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

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ABSTRACT
We use laboratory experiments to investigate how and under what circumstances networks amongst employers emerge that facilitate information sharing about the trustworthiness of job candidates, when worker opportunism is possible. The experimental design allows us to distinguish between mechanisms underlying the relations amongst employers and those between employers and workers. The data show that substantial information sharing within employer networks 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 employers to use. The other type is a ‘reciprocity network’ where information sharing is driven by the rewarding of previously given information by the requestor. Emerging reciprocity networks tend to crowd out anonymity networks. Both types of network enable employers to recruit trustworthy workers, thereby increasing the surplus from trade, which benefits both the employers and workers involved. However, restricted access to the networks may increase social inequality amongst employers. Social inequality amongst workers may occur as a consequence of limited access to certain jobs.

Keywords: Information networks, Recruitment, Experiments

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INTRODUCTION

Social networks play a crucial role in recruitment (Fernandez et al. 2000; Marsden 2001). For many types of jobs, more job matches are generated via network connections than through open and anonymous recruitment procedures (Granovetter 1974; Montgomery 1991; Flap and Boxman 2001). Though there is by now an extensive literature on the importance of networks for recruitment, its central focus has been on networks of a firm’s employees. It has been known for many decades that employee referrals are useful for screening new personnel (Rees 1966; Montgomery 1991). Newly hired workers are often relatives, neighbors or friends of current workers (Fernandez and Castilla 2001). This phenomenon is now well understood. In this paper, we also study the role that networks play in recruitment. Our focus is on a different type of network, however, to wit, employer information networks. These are social networks in which employers share information about prospective workers (Marsden 2001). Such networks have been studied much less than other types of labor market networks. We will show that they have important repercussions for the labor market.

Information about workers may be valuable in occupations where workers have considerable discretion about their performance at a job. There are many such occupations (e.g., Williamson 1985; Baker 1992; Goldthorpe 2000). As a result, monitoring is difficult and costly, making the acquisition of information about a candidate’s trustworthiness a crucial element in the recruitment process.¹ The performance history of prospective workers may be relevant information with respect to her or his trustworthiness. 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 social networks, employers may share this information.

We have previously shown that the mere availability of information about a candidate’s trustworthiness strongly affects the channels through which employers recruit, allowing them to hire more trustworthy workers (Schram et al. 2010). A fundamental limitation of the set-up in our previous paper is that information was exogenously given to all employers. The central focus of the present study is the question of how and under what circumstances social

¹ Of course, recruiting more generally involves uncovering information to reduce the uncertainty about a candidate. 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) others may be harder to discover. The candidate’s trustworthiness is this kind of characteristic.
networks amongst employers emerge that facilitate the dissemination of such information. This is important because the emergence of information sharing between employers is not \textit{a priori} obvious (as noted in a more general setting by Buskens et al. 2010). 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 (Marsden 2001). We argue here that 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.\footnote{We study networks in the sense of Podolny and Page (1998), i.e., a collection of actors that pursue repeated, enduring exchange relations without a legitimate organizational authority to arbitrate and resolve disputes. Many business groups and strategic alliances are instances of such networks without a formal arbiter.} An understanding of the emergence of information networks is important, because information about a job candidate’s trustworthiness is crucial in the recruitment process. Access to an information network may therefore affect an employer’s recruitment strategy, which in turn may affect workers’ access to certain job vacancies, thereby generating labor market inequality (Streeck 2005).

To increase our understanding of this emergence, we will address three key research questions. First, we will investigate how much information is shared amongst employers and what determines an employer’s decision to share. Second, we will study the mechanisms underlying information sharing and consider the various kinds of information networks they give rise to. Third, we are interested in the effects that employer information sharing networks have on employer-worker relations.

That information networks exist in the labor market should not come as a surprise. In fact, 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 (Rees 1966; Raub and Weesie 1990). Think, for instance, of the sharing of information about the reliability of borrowers in the financial sector (Brown and Zehnder 2005; Karlan et al. 2009); about the quality of applicants to higher education institutions; or about the appropriateness of particular individuals as marriage partners. For the recruitment process, two (related) examples serve to show how information may be shared. First, an employer looking to hire a new worker may receive information from other employers in her network about suitable candidates that have worked for them in the past. Second, these other employers may write recommendation letters providing specific information about these former workers.\footnote{Letters for former employees are the most obvious example. One may also think of recommendation letters for current employees, but then the interests of the current employer (who may want to keep the worker) need to be taken into account. We thank Roberto Fernandez for pointing this out to us.} For information exchange within employers’ networks, we are not thinking of standardized
recommendation letters for multiple use (as in many job markets) but of more direct recommendations from one employer to another (perhaps through personal correspondence, or otherwise in personal contact when playing golf or at a charity gathering, for example).

The empirical method we apply is that of laboratory experimentation. The laboratory provides an ideal environment to study social structures like social networks 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 (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.

Laboratory control will allow us to distinguish between two properties of information networks that may influence the way information is shared. In turn, this will allow us to isolate possible mechanisms underlying the emergence of employer information networks. The first property is the cost of information exchange. Raub and Weesie (1990:648) argue that such costs should be included in the analysis, because they may limit the effectiveness of stable employer information networks even in the presence of common interests. To accommodate this possibility, our design will vary the information transmission cost. When there are such costs, creating and maintaining networks is also costly (Marsden 2001). The second property is whether, in the process of information sharing, identities are known or not. This is because any kind of reputation formation (e.g., Raub and Weesie 1990) requires that one can identify other individuals. Our design will carefully distinguish between a situation in which an employer who requests information can identify those other employers who decide to share information and those that do not (and vice versa, the employer who asks for information can be identified) and a situation where identification is impossible. Of course, non-identifiability is not intended to describe actual practice in social relations between employers. Instead, it provides a benchmark allowing us to isolate the role of identification in these relations. This distinction in treatments 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, identifiability may be important because closure (a.k.a. ‘density’) 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 and sanctions are possible. As a consequence, if in creating information networks
employers are guided by self-interest, then relatively closed networks will be most effective and therefore identifiability 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.\(^4\) In this line of argument, identification is not necessary for the emergence of information networks and may even be harmful (Granovetter 1985). The distinction based on the identifiability of others within a network, will thus allow us to distinguish between the Coleman and Granovetter paradigms.

Our results show that both play a role. Two types of information networks emerge, both with substantial information sharing. One consists of Granovetter-like ‘anonymity networks’ where information is anonymously and voluntarily provided as a collective good for all employers to use. The other type is a Coleman-like ‘reciprocity network’ where information sharing is driven by the rewarding of previously information given by the requestor. Costs for providing information mitigate both the voluntary contribution and reciprocity mechanisms, however. Moreover, when reciprocity networks emerge, they tend to crowd out anonymity networks. Finally, information networks enable employers to recruit trustworthy workers, which in turn creates a high quality of trading, benefiting both employer and worker.

