometrica*, 77: 1047-94.
- Bandiera, O, I. Barankay and I. Rasul (2010), "Social Incentives in the Workplace," *Review of Economic Studies*, April 2010, Vol. 77, Iss. 2: 417-59.
- Bohnet, I. (2009), "Experiments," in: "The Oxford Handbook of Analytical Sociology," Eds.: Peter Hedström and Peter Bearman.
- Boxman, E.A.W. and H.D. Flap (1991), "Informe contacten en Beroepspositie van Managers", *Tijdschrift voor Arbeidsvraagstukken* 7-1, pp. 51-60.
- Bourdieu, P. (2000), *Les Structures Sociale de l'Économie*. Paris: Editions du Seuil.
- Brandts, J., K. Gërkhani, A. Schram and J. Ygosse-Battisti (forthcoming), "Size Doesn't Matter! Gift Exchange in Experimental Labor Markets". *Journal of Economic Behavior and Organization*.
- Brandts, J. and G. Charness (2004), "Do Labour Market Conditions Affect Gift Exchange? Some Experimental Evidence," *Economic Journal*, 114, 684-708.
- Brown, M., Falk, A. and Fehr, E. (2004), "Relational Contracts and the Nature of Market Interactions," *Econometrica*, 72, 3, 747-780.
- Brown, M. and C. Zehnder (2005), "Credit Registries, Relationship Banking and Loan Repayment," IEW Working Paper 240, May 2005.
- Burt, R.S. (1997), "The Contingent Value of Social Capital," *Administrative Science Quarterly* 42/2: 339-365.
- Burt, R.S. (2005), *Brokerage & Closure. An Introduction to Social Capital*. Oxford University Press.
- Callander, S. and C. Plott (2005), "Principles of Network Development and Evolution: An Experimental Study," *Journal of Public Economics*, 89, 1469-1495.
- Coleman, J.S. (1986). Social Theory, Social Research, and a Theory of Action. *The American Journal of Sociology* 91: 1309-1335.
- Coleman, J.S. (1988), "Social Capital in the Creation of Human Capital," *American Journal of Sociology* 94, pp. s95-s120.
- Cook, K. S., and R. M. Emerson. (1978), "Power, equity and commitment in exchange Networks," *American Sociological Review*, 43: 721 – 739.
- Corbae, D. and J. Duffy (2008), "Experiments with Network Formation," *Games and Economic Behavior*, 64, 81-120.
- Corcoran, M., L. Datcher and G.J. Duncan (1980), "Most workers find jobs through word of mouth", *Monthly Labour Review*, August, pp. 33-35.
- Corten R. and V. Buskens (2010), "Co-evolution of Conventions and Networks," *Social Networks*, 32, 4-15.
- Eguchi, K. (2005), "Job Transfer and Influence Activities," *Journal of Economic Behavior and Organization* 56-2, pp. 187-197
- Falk, A. and J. Heckman (2009), "Lab Experiments Are a major Source of Knowledge in the Social Sciences," *Science*, 326, 535-538.
- Falk, A. and M. Kosfeld (2003), "It's all about Connections: Evidence on Network Formation," IZA Discussion Paper, No. 777.
- Fehr, E. and H. Gintis (2007), "Human Motivation and Social Cooperation: Experimental and Analytical Foundations," *Annual Review of Sociology*, 33, 3, 1-22.
- Flap, H. (2004). Creation and returns of social capital. A new research program. Pp. 3-25. In Flap, H. & Volker, B. (eds.). Creation and returns of social capital. A new research program. Routledge. Taylor & Francis Group: London & New York.
- Gintis, H. 2008. Five Principles for the Unification of the Behavioral Sciences. Working paper. Santa Fe Institute and Central European University.
- Goeree, J., A. Riedl and A. Ule (2008), "In Search of Stars: Network Formation among Heterogeneous Agents," *Games and Economic Behavior*, 67, 2, 445-466.
- Goldthorpe, J.H. (2000), *On Sociology: Numbers, Narratives, and the Integration of Research and Theory*, Oxford University Press.
- Granovetter, M.S. (1974), *Getting a Job: A Study of Contacts and Careers*. Basic Books; Cambridge, MA.
- Granovetter, M. 1985. Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology* 91: 481-510.
- Granovetter, M. 1992. "Problems of Explanation in Economic Sociology." Pp. 25-56 in *Networks and Organizations: Structure, Form, and Action*, Editors Nitin Nohria and Robert G. Eccles. Boston, MA: Harvard Business School Press.
- Granovetter, M.S. (1995), *Getting a Job: A Study of Contacts and Careers*, 2nd edition. University of Chicago Press, Chicago.