These results provide examples of the emergence of social structure, the understanding of which is a central issue in sociology (Parsons 1937; Cook and Emerson 1978; Granovetter 1985; Coleman 1986; Kollock 1994, Lawler and Yoon 1996). In spite of an increasing interest over the past decade (Brown et al.2004; Fehr and Gintis 2007; Karlan et al.2009; Bandiera et al.2009) mainstream economists have typically paid less attention to it. Our results illustrate some of the ways in which material incentives and social relations interact and our study may therefore be seen as an attempt to contribute to bridging the gap between sociology and economics (Gintis 2009). Fehr and Gintis (2007) present a strong argument for the need for more interaction between the two disciplines. 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. We vary the properties of information sharing between employers and analyze the effects of these variations on macro-level properties such as the resulting network. Since we can observe all individual decisions (for example, whether

\(^4\) Such a moral obligation need not be unconditional. For example, it may involve an obligation to contribute, if enough others are doing so (e.g., Diekmann and Lindenberg 2001).
or not to give information) we can study in detail how behavior at the micro-level leads to macro-level outcomes.

In what follows, we first present more of the background underlying our study. We then present our method, discussing the experimental design, the participants in the experiment and the procedures used. In the last three sections we present our results, a discussion of their implications and the conclusions.

STATE-OF-THE-ART
In a stylized representation of the hiring process employers recruit workers through two broad channels: on the one hand the ‘official’ (‘formal’) channel which resembles a centralized market and on the other (decentralized) 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 informal networks contacts between employers and workers are made in a much more decentralized way. In making such a contact, detailed information about a worker may be available. The choice between recruitment channels therefore 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 workers (Granovetter 1973).

It is important to note that social relations may play an important role in both channels (Granovetter 2005), though the type of relations and their effect may differ. In particular, the anonymous character of centralized markets makes it less likely than in the informal channel that either of the two mechanisms we distinguished above (collective dissemination or reciprocal exchange of information) will emerge. For example, if employer A finds a job candidate through a public employment agency, it is unlikely that her social network will include previous employer B of this worker and even less likely that in addition B will at some point contact one of A’s previous workers through an official channel.

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5 In many countries, public or private employment agencies provide the services of such centralized exchanges; some internet job-matching sites have similar characteristics.
Various studies in sociology and economics are relevant for our analysis. For example, some sociological papers investigate the endogenous emergence of networks in the laboratory. First, Corten and Buskens (2010) use simulations and experiments to analyze how networks and behavior in a coordination game co-evolve. They find that the extent of coordination depends both on characteristics of the game and of the network. More generally, Burger and Buskens (2009) show experimentally that actors endogenously form networks to reach better positions in various contexts. They also observe that efficient networks and networks in which everyone is equally well off both occur more often than predicted by theory. Finally, Brauna and Gautschi (2006) show that network positions (as well as relational features) are important determinants of outcomes (profit splits) in bargaining games.

All of these studies serve as examples of how networks are formed in the laboratory and how participating in such networks may be beneficial. In this general sense, our conclusions will confirm these previous results. However, the approach followed here differs from these previous studies in important ways. First of all, the typical procedure has been to explicitly ask subjects if they want to be linked to one or more others. If not, there is a fall-back option (usually the subject no longer actively participates and receives an outside –fixed– payoff instead). In our setup, there will be no explicit decision to link to someone else. Instead, subjects will decide whether or not to provide information. Ex post, we will be able to study whether this has led to network structures. A second difference is that we will not use a fall-back option. In the environment we are interested in, employers want to hire a worker. If they do not give (or receive) information via a network, they still want to hire. In other words, the set of options they choose from is not affected by whether or not they are linked to others. In this way, our setup more closely resembles the way in which informal networks are formed outside of the laboratory. It is uncommon for employers to be explicitly asked to join an ‘old boys’ network’, for example.

Another difference is that in the networks considered in these previous studies, there are no issues of trustworthiness, while this is a central focus of our research. In a different setting (buyers and sellers of a good), Kollock (1994) provides a seminal experimental sociological

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6 We discuss the literature most closely related to the formation of information networks in recruitment. Other literature is more indirectly related. First, there are many studies on recruitment strategies (Schram et al.2010 gives an overview). Second, the rich literature on indirect reciprocity (see Seinen and Schram 2006 or Ule et al.2009 for references) is related to our analysis of worker reputations, but typically involves very different settings. Third, for an example of how firms form networks to exchange information unrelated to recruitment, see Cassar et al.(2009). Finally, for more general and recent studies of experimental sociology, see Willer and Walker (2007) and Webster and Sell (2007). The discussion of these literatures is beyond the scope of this paper.

7 For related work in economics see Callander and Plott (2005), Falk and Kosfeld (2003) and Goeree et al.(2008). These follow network formation protocols that are similar to those in the papers discussed here.
study on the importance of trustworthiness in trading relations. He analyzes how the establishment of fixed trading partnerships depends on the uncertainty about the quality of the good to be traded.\textsuperscript{8} While his paper is about the establishment of long term relations between employers and workers, ours is about first time recruitment and especially the role that relations amongst employers may play. Kollock already foresaw the importance of such research. Among the future directions 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 1994:342). Our study aims to address precisely this need.

In our setup, the information shared in a network of employers may affect the relation between an employer and a worker. Some previous experimental studies have dealt directly with how behavior in a social relation is affected by information provided by others.\textsuperscript{9} For example, Buskens et al.(2010) have two trustors play a standard trust game sequentially with one trustee, with this sequence taking place fifteen consecutive times.\textsuperscript{10} In one situation each trustor only has information about the own interaction (an example of ‘dyadic embeddedness’), while in the other situation information is also given about the interaction between the other trustor and the trustee (‘network embeddedness’). Both types of embeddedness are exogenously imposed. The authors conclude that both dyadic and network embeddedness affect behavior. Trustees become more trustworthy in reaction to the possibility that trustors may sanction them based on information obtained through their own experiences or through the ‘network’. In turn, this increased trustworthiness increases trust. This work is important in that it shows how information from a network may affect its members’ relations. It is very different from our research, however. Most importantly, we study the endogenous formation of networks for information exchange. Moreover, by design we will exclude the possibility of recognition of a worker by an employer. Hence, there are no repeated game effects between the two (and no possibility of direct reciprocity of previous choices). This will allow us to isolate the effects of network information and focus directly on these effects.

To the best of our knowledge, there are no previous experiments studying the relationship between networks and markets in the way we do. A theoretical study by Bowles and Gintis (2004) is relevant, however. They investigate the interplay between ethnic networks and an

\textsuperscript{8} Brown et al.(2004) are an example of economists interested in very similar issues.
\textsuperscript{9} More generally, Buskens and Raub (2010) give an overview of experimental and other research on the effects of embeddedness on trust in social dilemmas.
\textsuperscript{10} In a trust game, a trustor may transfer money to a trustee. The experimenter adds to this amount and then the trustee decides whether to transfer money back to the trustor.
anonymous market. The cultural affinity of ethnic networks can support enforcement of pro-
social behavior among members by reducing information costs, while the anonymous market
has the virtue of offering unrestricted trading opportunities. The authors develop a general
equilibrium model in which the size of the anonymous market and the size of parochial
networks are determined endogenously. Exchanges between group members happen only
once. These two features are common with our research design. There is one crucial
difference, which is that in their model network members automatically have access to a
common pool of information, whereas our experimental set-up is designed precisely to study
the process by which such a common pool is created.