- Holzer, H. (1987), "Search Method Use by Unemployed Youth," *Journal of Labor Economics*, 6, 1-20.
- Ioannides, Y. and L. Loury (2004), "Job Information Networks, Neighborhood Effects and Inequality," *Journal of Economic Literature*, XLII, Dec., 1056-1093.
- Karlan, D. M. Mobius, T. Rosenblat and A. Szeidl (2009), Trust and Social Collateral, *The Quarterly Journal of Economics*, 124/3: 1307-1361.
- Kollock, P. (1994) The emergence of exchange structures: An experimental study of uncertainty, commitment, and trust. *The American Journal of Sociology*, 100(2): 313-345
- Lin, N. (1999), "Social Networks and Status Attainment," *Annual Review of Sociology*, 25, 467-487.
- Lawler, E.J. and J. Yoon (1996), "Commitment in Exchange Relations: Test of a Theory of Relational Cohesion," *American Sociological Review* 61-1: 89-108.
- Martí, J. de and Y. Zenou (forthcoming), "Social Networks," I. Jarvie and J. Zamora-Bonilla (Eds.), SAGE Handbook of Philosophy of Social Science.
- Marsden, P. (2001), "Interpersonal Ties, Social Capital and Employer Staffing Practices," In Lin *et al.* (eds.) *Social capital. Theory and research*. pp. 105 – 127. New York , Aldine de Gruyter.
- Milgrom, P.R. (1988), "Employment Contracts, Influence Activities, and Efficient Organization Design," *The Journal of Political Economy* 96-1, pp. 42-60.
- Montgomery, J. (1991), "Social Networks and Labor-Market Outcomes: Toward an Economic Analysis," *American Economic Review*, 81, 5, 1408-1418.
- Parson, T. (1937), *Structure of Social Action*, McGraw Hill.
- Podolny, J.M. and K.L. Page (1998), "Networks Forms of Organization," *Annual Review of Sociology* 24: 57-76.
- Portes, A. (1998), "Social Capital: Its Origins and Applications in Modern Sociology," *Annual Review of Sociology* 24: 1-24.
- Raub, W. and J. Weesie (1990), "Reputation and efficiency in social interactions: An example of network effects," *American Journal of Sociology* 96: 626-654.
- Rees, A. (1966), "Information Networks in Labor Markets," *American Economic Review*, 56, 1-2, 559-566.
- Russo, G., C. Gorter and R. Schettkat (2001), "Searching, Hiring and Labor Market Conditions," *Labor Economics* 8, pp. 553-71.
- Schram, A., J. Brandts and K. Gërkhani (forthcoming), "Information, Bilateral Negotiations," *European Economic Review*.
- Smith, V. (1962), "An Experimental Study of Competitive Market Behavior," *Journal of Political Economy* 70/2: 111-137.
- Streeck, W. (2005), "The Sociology of Labor Markets and Trade Unions," in: Neil J. Smelser and Richard Swedberg, eds., *The Handbook of Economic Sociology*, 2<sup>nd</sup> Ed., Princeton, Princeton University Press, 254-283.
- Uzzi, B. (1997), "Social Structure and Competition in Interemployer Networks: The Paradox of Emdeddedness," *Administrative Science Quarterly*, 42, 1, 35-67.
- Webster, M. and J. Sell. 2007. Laboratory Experiments in the Social Sciences. Oxford: Academic Press/Elsevier.
- Western, B. (1998), "Institutions and the labor market". In: Brinton & Nee (Eds.), *The New Institutionalism in Sociology*. Stanford University Press. (pp. 224-245)
- Willer, D. and H. A. Walker (2007), Building Experiments. Testing Social Theory, Stanford: Stanford University Press.
- Williamson, O. (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: The Free Press.
- Williamson, O. (1985), *The Economic Institutions of Capitalism: Employers, Markets, Relational Contracting*. New York: The Free Press.