Aside from the experimental and theoretical literature, there is also a rich empirical
literature in sociology which studies the use of networks in the recruitment process, using
field data. Marsden (2001) points to the information benefits of employers’ network contacts.
These benefits are particularly high for jobs where performance and skills are difficult to
observe. This provides important input for our experimental approach. Inter alia, laboratory
control will allow us to derive causal inferences about the relationship between such networks
and their consequences for recruitment. Fernandez et al.(2000) and Fernandez and Castilla
(2001) present in-depth studies of the role of social networks in the hiring of new phone
center workers via employees’ referrals. They study the benefits to the firm of hiring through
employees’ networks, distinguishing between the ‘richer pool’, the ‘better match’ and the
‘social enrichment’ hypotheses.11 The results show evidence in support of the ‘richer pool’
hypothesis: the pool of referred applicants is more qualified and more readily hirable than
non-referral applicants. As a consequence, an important mechanism by which employers can
benefit from using their employees’ social networks is through lower screening costs. Erick-
son (2001) adds to this by observing that for many upper-level jobs employers consider hav-
ing a network to be part of employees’ job qualification per se. They prefer to hire people
with larger social networks. In general terms, such results are related to our study, because of
the focus on the socially embedded nature of the recruitment process. A substantial difference
is that while most of these authors look at employers’ benefits from utilizing employees’
social ties, we focus on the social network between employers themselves.

11 In related empirical studies, Fernandez and Sosa (2005) study gender segregation effects and Fernandez and
METHOD

The labor market environment we study is one with more workers than employers, i.e., of excess supply for workers.\textsuperscript{12} This is empirically the more relevant case to study. In this situation, workers have a market disadvantage because some remain unemployed, but they have an advantage within the employment relation, because they can independently determine their performance after the wage has been established. This creates a certain power balance in the social relation between employers and workers, which is precisely what makes it an interesting environment to study.

Participants

The experiment was run in the spring of 2009 at the CREED laboratory of the University of Amsterdam. We recruited 234 participants, mainly undergraduate students at the University of Amsterdam. All received an invitation to sign up and participation was on a first-come, first-serve basis. Each participant took part in one of 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 employer or worker. Sessions lasted approximately 135 minutes, and participant earnings were performance based, with an average of €29.75 (including a €7 show-up fee).

Design and Procedures

Terminology. In the laboratory, the experimental situation is presented in terms of a market in which an abstract good is traded between buyers and sellers. This is common in the experimental labor market research and used in seminal papers like Fehr et al.\textsuperscript{(1993)}. An important reason to use abstract terms is to reduce bias due to participants’ preconceived ideas about what employers or workers ‘ought to do’. In this way abstract terminology contributes to the internal validity of the design.\textsuperscript{13} Nevertheless, 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.

Treatments. In line with the discussion above, our design consists of four separate experimental treatments, varying along two dimensions. The first dimension consists in

\textsuperscript{12} This has received most attention in previous literature, including Köllock (1994). Schram et al.\textsuperscript{(2010)} and Brandts and Charness (2004) also consider the case of more employers than workers.

\textsuperscript{13} The loss of external validity that this causes is considered to be minor (e.g., Fehr et al.1993). For a discussion of the tradeoff between internal and external validity, see Schram (2005).
whether or not employers can identify each other when sharing information.\textsuperscript{14} 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.

| Rounds | Participants in any treatment interact in 30 rounds, preceded by three practice rounds. The same four employers and five workers interact anonymously in a group throughout the 30 rounds.\textsuperscript{15} 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 rounds are split into 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.

The description of the central part of our treatments involves two inter-linked parts: the description of how agreements between employers and workers are reached and the description of how information is disseminated through employers’ networks. In these 20 rounds recruitment can take place through two channels: a centralized market or bilateral (private) negotiations. Employers and workers can choose which they would like to enter. 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.

Effort. After all trading activity has ended, each worker involved in a labor contract chooses the ‘effort’ she is willing to give.\textsuperscript{16} We assume that all workers are a priori homogenous in the sense that there are no differences in quality: the only thing that distinguishes between workers is the effort they choose. This allows us to isolate the effect of worker discretion in the effort level they choose. 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 \(r(0)=10\).\textsuperscript{17} A worker’s payoff \((\pi_l)\) is

\textsuperscript{14} Participants take part anonymously. As explained below, identifiability is based on fixed participant codes and enables keeping track of another participant’s decisions over time.

\textsuperscript{15} For a study involving larger groups (in a different context) see Brandts et al.(2010).

\textsuperscript{16} Choosing effort in this way has been standard in this literature since at least Fehr et al.(1993). The essence is that workers make a (costly) choice affecting the outcome for the employer. This is comparable to a seller’s choice of quality level in Kollock (1994).

\textsuperscript{17} The experimental ‘currency’ is ‘experimental franc’. Francs are exchanged for Euros at the end of the experiment at the rate 15 francs = € 1.
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.

**Recruitment channels.** The choice between channels works as follows. At the beginning of each of the 20 rounds each employer can express a wish to negotiate bilaterally with a worker.\(^{18}\) These negotiations represent the phase in informal recruitment, in which employers talk personally to potential workers that have been referred to them by other employers in their network. 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 has not asked for it or because the solicited worker has declined- enter the centralized market.\(^{19}\)

**Idealized market.** 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.\(^{20}\) 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 (reflecting 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

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\(^{18}\) This wish may, of course, be based on previous experiences in the two channels.

\(^{19}\) With five workers and four employers there is always at least one worker not involved in bilateral negotiations.

\(^{20}\) To ensure anonymity across rounds, participants’ positions on the monitor are randomly shuffled between rounds. Therefore, an employer cannot carry information about a worker’s trustworthiness over from one round to the next, allowing us to restrict access to this information to the networks.
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 replicate markets observed in the field. Instead, they are what Granovetter (1985:484) calls “idealized markets” 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 –informal– channel, the bilateral negotiations.

*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.\(^{21}\) The worker concerned can 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 idealized market. In 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. This is organized in a way, that the latter cannot recognize them as newcomers in the market. After the bilateral agreements have been reached, the workers choose an effort as described above.

*Information.* A crucial difference between the idealized market and bilateral negotiations is that in the latter –before making a wage offer– 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. As explained above, our interest in this paper is in how and under what circumstances a social network of employers can arise where such information is shared.

*Information exchange.* After employers and workers have been paired for bilateral negotiations each employer asks all other employers in their group 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’

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\(^{21}\) The initiative is on employers’ side: they decide whether to offer bilateral negotiations in the first place and also make the wage offers. This asymmetry reflects the basic power relations in the labor market (Western 1998; Streeck 2005).
willingness to share information and not so much in their desire to request it. Each employer who 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.

When employer A is asked by employer B to provide this information, we first tell A what it is, i.e., how often A has reached an agreement with that worker and how often this was followed by high effort. The worker remains anonymous and cannot be recognized by A in future interactions. This is important, because it ensures that the information cannot be used for direct reciprocation by employer A of this worker’s past efforts. Moreover, 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 conversation between two employers on the golf course will reveal information about whether the worker concerned is trustworthy but not about the wage this worker earned in the previous job.

Identifiability. 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 revealed to the other employer involved in the transfer. Given the dynamic structure of our environment, this makes it possible to keep track of other employers’ choices over time. In contrast, without identifiability, both employers that ask for information and those that (dis)agree to give it do so without other participants being able to keep track of this decision.

Costs. In the sessions with costly information an employer has to pay a fixed cost of 0.3 francs every time she gives information. 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

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22 Because requesting information is costless but useful in our experiment, most employers would likely do so anyway. Automatic generation of the request reduces the noise in our data.

23 Outside of the laboratory not all information need be truthful, of course. Note that we are considering information about an employer’s former worker, which reduces the incentive to misrepresent her trustworthiness. By imposing the truth, we abstract from the complications related to strategic lies and isolate the decision to share information per se.
earnings from any single labor contract (10 or 30 francs). In the sessions with costless information there are no charges associated with information flows.

Initial rounds. 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. This is important, because not many participants will have experience with such markets (in contrast to employers in the field, who likely deal with markets very regularly). Moreover, these rounds 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 these 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, 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.

[Hypothese start]

HYPOTHESES

As discussed in the introduction, the focus of our study is on how and under what circumstances networks amongst employers emerge that facilitate the dissemination of information about workers’ trustworthiness. Before deriving specific hypotheses we reformulate our three fundamental research questions to reflect the laboratory situation:

1. How much information is shared by subjects in the role of employers and why?
2. What kinds of information networks do we observe?
3. What are the effects of information sharing for employers, workers and their interaction?

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 can and will consider the effects of the information network properties distinguished by our treatments: identifiability and costs.

More specifically, our approach will consist in using treatment differences in the data to understand the mechanisms underlying observed behavior. With respect to our first research question we will look both at fractions of information requests honored as well as at the determinants of the decision to provide information when asked. Two possible hypotheses are that (i) the absence of identifiability and (ii) the presence of information sharing costs will hinder the emergence of significant levels of information exchange. The rationale behind (i) is that an important mechanism like reciprocation of other’s provision of information is impossible without identification. The mechanism underlying (ii) is that employers, even when it is possible to identify others, may rationally calculate that they will not be able to reap sufficient benefits from information exchange to compensate for the corresponding costs.

With respect to the second research question we can hypothesize how the treatment variables (i.e., network properties) will influence the structure of observed networks. Across treatments, distinct kinds of information networks can arise. An important 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 identifiability, 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. Experiments on social dilemma’s have shown that many people act as ‘conditional cooperators’ in such an environment, i.e., they contribute if and only if sufficient others do (Brandts and Schram 2001; Diekmann and Lindenberg 2001). As a consequence, the variation in contribution levels across groups tends to be large. For our experiment, this means we expect to see some groups with successful anonymity networks and others without. We expect the number of successful anonymity networks to be decreasing in the costs of information provision.

Identification on the other hand, will allow employers to reciprocate leading to what we call ‘reciprocity networks’. This will however again depend on the costs of sharing information. Consistent with our discussion of the first question, we thus posit that with identifiability and without costs more reciprocation will allow larger networks with more links to arise. This means that more employers will share information and that the resulting networks will tend to be closed in the Coleman (1988) sense.24

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24 Recall that closure measures the extent to which any two connected agents connect to the same third parties.
Finally, we will examine how workers’ wage levels and trustworthiness (measured by their effort levels), and employers’ earnings depend on the degree of information sharing and on the network structures that emerge. Here, our hypotheses are that significant information exchange leads to more trading through the informal channel, higher trustworthiness, and higher earnings for both workers and employers. These effects are expected to be stronger, the larger and more closed the information network is. The rationale behind these hypotheses is that in the environment we study, connections and the information generated can only be useful if an employer recruits through the informal channel. The higher the level of information exchange about the trustworthiness of prospect workers, the higher the probability that employers will reward workers (i.e., through high wages) based on indirect reciprocation of their efforts in the past. This in turn will lead to higher effort levels by the workers because they will reciprocate employers’ rewards with more trustworthy behavior. In addition, increased trustworthiness may also result from workers’ concerns about their reputation in future relations. This increased trustworthiness leads to higher surplus from trade. The social relation between an employer and worker in this situation (which is based on a reciprocal interaction) will then lead to a division of this surplus that is fair in the sense that it benefits both. As a result, the overall earnings of both employers and workers will be higher when recruiting through the informal channel than the formal one. Consistent with our hypotheses for questions 1 and 2, we predict that these effects will be strongest in the case of a network structure with identifiability and without costs. Table 2 summarizes our research questions, hypotheses and the corresponding mechanisms.

[Table 2 here]

\textbf{RESULTS}

In this section we present the results in detail. In the discussion section, we will interpret these results and relate them to our research questions and hypotheses, and to the literature discussed above.

\footnote{25 Indirect reciprocity is a powerful mechanism in the interaction between strangers (Seinen and Schram 2006; Ule et al.2009). It implies rewarding a stranger for prior kind acts to third parties. Here, a high wage offer may be a combination of an indirect reciprocal response to the worker’s previous actions and a calculative response to the estimated probability that a high wage will be met with high effort.

26 It is not a priori obvious that both should benefit from higher surplus. When high effort is imposed instead of chosen by a worker, the surplus is mainly absorbed by the employer (Schram et al.2010 and references therein).}
**Information Sharing**

Table 3 gives a first impression of the extent of information sharing across treatments. Recall that every time an employer decides to enter bilateral negotiations, she automatically asks the other employers for information. Table 3 shows the fraction of these requests that are positively responded to.

[Table 3 here]

The results show that, in this aggregated view, the distinction between costless and costly information is more important than the effect of identifiability. When information sharing is costless it is high overall; the difference between the two identifiability treatments is not statistically significant at conventional levels. When information is costly just over half of the requests are honored. Again, the difference between the two identifiability treatments is not significant. This lack of an effect of identifiability means we cannot reject the null that there is no difference in favor of the alternative hypothesis 1) in table 2. We will return to this issue in our discussion. Statistically speaking, costs do matter. Without identifiability the amount of information given is higher (91%) when costless than when costly (59%). This difference is statistically significant (Mann-Whitney U=5.00, N=12, p=0.037). With identifiability, the amount of costless information given (94%) is significantly higher than the 52% when it is costly (Mann-Whitney U=0.00, N=14, p<0.01). For both cases, we therefore reject a null of no effects of costs in favor of the alternative 2) in table 2.

To better understand what is going on in the different treatments we consider information sharing in more detail. Table 4 shows information flows in one particular group –group 1– of the identifiability/costly treatment. Each cell shows the fraction of information requests that was honored between two of the four employers in the group.

[Table 4 here]

Inspection of the entries in table 4 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, while 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.

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27 Because subjects interact in markets and across rounds, we use market averages as units of observation.
28 Appendix B contains tables for all groups in this treatment. This treatment has the highest variation in observed networks. Tables for other treatments are available upon request.
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 4. 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 4, \( f_{AB}=1 \) and \( f_{BA}=0.73 \). For each treatment we then determine the correlation coefficient between \( f_{XY} \) and \( f_{YX} \) across 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. Table 5 shows these correlation coefficients.

[Table 5 here]

First consider the treatment without identifiability 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 3 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 identifiability one cannot determine who the sender of information is.

Similarly, in the treatment with costly information and no identifiability, 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 while employers in other groups hardly provide information at all. What appears to be happening is a kind of ‘collective’ reciprocity (a.k.a. “generalized exchange”; e.g., Yamagishi and Cook 1993) at the group level where employers respond positively (negatively) to high (low) overall levels of information provision in their group by conditionally cooperating. Differences across groups then yield the (marginally) significant correlation coefficient across all groups in this treatment. This provides support for hypothesis 3) in table 2.