## APPENDIX A: EXPERIMENTAL INSTRUCTIONS

This appendix gives the English translation of the original Dutch instructions for the sessions with costly information and identification. (*Italics indicate places where alternative texts were used for other treatments*). The instructions were programmed as html pages. Horizontal lines indicate page separations.

### At the start of the experiment:

---

#### Welcome

You are about to participate in a decision-making experiment. The instructions are simple. If you follow them carefully, you may earn a substantial amount of money. Your earnings will be paid to you in euros at the end of the experiment. This will be done privately, one participant at a time.

The monetary unit in the experiment is ‘**experimental francs**’. At the end of the experiment francs will be converted to euros at a rate of **1 euro for 15 francs**.

These instructions consist of 8 pages like this one. During the instructions you can page forward or backward by clicking with your mouse on ‘previous page’ or ‘next page’. Sometimes a page will not fit on your screen. In that case you can use the scroll bar to view the whole page.

[Next page](#)

---

#### Rounds and Groups

The experiment consists of 30 rounds, preceded by 3 practice rounds. After round 10 additional instructions will be given before we proceed.

In every round you will participate in a market where hypothetical goods are traded. Buyers can buy at most one good and sellers can sell at most one good. How you can make money by trading will be explained below.

In total 9 people will participate in the market. **There are 4 buyers and 5 sellers**. You will have the same role in every round: either buyer or seller. That will be determined before the first practice round. The other buyers and sellers in your market will be the same other participants in every round. You do not know who they are, however. Because there are more sellers than buyers in each round at least one seller will not be able to sell the good.

The composition of markets is anonymous. You do not know with whom you are in the market. Others do not know whether they are with you.

[Previous page](#) [Next page](#)

---

#### Buying and Selling the Good

If the buyer buys from a seller s/he pays an agreed upon price. How the price is determined will be explained below.

To deliver the good, the seller may endure costs. There are two possibilities. If the seller delivers a **low quality** good, there are **no costs**. If the seller delivers a **high quality** good the costs are **20 francs**.

If a buyer gets the good s/he receives a revenue in francs. If the buyer buys a **low quality** good this revenue is **10 francs**. For a **high quality** good the revenue for the buyer is **50 francs**. This allows you to calculate earnings in a round, dependent on the quality.

**1. The good has low quality:**

Earnings for the **seller** = agreed upon price

Earnings for the **buyer** = 10 – agreed upon price

**2. The good has high quality:**

Earnings for the **seller** = agreed upon price – 20

Earnings for the **buyer** = 50 – agreed upon price

**If you do not buy or sell anything your earnings are 0.**

[Previous page](#) [Next page](#)

---

## Phases

Each round consists of two phases.

In the **first phase** of a round buyers and sellers participate in a public market where each buyer can respond to an offer by any seller and vice versa.

In the **second phase** it is determined whether the good has **low** or **high** quality. This is determined by the **seller** (*buyer*).

[Previous page](#) [Next page](#)

---

## Phase 1

Participation in the public market proceeds as follows. Buyers may post an offer for the good and this offer holds for every seller in the market. Sellers may post an ask price and this holds for every buyer.

On the lower half of your screen you will see two rows of boxes. In the top row there is a box for each buyer. In the lower row there is a box for each seller.

You will recognize your own box by its yellow color.

**BEWARE:** buyers and sellers are randomly reallocated to boxes in every round. Therefore, you cannot keep track across rounds of what specific other participants are doing.

[Previous page](#) [Next page](#)

---

## Phase 1

If a buyer or seller places an offer on the public market, this appears in her or his box.

If you are a seller you will see a button ‘accept’ next to each buyer’s box. By clicking this you indicate that you will sell the good to that buyer at that price. You can only click the button if the buyer concerned is still active on the market. If the buyer has already bought from another seller you can no



longer click 'accept'. You can still see at what price that buyer bought the good (and you will see the same price in the box of one of the sellers).