In the treatment with identifiability where information is costless the correlation coefficient is 0.13 with a two-sided significance of 0.527. No reciprocal behavior is observed, even though identification allows one to reward the sender of information. Note that this result does not allow us to support alternative hypothesis 4) relative to a null that there is no correlation across pairs in information provision.
Finally, in the treatment with costly information and identifiability 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 paid a cost to do so, reciprocal behavior in the form of sharing the own information with that other employer does emerge. In contrast to the costless case, this does reject a null of no correlation in favor of alternative 4).

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 identifiability 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 decisions to share information of the employer asking for information). Table 6 gives the results of this regression. Here, the dependent variable is a dummy indicating whether or not an employer responds positively to an information request. The independent variables are defined in a footnote to the table.

[Table 6 here]

Note that all of the estimated coefficients in table 6 are statistically significantly different from zero at the 5%-level or better. There is a clear intuitive explanation for the sign of each. First, employers tend to decrease their willingness to participate in an information network as 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 and provides further support for alternative hypothesis 4). Finally, having earned more in a previous contract makes it relatively easier for an employer to bear the costs of providing information.

**Information Networks**

In the 12 groups without identifiability, only anonymity networks can arise. We observe no networks without any information sharing. Moreover, only one ‘full-information network’ occurs (one of the groups with costless information), where information requests are always honored. The other (11) groups are in between these extremes and can be characterized as
‘partial-information’ networks. As we saw above, more information is exchanged when it is costless than if it is costly, however.

Under employer identifiability, 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 almost always given when asked. Note that these networks are almost completely closed in the sense that every employer is connected (through information provision) to every other. We only observe in one group (out of 5) that the network is completely closed in this sense, however (i.e., there is only one group where information is given 100% of the time). 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 identifiability 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 relationship between any two employers and define them as either having a network connection or not (as in Goeree et al. 2008). 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. 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. Recall that closure measures the extent to which any two agents connected in a network both have connections to the same third parties. For our definition of a network link, this means that if employer A and B both provide the other with information 50% of the time and A and C do the same, then B and C also provide each other with information 50% of the time. We noted above that Coleman (1988) has argued that closed

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29 To check the robustness of our classification, we also (in the next subsection) apply a stricter definition based on 80%-network contacts.
networks will be more effective in sharing information. Our data allow us to investigate this empirically. Here we discuss the observed extent of closure. Below, we will relate a network’s closure to its effects on employers and workers.

For the analysis of closure, 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 determine 50%-network connections based on the final 10 rounds only, very similar results are obtained. All in all, with costly information closure is limited: not a single network is completely closed in a non-trivial sense. A comparison with the almost completely closed networks when information is costless provides support for alternative hypothesis 5) (table 2).

**Employer-Worker Relations**

We first give an overview of the recruitment channel used, wage levels, worker trustworthiness and earnings of employers and workers. The focus is on how levels of trustworthiness and employer and worker earnings in the informal channel compare to those in the idealized market and how this varies with the treatment variables (i.e., network properties). Below we will dig deeper into the two treatments with costly information sharing and analyze how employer-worker relations are affected by variations in the information networks that arose.

Table 7 shows average values of key variables for all four treatments.

[Table 7 here]

We will discuss each row in turn. The second and third rows of the table show that the fractions of overall realized contracts are quite similar across the four treatments (in all treatments almost all contracts are established). The fourth row shows that recruitment through the informal channel is considerable, the lowest value (the only case where a majority of contracts is made in the idealized market) being almost 38% for the treatment with identifiability and costly information. Comparing across treatments the fraction of labor contracts made through these informal recruitment channels to the level of information sharing (table 3), note that distinct levels of information are not the sole cause of differences
in channel choice. For example, without identifiability, 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.

Rows 5-16 show averages for workers’ wages, their effort levels and the earnings of workers and employers. By comparing rounds 1-10 to 11-30, one can see the difference that the option of an informal recruitment channel makes.Rows 5-7 show that in all four treatments wages are considerably higher in the informal channel than in the idealized markets.

Rows 8-10 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. The difference is statistically significant in each of the four treatments.30 This rejects a null of no difference across channels in favor of alternative hypothesis 7). In turn, this leads to higher overall earnings in the informal channel, as we will discuss below.

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 7, 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 the informal channel in rounds 11-30, one can see that both employers and workers earn more after recruitment through the informal channel. 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 in the latter case takes place via the idealized market or through the informal channel. A comparison between the two channels in rounds 11-30 shows that in three out of four treatments these earnings are higher for contracts from the informal channel than for those that are made in the idealized

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30 For each treatment, a Wilcoxon signed rank test was run on group average effort levels in BN versus IM. The results are for costly/identifiable: \(Z=-2.429, N=9, p=0.015\); costless/identifiable: \(Z=-2.023, N=5, p=0.043\); costly/unidentifiable: \(Z=-2.201, N=6, p=0.028\); costless/unidentifiable: \(Z=-2.201, N=6, p=0.028\).
market. For the workers the comparisons are different. Their earnings increase from rounds 1-10 to rounds 11-30 only if in the latter case they engage in contracts through the informal channel. 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.

For further analysis we distinguish between treatments. First, we test hypothesis 8) (that employers and workers earn more in the informal channel) for the cases of costless information, where information about workers’ trustworthiness is abundantly shared. Pooling across the identifiability treatments, the difference in employers’ earnings do not differ significantly between the two channels (Wilcoxon, $Z=−1.156, N=11, p=0.248$). Workers earn significantly more after finding a job through the informal channel, however (Wilcoxon, $Z=−2.845, N=11, p=0.004$). This latter result provides partial support for hypothesis 8) in table 2.

Turning to the costly information treatments, we will take account of the observed variation in the extent of information provision when investigating employer and worker relations. Recall that for these treatments we found positive correlations in information sharing, indicating reciprocal patterns between particular employers. We start with the case without identifiability, for which we concluded that this reciprocity was at the group level. We want to further explore the heterogeneity across groups in this treatment. Table 8 shows averages for trading activity in each of the six groups, ranked from most to least information shared.

[Table 8 here]

One can see by inspection how the average fraction of information given is directly and positively related to the percentage of contracts agreed upon in the informal recruitment channel. This supports hypothesis 6) for this treatment. Observe also that in group 3, where the percentage of information given is very high, recruiting through the informal channel leads for both employers and workers to much higher earnings than in the idealized market. For workers this holds in five out of six groups. Employers earn more from informally recruited contracts than in the idealized market in only two of the six cases. In the other four groups, they do earn more on average after having recruited informally than in the first ten rounds, however (this is not shown in the table). Therefore, the introduction of an informal channel is (financially) beneficial to employers even if their earnings are lower when they use this channel than when they do not. Nevertheless, when both channels co-exist it appears that a very high level of (anonymous) information sharing is needed for trades in the informal channel to be more profitable for employers than trades via an idealized market.
Next, turn to the case of costly information and employer identifiability. Here, we observed a rich variety of information networks. First, we consider the relationship between information sharing and channel choice. To study this we need a measure for the regularity of information sharing, for which we use the 50%-network connection criterion defined above. We count the number of connections that each employer has, which for each employer will be an integer number between 0 and 3. It turns out that the fraction of choices to enter bilateral negotiations increases monotonically from 0.30 for employers without connections to 0.65 for those with three connections. This provides further support for hypothesis 6).

The next question is whether endogenously formed information networks benefit those involved, i.e., do employers that share information earn more than those that do not? We again use the 50%- criterion and add a 80%- variant thereof. Table 9 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 connections 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.