**If you enter an ask price lower than the highest bid by any buyer, you will automatically sell the good at the price offered by that buyer.**

If you are a buyer you will see a button 'accept' next to each seller's box. By clicking this you indicate that you will buy the good from that seller at that price. You can only click the button if the seller concerned is still active on the market. If the seller has already sold to another buyer you can no longer click the button. Again, you will still see the price.

**If you enter a bid higher than the lowest ask price by any seller, you will automatically buy the good at the price asked by that seller.**

You may change your bid or ask as often as you like. It does hold that **a buyer may only increase the own bid. A seller may only decrease the own ask.**

The public market will remain open for 90 seconds. You will see the time count down on your screen. Whoever has not bought or sold when the market closes does not buy or sell the good in that round. When no more sales are possible (4 goods have been sold) the clock automatically jumps down to 5 seconds.

[Previous page](#) [Next page](#)

---

## **Phase 2**

In phase 2 the seller determines the quality of the good. S/he does this by clicking either 'high' or 'low' and confirming the choice.

As mentioned before: if the quality is low, the revenue for the buyer is 10 and the costs for the seller are 0. If the quality is high, the revenue for the buyer is 50 and the costs for the seller are 20.

When everyone has finished, the next round starts.

[Previous page](#) [Next page](#)

---

## **End**

This brings you to the end of these instructions. When everyone is ready we will start the first of three practice rounds. These will not affect your earnings. At the start of the practice rounds we will distribute a summary of the most important parts of these instructions.

When the first practice round starts you will see at the top of your screen whether you are a buyer or seller.

If you have finished reading these instructions, please indicate this by clicking the button 'ready' (at the bottom of this screen). Then please wait quietly until everyone is ready. That may take a little while, so we ask for your patience.

[Previous page](#) [Back to first page](#)

---

## Before Round 11:

---

### An Additional Phase

We add a third phase to each of the 20 rounds that will follow.

Therefore, from now on each round will consist of three phases. We will first give a brief overview and then provide more details about each phase.

In the **first phase** each buyer can propose to one seller to **negotiate** a price for the good **separately** from the other participants. The seller will be given an opportunity to indicate whether or not s/he is willing to negotiate bilaterally. The seller may also decide in phase 1 not to negotiate bilaterally with any buyer (but to only participate in the public market, instead).

In the **second phase** of a round buyers and sellers negotiate about a price for the good. If a buyer and seller have agreed to participate in bilateral negotiations, they negotiate privately. Any participant not involved in bilateral negotiations participates in a **public market** like the one in rounds 1-10. Thus, the market is opened at the same time as the private negotiations take place. Those negotiating bilaterally will see what is happening on the public market but cannot participate in it. If the negotiations do not lead to an agreement the buyer and seller concerned can switch and participate in the public market.

No one participating in the public market can observe anything that is occurring in any private negotiations.

In the **third phase** the quality of the good (**low** or **high**) is again determined by the **seller** (*buyer*).

[Next page](#)

---

### Phase 1

In phase 1 buyers first indicate whether they want to immediately proceed to the public market or first want to privately negotiate with a seller. This is done using the buttons 'market' and 'negotiate'.

By clicking on 'market' the buyer indicates not wanting any private negotiations.

By clicking on 'negotiate' the buyer indicates a wish to negotiate bilaterally with a seller. Because there are more sellers than buyers, not every seller will be invited to negotiate. **A random lottery will be used to determine which seller will be linked to a buyer.**

**BEWARE:** in every round the sellers are randomly allocated to buyers who wish to negotiate. A buyer can therefore not know whether or not s/he has previously negotiated with a seller and a seller cannot know whether s/he has previously negotiated with a buyer.

[Previous page](#) [Next page](#)

---

## Phase 1

If a seller is offered private negotiations with a buyer s/he must indicate whether or not s/he is willing to participate in them. This is done by clicking 'yes' or 'no' and confirming the decision.

If a buyer and seller thus agree to negotiate bilaterally the buyer may obtain **information about the seller** before the negotiations start. We will explain below how this information is collected.

This information is **the number of times that the seller chose low quality and the number of times that the seller chose high quality in previous rounds.**

**BEWARE:** the count of the numbers of low and high quality will start now. No information will be given about choices in rounds that have at this point been finished.

[Previous page](#) [Next page](#)

---

## Phase 1

If you are a buyer, the information is collected in the following way.

Before you start negotiating with a seller, you will ask all other buyers about their experiences with this seller. You will not need to ask this yourself. **If you are about to negotiate, other buyers are automatically asked for this information.**

At the same time, as a buyer you may be asked about your experiences with certain sellers. More specifically, you will be asked to give your experiences with all sellers that are going to negotiate with other buyers. This is done one at a time. When you are asked, we will inform you about your previous experiences with that seller. You will not be asked for information if you have no experiences with a seller.

The information concerned is **the number of times that the seller gave you high quality and low quality goods in previous rounds.**

There are no costs related to asking for *[or providing]* information. **Giving information costs 0.3 francs.** Therefore, if you give information to all three other buyers in a round, this will cost you 0.9 francs. Of course, if you give no information, you will bear no costs. *[last three sentences were dropped in the sessions with costless information]*

After all buyers have decided whether or not they want to give information, the information provided is passed on to the buyers who are in negotiations. For each buyer, you will see what information he or she is giving. **Buyers have fixed names:** "buyer 1", "buyer 2", "buyer 3", and "buyer 4" (if you are a buyer, you will see at the top left of your screen which buyer you are). With these names, you can keep track of which buyers are providing information.

*[ In the treatment without identification, the preceding paragraph is replaced by:  
After all buyers have decided whether or not they want to give information, the information provided is passed on to the buyers who are in negotiations. You will not be able to see which buyers do or do not provide information. Other buyers are denoted by "a buyer", "another buyer", etc. You can therefore not keep track of which buyers are providing information. ]*

---

Especially in early rounds, it may of course happen that some buyers have no experience with a specific seller. In that case, you will be told that the buyer concerned has no experience with the seller yet.

[Previous page](#) [Next page](#)

---

## Phase 1

In summary, collecting information proceeds as follows.

1. For all **sellers involved in negotiations**, we will check with which buyers they have traded in previous rounds.
2. as a **buyer**, you will be asked to provide this information, irrespective of whether you yourself are going to negotiate or buy through the market.
3. if you as a buyer are asked for information, you choose whether (0.3 franks) or not (no costs) you want to provide it.  
*[alternative for costless provision sessions: if you as a buyer are asked for information, you choose whether or not you want to provide it.]*
4. all **buyers in negotiations** are given the information supplied by others or receive the announcement that another decided not to provide the information.

Note that you will receive no information about your own experiences with the seller. **Sellers' identities are anonymous** and you can therefore not recognize them from previous rounds.

**Beware:** the information you receive as a buyer will only appear once. After you have confirmed that you have seen it, the negotiations will start and the information will no longer be shown. If you fear that you may not remember the information, you can write it down. Of course, this will only be useful in the round concerned. In later rounds, you cannot know whether you are dealing with the same seller.

[Previous page](#) [Next page](#)

---

## Phase 2

In phase 2 buyers and sellers negotiate the price of the good.

In the market, things proceed precisely as in the first 10 rounds. The only difference is that sometimes not everyone is participating. Recall that those involved in private negotiations are not participating in the market. For these buyers and sellers you will see empty boxes in the market.

Here we explain what happens when buyers and sellers negotiate bilaterally. During these negotiations they can continuously see at the bottom of their screen what is happening in the public market.

**The negotiations proceed as follows.** After the buyer has seen the information about the seller's previous quality choices the buyer places a bid for the good. This number is entered in the location provided after which the button 'confirm' must be clicked.

Next, the seller must indicate whether or not s/he accepts the bid. This is done by clicking 'yes' or 'no' and confirming.

**If the seller accepts the bid**, the buyer and seller must wait until all participants are ready before proceeding to phase 3. Participants in the market only notice this by the fact that the corresponding boxes are never activated. Therefore, no one in the market knows the results of private negotiations.

**If the seller does not accept the bid**, then the buyer and seller can both participate in the public market, if it has not been closed yet. On your screen you will directly enter the market.

[Previous page](#) [Next page](#)

---

### **Phase 3**

In phase 3 the seller (*buyer*) determines the quality of the good. S/he does this, just like in the first 10 rounds, by clicking 'high' or 'low' and confirming.