In the environment that we study connections can only be useful if an employer recruits through the informal channel, so that our \textit{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 (un-interacted) 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, –following hypothesis 8– we expect the interaction effect to be significantly positive; with connections, recruiting via the informal channel should be advantageous (and \textit{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.\footnote{More precisely, to test the combined effect, we check whether the sum of the coefficients for uninteracted terms and the interaction term is significantly different than the coefficient for participation in the informal channel alone. For the 50%-variable this is the case at \(p=0.06\), for the 80%-variable at \(p=0.03\).} 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 use reciprocal relations to create profitable networks for information sharing.

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 ($Z=-1.96, N=6, p=0.05$). 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, the reputations that are relevant in this respect are related to the extent that specific employers share information. These are only privately known (i.e., not shared in the network). This limits the effectiveness of punishment in the Coleman sense but does not destroy it.

**Overall summary of the results**

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 identifiability. With identifiability, the number of network connections an employer has positively and strongly affects the trustworthiness of the workers she hires. Specifically, employers that share information hire workers that are more often trustworthy than others. As a consequence, employers that recruit through informal channels earn on average more than those who do not. Workers hired informally

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32 Keep in mind, however, that significance is based on asymptotic properties, while we have only 6 (group) observations.

33 In a substantial minority of cases (25%-40%) trust and trustworthiness emerge between employer and worker even without information sharing. This was previously observed by Fehr et al. (1993).
earn more than those hired through the formal channel. Together, these results support all of the hypotheses depicted in table 2, except 1).

**DISCUSSION**

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

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

As a preliminary point, note that –by design– information is only shared in the informal recruitment channel. As noted above, outside the laboratory the mechanisms underlying information sharing are much less likely to occur in formal, impersonal channels. Laboratory control allows us to isolate this difference between the two channels by not allowing for any information sharing in the idealized market.

We can summarize observed information sharing as follows. First, as hypothesized, the existence of costs reduces the extent of information exchange. Second, contrary to what we hypothesized, the absence of identifiability does not hinder information sharing. Third, when information is costless, it is given very often. Fourth, when it is costly, the specific social structure of information sharing depends strongly on whether employers can identify each other.

We interpret these findings as follows. In networks where identification is not possible and information provision is costless, almost every employer shares the information requested. Though this finding supports a more material motive, we find that a majority of the employers is also willing to share costly information, even when anonymity prohibits future reciprocal responses. Other mechanisms than the mere effect of material incentives appear, therefore, to be at play in explaining this generosity in information sharing. Employers in these anonymous groups seem to have established a general norm of information provision as a contribution to a collective good (Yamagishi and Cook 1993). The main mechanism underlying employers’ adherence to this norm may well be their pro-social motivation generated by social relations that employers within a network are embedded in (Granovetter 1985). In particular, we have hypothesized that conditional cooperation with the others in their group is the principle mechanism at work. A typical employer is willing to bear the costs of sharing information if enough others are willing to do the same. This finds support in the considerably distinct social structures we observe across groups. In some groups the result is a complete information network while in others sharing breaks down completely.
The observation that the social structure emerging between employers that cannot identify each other is less driven by material incentives than a conditional pursuit of common interests (Raub and Weesie 1990) 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 identifiability, employers’ willingness to share information is clearly not an outcome of reputation building (which is impossible without identification).

Other mechanisms are at work when identification is possible, however. When provision is costless, information is almost always shared. Employers do not want to be recognized as being unwilling to share it. In the case with identifiability and costly provision a similar aggregate level of information sharing is reached as in the case without identifiability. Importantly, this is obtained through a different mechanism and leads to a completely different social structure. Now, information sharing is based on direct reciprocation of others’ decisions 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. Identifiability enables (private) reputation building, which in turn enables reciprocity. The combination of the two yields information sharing. Reputation should 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. For the employers that do use the informal recruitment channel, the interaction between reputation and reciprocity yields an 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.

We can conclude that with identifiability, Granovetter’s social embeddedness paradigm is less important than Coleman’s argument that reciprocity through sanctioning and rewarding of reputations is the mechanism driving our results. This explains why we found no support for hypothesis 1). The idea underlying the hypothesis is that the Coleman mechanism of reciprocation would increase the extent of information exchange. It turns out that this increase is off-balanced by decreased information provision as a collective good.

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34 Importantly, reputation is private in our identifiability treatment, i.e 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 the willingness to share information is publically known.
What kinds of information networks arise?

A consequence of the distinct ways that employers decide on whether or not to give information, is that we can classify the networks that emerge in two general categories of social structure: (i) those where information is anonymously and voluntarily provided as a collective good; we have called these ‘anonymity networks’; and (ii) reciprocity-based information sharing networks, which we have called ‘reciprocity networks’. This distinction runs parallel to our experimental treatments. Without identifiability, reciprocity-based networks cannot be formed. In either type of network, the extent to which information is actually provided varies with the costs of providing it.

It is interesting that reciprocity networks crowd out anonymity networks in the sense that unconditional provision becomes rare and employers look to form networks of mutual information sharing. This finding supports Granovetter’s (1985) argument that identification is not necessary for the emergence of networks and may even be harmful. The harm occurs because pro-social motivations like conditional cooperation are crowded out by more interest-driven types of motivations like reputation building. In the end, when information is costly and identification allows for reputation formation the result is a large variety of reciprocity networks across groups, varying from completely open to completely closed.

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

As hypothesized above, information networks lead to higher wage offers and more trustworthiness of workers in the informal recruitment channel than in the idealized market. These higher wages and trustworthiness lead to higher worker earnings in all treatments. The driving force is that in the informal recruitment channel, the information networks enable indirect reciprocity by employers of workers’ efforts in the past. As a result, 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 direct reciprocation by trustworthy workers who were offered a high wage in the first place in combination with a fair sharing between employer and worker of the benefits generated by the worker’s trustworthy choice. 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 that occurs after introduction of an informal recruitment channel.\footnote{For evidence that it is really information sharing that causes these effects see Schram et al.(2010).} In particular, their high earnings in the informal channel are
due to employers’ ability to pinpoint trustworthy workers using the information shared. This is an important way in which the social networks between employers affect the relations between employers and workers, and in fact benefits both. Note that these findings support the hypotheses that we put forward above when discussing our research questions. They are also in line with the instrumental social capital literature on both the demand (Fernandez et al. 2000; Erickson 2001) and supply side (Lin et al. 1981, Lin 1999) of the labor market. The social capital employers utilize from their endogenously formed networks and the informal negotiations between employers and workers make them both better off.

What remains to be explained are the observed patterns for wages and trustworthiness in the idealized market before and after introduction of the informal channel. These patterns may be driven by two counteracting forces. First, there is a selection of trades in the informal channel compared to the idealized market. Employers are aware of the fact that untrustworthy workers (those unwilling to provide high effort) will not go to the informal channel, 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 after the informal recruiting channel has been introduced, 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. These lower wages in the market will themselves reinforce the tendency of workers to choose low effort there. 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. After the informal recruitment channel has been introduced, 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. This explains the diverse results we observe across treatments. For example, we observe in our data 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 a decrease of trustworthiness in the idealized market.