It still holds that a low quality means that the revenue for the buyer is 10 and the costs for the seller are 0. A high quality means a buyer revenue of 50 and seller costs of 20

When everyone has finished, the next round starts.

[Previous page](#) [Next page](#)

---

### **End**

This brings you to the end of these instructions. When everyone is ready we will proceed with round 11 of the experiment. We point out once more that we will start counting sellers' quality choices now. This information may be made known to buyers if they bilaterally negotiate with the seller concerned. Whether it is actually made known depends on the willingness of other buyers to provide it.

First, we will distribute a summary of the most important parts of these instructions.

If you have finished these instructions, please indicate this by clicking the button 'ready' (at the bottom of this screen). Then please wait quietly until everyone is ready. That may take a little while, so we ask for your patience.

[Previous page](#) [Back to first page](#)

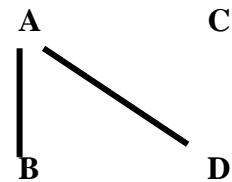
---

## APPENDIX B: INFORMATION PATTERNS

In this appendix, we show for each of the nine groups in the treatment with identification and costly information, the patterns of information sharing, as shown for group 1 in table 3. In addition, we show the 50%-information connections as described in the main text. In these graphs (on the right) a line connecting two employers indicates that they have 50%-information connection.

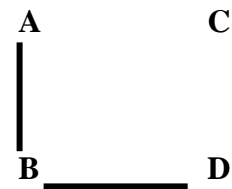
### Group 1

	To A	To B	To C	To D
From A	---	1.00	0.38	0.82
From B	0.73	---	0.86	0.43
From C	0.20	0.31	---	0.44
From D	1.00	1.00	0.78	---



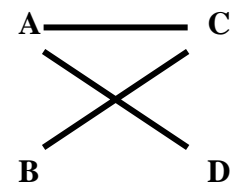
### Group 2

	To A	To B	To C	To D
From A	---	0.60	0.60	0.40
From B	0.88	---	0.60	0.90
From C	0.42	0.28	---	0.36
From D	0.29	0.63	0.00	---



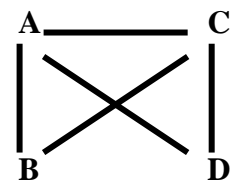
### Group 3

	To A	To B	To C	To D
From A	---	---*	1.00	0.82
From B	0.50	---	0.67	0.27
From C	0.54	1.00	---	0.25
From D	0.85	0.00	1.00	---



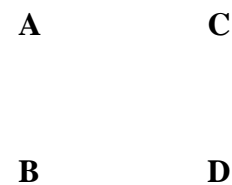
### Group 4

	To A	To B	To C	To D
From A	---	0.90	0.92	0.80
From B	0.71	---	0.82	0.20
From C	0.92	1.00	---	0.90
From D	0.63	0.40	0.86	---



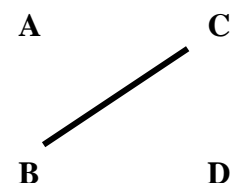
### Group 5

	To A	To B	To C	To D
From A	---	1.00	---*	---*
From B	0.44	---	---*	0.00
From C	0.50	---*	---	0.00
From D	---*	0.50	0.11	---



### Group 6

	To A	To B	To C	To D
From A	---	0.00	0.13	0.00
From B	---*	---	0.75	0.00
From C	1.00	1.00	---	0.17
From D	0.50	0.38	0.41	---



**Group 7**

	To A	To B	To C	To D
From A	---	---*	---*	0.00
From B	0.00	---	0.00	0.00
From C	1.00	---*	---	1.00
From D	0.33	0.00	1.00	---

**A****C****B****D****Group 8**

	To A	To B	To C	To D
From A	---	0.00	---*	0.00
From B	---*	---	0.00	0.00
From C	---*	0.00	---	0.60
From D	---*	0.38	0.67	---

**A****C****B****D****Group 9**

	To A	To B	To C	To D
From A	---	0.00	0.27	0.30
From B	0.00	---	0.00	0.00
From C	0.00	---*	---	0.00
From D	0.86	---*	0.50	---

**A****C****B****D**