**CONCLUSIONS**

We have used experiments to create a setting in which we can systematically study how social networks between employers emerge in recruitment. This is an important example of the
benefits of interdisciplinary research. It shows how sociological concepts like social structure that have traditionally been neglected by economists may have a major impact in an area that many economists consider to be central to their discipline. On the other hand, our structuring of the idealized markets, the informal channel, and the information flows (including the costs thereof) follow the tradition in economics and may thereby contribute to the understanding of the sociological processes involved. Moreover, we combine broad mechanisms central to sociology (such as social embeddedness) and economics (such as calculative responses to variations in the costs of an action) to explore specific mechanisms like reciprocity or conditional cooperation that are important to increase our understanding of the recruitment process. In this way, our research hopes to provide a demonstration of how an interweaving of the two disciplines can benefit both.

Laboratory control has allowed us to link observed patterns at the macro-level to the mechanisms involved in 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’ decisions and how, in turn, the resulting social structures condition the behavior of the same individuals. Our results further illustrate how specific network properties affect the functioning of information networks. When information transmission has no cost, one can say that a general norm of sharing information develops. When providing information is costly, pro-social motivations like conditional cooperation and (direct) reciprocal behavior explain information sharing. Which is at work depends on whether or not employers in the network can identify one another. If not, conditional cooperation within the network employers are embedded in explains their adherence to a general norm of information sharing. If they can identify one another, information sharing is explained by reciprocal behavior in response to the reputation of the employer requesting information. It is precisely this distinction in the identifiability of others in the network that enabled us to separate the impact of these two mechanisms on the emergence of social structure. By doing so, it also helped us to investigate which of the paradigms –Coleman versus Granovetter– was better able to explain the behavior we observed in the laboratory. We conclude that neither is exclusive, the explanatory power strongly depends on the properties of the social structure. There is a trade-off, however. A reciprocal mechanism tends to crowd out the possibility of developing a general norm.

Our results show the importance of employer networks for recruitment. When either of the general mechanisms is at play (either a Granovetter-like collective dissemination of information or Coleman-type reciprocal information exchange), employers will be able to hire
more trustworthy workers. This higher trustworthiness will lead to increased surplus from trade, which benefits both employers and workers.

Our results are also relevant for understanding social inequality. Social relations developed in both types of information networks have instrumental value to employers by providing them with information (i.e., social resources) they can access and utilize in hiring trustworthy workers through the informal channel. This type of ‘instrumental’ social capital complements other types such as the instrumental advantages to the firm in utilizing its employees’ social networks (Fernandez et al.2000; Erickson 2001). Access to the instrumental social capital in the networks is not equally distributed across employers, however, because not all employers participate in networks. The exclusion of some employers is an example of differential access to the social capital (Lin 1999, Flap and Boxman 2001), which in turn implies differential access to information and thus social inequality among employers in finding trustworthy workers. Note that in our case this differential access emerges endogenously and is based on employers’ own choices in providing information to others.

Only reciprocal networks exclude non-members from information access, however. With anonymity networks, all employers may enjoy the benefits of the information provided. The distinction between anonymity and reciprocity networks therefore has important implications regarding social inequality (Bourdieu 2000; Streeck 2005). In particular then, our result that reciprocity networks crowd out anonymity networks implies that in an environment where anonymity networks pre-exist, the emergence of reciprocal information networks may increase social inequality among employers.

There are also other ways in which employer networks affect social inequality. A direct effect is that these networks restrict some workers’ access to certain jobs. There is also an indirect effect. Inequality is decreased amongst those involved in recruitment through networks because the higher surplus from trade that this yields is shared fairly by employers and workers. However, this increases the gap between workers that find a job through employers’ networks and those that do not.

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 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.

More generally, one may wonder about the external validity of our experimental design.
How do networks in our laboratory relate to networks in the field? Though one should be
careful when generalizing our experimental results, they have important implications. By
carefully structuring the experiment based on networks in the field, while stripping as many
‘unnecessary’ characteristics as possible, we have been able to draw causal inferences about
the mechanisms underlying the emergence of such networks. This is an example of how the
lack of external validity in comparison to field studies is compensated by a higher internal
validity (Schram 2005). Moreover, by enhancing the incentive compatibility of participants’
actions, experimental findings like ours have been shown to be robust across design
variations, which relaxes the external validity concerns (see Buskens et al.2010 for a
discussion). Nevertheless, future research should directly check the robustness of our results
by carefully re-introducing features of networks observed outside the laboratory.

Many directions for such 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, which may strongly affect the
nature of the social networks 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


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Lin, N., W.M.Ensel and J.C.Vaughn(1981),“Social Resources and Strength of Ties: Structural Factors in


APPENDIX A: EXPERIMENTAL INSTRUCTIONS – TO BE PROVIDED ONLINE

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.

---

**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)**.

---

**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 wil 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.

---

**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.

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.

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.
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).

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.

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.

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 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.

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.

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.

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.

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.
APPENDIX B: INFORMATION PATTERNS – TO BE PROVIDED ONLINE

In this appendix, we show for each of the nine groups in the treatment with identifiability 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.

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<th>To B</th>
<th>To C</th>
<th>To D</th>
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<td>To C</td>
<td>To D</td>
</tr>
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<td>-------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>From A</td>
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<td>---*</td>
<td>---*</td>
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</tr>
<tr>
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<td>---</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>From C</td>
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<td>---*</td>
<td>---</td>
<td>1.00</td>
</tr>
<tr>
<td>From D</td>
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<td>0.00</td>
<td>1.00</td>
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<table>
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<th>To D</th>
</tr>
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<td>---*</td>
<td>0.00</td>
</tr>
<tr>
<td>From B</td>
<td>---*</td>
<td>---</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>From C</td>
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<td>From D</td>
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<table>
<thead>
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<th>To C</th>
<th>To D</th>
</tr>
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<td>0.00</td>
</tr>
<tr>
<td>From C</td>
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<td>---*</td>
<td>---</td>
<td>0.00</td>
</tr>
<tr>
<td>From D</td>
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</tr>
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</table>
TABLES AND FIGURES
Table 1: Experimental Treatments

<table>
<thead>
<tr>
<th></th>
<th>Costless information</th>
<th>Costly information</th>
</tr>
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<tbody>
<tr>
<td>No identifiability</td>
<td>6 groups</td>
<td>6 groups</td>
</tr>
<tr>
<td>Identifiability</td>
<td>5 groups</td>
<td>9 groups</td>
</tr>
<tr>
<td>Research Question</td>
<td>Mechanisms</td>
<td>Testable hypotheses</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| How much information is shared by employers and why? | • Identification allows for reciprocation, which supports information sharing  
• Rational calculation showing that costs decrease the expected net benefits of information sharing | 1) More information is shared in the treatments with identifiability  
2) Less information is shared in the treatments with costly information provision |
| What kinds of information networks arise? | • Without identifiability, information is a public good and conditional cooperation yields a large variation in anonymity networks  
• With identifiability, direct reciprocation of other’s previous information provision allows reciprocal networks to arise  
• With identifiability, lower costs will increase the extent of reciprocity in networks, yielding more network connections | 3) In the treatments without identifiability we will observe both groups with high levels of information provision and groups with low levels.  
4) In the treatments with identifiability there will be high correlation in the extent of information exchange across pairs of individuals  
5) With costless information provision, reciprocal networks will be more closed than when provision is costly |
| How does information sharing affect employers and workers? | • Higher information exchange leads to more recruiting through networks because employers can indirectly reciprocate the worker’s past efforts  
• Recruiting through networks yields higher trustworthiness through a worker’s direct reciprocation of a high wage and/or through worker’s reputation concerns  
• Higher trustworthiness leads to higher earnings for employers and workers through a fair sharing of increased surplus from trade | 6) Employers involved in more information sharing will make more use of bilateral negotiations  
7) High effort is more often chosen after trades made through bilateral negotiations than after trades in the idealized market  
8) On average, both employers and workers have higher earnings after trading through bilateral negotiations than after trading in the idealized market |
### Table 3: Information Sharing per Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fraction of requests honored</th>
</tr>
</thead>
<tbody>
<tr>
<td>No identifiability, costless</td>
<td>0.91</td>
</tr>
<tr>
<td>No identifiability, costly</td>
<td>0.59</td>
</tr>
<tr>
<td>Identifiability, costless</td>
<td>0.94</td>
</tr>
<tr>
<td>Identifiability, costly</td>
<td>0.52</td>
</tr>
</tbody>
</table>
Table 4: Example of Information Sharing

<table>
<thead>
<tr>
<th></th>
<th>To A</th>
<th>To B</th>
<th>To C</th>
<th>To D</th>
</tr>
</thead>
<tbody>
<tr>
<td>From A</td>
<td>----</td>
<td>1.00</td>
<td>0.38</td>
<td>0.82</td>
</tr>
<tr>
<td>From B</td>
<td>0.73</td>
<td>----</td>
<td>0.86</td>
<td>0.43</td>
</tr>
<tr>
<td>From C</td>
<td>0.20</td>
<td>0.31</td>
<td>----</td>
<td>0.44</td>
</tr>
<tr>
<td>From D</td>
<td>1.00</td>
<td>1.00</td>
<td>0.78</td>
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</tr>
</tbody>
</table>

*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.
### Table 5: Correlation in Information Sharing

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Correlation Coefficient</th>
<th>Two-sided Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No identifiability, costless</td>
<td>-0.20</td>
<td>0.233</td>
</tr>
<tr>
<td>No identifiability, costly</td>
<td>0.31</td>
<td>0.068</td>
</tr>
<tr>
<td>Identifiability, costless</td>
<td>0.13</td>
<td>0.527</td>
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<tr>
<td>Identifiability, costly</td>
<td>0.56</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note. The correlation coefficient measures the correlation between the fractions of (1) information requests by X, honored by Y and (2) information requests by Y, honored by X.
**Table 6: Employer’s Response to Information Request**

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Absolute z-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.53</td>
<td>3.71**</td>
</tr>
<tr>
<td>Round</td>
<td>-0.08</td>
<td>5.09**</td>
</tr>
<tr>
<td>Type of channel giver is in†</td>
<td>-0.33</td>
<td>2.50*</td>
</tr>
<tr>
<td>Most recent decision of requestor²</td>
<td>0.68</td>
<td>5.03**</td>
</tr>
<tr>
<td>Most recent earning from contract³</td>
<td>0.01</td>
<td>2.10*</td>
</tr>
</tbody>
</table>

*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 $Pr_{ijg} = \Phi(X_{ijg}' \beta + \mu^g)$ where $Pr_{ijg}$ 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.

†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.

²The 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.

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

* (***) denotes statistical significance at the 5% (1%)-level.
## Table 7: Key Statistics

<table>
<thead>
<tr>
<th>Rows</th>
<th>% contracts realized</th>
<th>% contracts in BN</th>
<th>Average wage (IM) R1-10</th>
<th>Fraction high effort (IM) R1-10</th>
<th>Average employer earnings (IM) R1-10</th>
<th>Average worker earnings (IM) R1-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
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<td>R11-30</td>
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<td>.67</td>
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<td>-1.77</td>
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<td>13.30</td>
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<td>.23</td>
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<td>.67</td>
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<td>4.33</td>
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<td>.34</td>
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<tr>
<td></td>
<td>Average employer</td>
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<td>5.18</td>
<td>.18</td>
<td>6.72</td>
<td>15.10</td>
</tr>
<tr>
<td></td>
<td>earnings IM R11-30</td>
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<td>15.10</td>
<td>.35</td>
<td>10.24</td>
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<td>15.84</td>
<td>6.72</td>
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<td>10.24</td>
<td>7.74</td>
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<td>11.25</td>
<td>.34</td>
<td>15.84</td>
<td>7.74</td>
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<tr>
<td></td>
<td>Average worker</td>
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<td>10.64</td>
<td>.18</td>
<td>15.84</td>
<td>7.74</td>
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<td></td>
<td>10.24</td>
<td>.35</td>
<td>15.84</td>
<td>7.74</td>
</tr>
</tbody>
</table>

**Notes:** R1-10=rounds 1-10 (only centralized market); R11-30=rounds 11-30; IM= Idealized Market; BN=Bilateral Negotiations (i.e.,informal channel). 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.
Table 8: Key Statistics per Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Average fraction info given</th>
<th>% contracts in BN</th>
<th>Average earnings employer in BN</th>
<th>Average earnings worker in BN</th>
<th>Average earnings employer in IM</th>
<th>Average earnings worker in IM</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.99</td>
<td>62.2</td>
<td>9.87</td>
<td>15.35</td>
<td>5.93</td>
<td>12.64</td>
</tr>
<tr>
<td>1</td>
<td>0.70</td>
<td>56.9</td>
<td>3.54</td>
<td>19.15</td>
<td>7.13</td>
<td>9.32</td>
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<tr>
<td>5</td>
<td>0.62</td>
<td>59.0</td>
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<td>14.79</td>
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</tr>
<tr>
<td>6</td>
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<td>50.6</td>
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<td>21.52</td>
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<tr>
<td>4</td>
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<td>-0.77</td>
<td>21.54</td>
<td>1.4</td>
<td>11.4</td>
</tr>
</tbody>
</table>

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 (i.e., informal channel). Employer earnings do not take information provision costs into account.
Table 9: Employer Earnings

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Regression with 50%-network connections</th>
<th>Regression with 80%-network connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7.15 (6.40)**</td>
<td>6.83 (7.72)**</td>
</tr>
<tr>
<td>BN</td>
<td>−1.93 (1.18)</td>
<td>−0.93 (-0.71)</td>
</tr>
<tr>
<td># Network connections</td>
<td>−0.65 (0.71)</td>
<td>−0.54 (-0.41)</td>
</tr>
<tr>
<td># Network connections*BN</td>
<td>2.55 (2.09)*</td>
<td>3.33 (1.94)*</td>
</tr>
</tbody>
</table>

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 $\pi_{it}^{\mu} = X_{it}^{\mu} \beta + \mu_{it} + \varepsilon_{it}^{\mu}$ where $\pi_{it}^{\mu}$ gives employer $i$'s earnings in round $t$; $X$ is the vector of independent variables described in the first column of the table; $\mu_{it}$ is a (white noise) group-specific error that corrects for the dependencies across individual decision in the same group and $\varepsilon_{it}^{\mu}$ is white noise error. Z-values are in parentheses. BN=Bilateral Negotiations (i.e., informal channel). * (**) denotes statistical significance at the 5% (1%)-level.
Figure 1: Experimental Design

Notes: IM=Idealized market; BN=Bilateral Negotiations (i.e., informal channel); In BN the employer first offers bilateral negotiations to one worker. If this is rejected, the employer and worker participate in IM. 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.