The emergence of employer information networks in an experimental labor market

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ABSTRACT

We use laboratory experiments to investigate whether employer networks emerge that facilitate information sharing about the trustworthiness of job candidates. The design allows us to distinguish between mechanisms underlying the relations among employers and those between employers and workers. One type of network we observe is an ‘anonymity network’ 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. Recruitment through these networks leads to higher earnings for both employers and workers.

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1. 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; Marsden and Gorman, 2001). Though there is 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, our focus is on a different type of network, to wit, employer information networks. These are social networks in which employers share information about prospective workers. Such networks have been studied much less (Marsden and Gorman, 2001). We will show that they have important repercussions for the labor market.

Information about prospective new workers may be valuable in occupations where they have considerable discretion about their performance. There are many such occupations (see 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. The performance history of prospective workers may be relevant information with respect to their 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: p. 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. 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 latter kind of characteristic.

In this paper, we address the question of how and under what circumstances social networks amongst employers emerge that facilitate the dissemination of information about a job candidate’s education institutions; or about the appropriateness of particular individuals as marriage partners.

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trustworthiness. This is important because the emergence of information sharing between employers is not 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 derives direct benefits from providing it; sometimes it may even be costly to do so (Marsden, 2001). We argue here that mechanisms like conditional cooperation, reputation building and direct reciprocity may lead to the emergence of stable social relations between employers that give rise to information networks. An understanding of the emergence of information networks is important, because the information exchanged about a job candidate’s trustworthiness can have important implications for the labor market. Participation in an information network may (i) provide the employer with information about the worker’s trustworthiness which may affect the employment relationship established between the two; (ii) affect an employer’s recruitment strategy, which in turn may affect workers’ access to certain job vacancies, thereby generating labor market inequality (Streeck, 2005).

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 pointing to suitable candidates that have worked for them in the past. This information is given before the employer contacts any prospective worker. Second, after a contact has been made between an employer and a worker, the other employers may provide recommendations giving specific information about their experience with this worker. We are interested in this second kind of information sharing. 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).

To increase our understanding of the emergence of information networks in the labor market and their consequences, we will address three sets of key research questions:

1. How much information do employers share and what determines their decisions to share? This question mainly focuses on the micro-level behavior of employers.

2. What information networks are formed, and what mechanisms are consistent with the formation of various kinds of networks? This studies networks at the macro-level.

3. What effects do employer information sharing networks have on employer–worker relations? This may be seen as investigating the effects of macro-level institutions on micro-level relations.

These questions will be addressed both theoretically and empirically.

Our theoretical approach applies theories on social exchange and social dilemmas (Emerson, 1962; Blau, 1964; Yamagishi and Cook, 1993; Molm, 2003, 2007) to the problem at hand. Most of the research on social exchange focuses on the effects that specific structures of exchange have on various behavioral and affective outcomes (e.g., power, trust, or commitment). In contrast, we focus on the emergence of the structure itself, within which exchange takes place, by studying how information sharing develops among employers. This follows the approach of Kollock (1994), albeit in a different setting. Importantly, we also take into account the effects of this social exchange amongst employers by considering the consequences for a second social exchange within the labor market, to wit, that between employers and (prospective) workers. In order to understand the outcomes in a recruitment process, both exchanges need to be studied simultaneously.

Our empirical approach applies laboratory experiments. The laboratory provides an ideal environment to study social networks because one can observe with precision their emergence, which in turn enables conclusions about the underlying mechanisms. The two main virtues of laboratory experiments are control and replicability. Causal knowledge requires controlled variation and the laboratory allows for tight control over the environment in which interaction takes place (Falk and Heckman, 2009). A recent discussion of social exchange theories and their relation to experimental work can be found in Molm (2007).

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 exchange. Raub and Weesie (1990: p. 648; see also Marsden, 2001) argue that such costs should be included in the analysis, because they may limit the effectiveness of stable networks even in the presence of common interests. To accommodate this possibility, our design will vary the information transmission costs. The second property is whether, in the process of information sharing, identities are known or not. This is important, because any kind of reputation formation requires that one can identify other individuals (e.g., Raub and Weesie, 1990). 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. This distinction will allow us to separate the impact on the formation of information 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. Of course, non-identifiability is not intended to describe actual practice in social exchange between employers. Instead, it provides a benchmark allowing us to isolate the role of identification in this exchange.

More specifically, identifiability will allow us to study two archetypical views of social networks. In one, a network is seen as a collection of dyadic relationships (e.g., Emerson, 1962; Blau, 1964; Coleman, 1972). In such relationships, calculative risk and monitoring systems allow for reputation building and direct reciprocity, which may be important mechanisms in driving individuals’ actions (Coleman, 1972). This requires that individuals in a dyadic relationship can identify each other. The second view sees a network as a collection of agents in which an individual’s actions are embedded. If such social embeddedness is the main generator of information sharing (Granovetter, 1985; Uzzi, 1997), then – as argued in Lawler and Yoon (1996) – the commitment to a social network would be driven by a moral obligation to contribute to a collective good. In this line of argument, identification is not necessary for the emergence of information networks and may even be harmful (Granovetter, 1985). In practice, both dyadic relationships and social embeddedness will likely play a role in information exchange within networks. Our distinction based on the identifiability of others, will allow us to isolate these two effects.

Our results show that both types of information networks emerge, each with substantial information sharing. On the one hand, we observe Granovetter-like ‘anonymity networks’ where information is anonymously and voluntarily provided as a collective good for all employers to use. On the other hand, Coleman-like

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2 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.

3 We employ here the basic definition of social exchange, i.e., social exchange is an exchange of resources between two or more actors who are dependent on one another for valued outcomes (Molm, 2007).

4 See Molm (2003) for an extensive review.
‘reciprocity networks’ are found where information sharing is driven by the rewarding of previously given information by the requestor. Costs for providing information mitigate both the voluntary contribution and reciprocity mechanisms. Moreover, when reciprocity networks emerge, they tend to crowd out anonymity networks. Finally, both types of information networks enable employers to recruit trustworthy workers, which in turn creates a high quality of trading, benefiting both.

In what follows, we first discuss studies that have addressed specific elements of our research questions. This is followed by a discussion of our theoretical setup. 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.

2. Embedding this study

Various studies in sociology and economics are relevant for our analysis. 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 theoretical network models.

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 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. Arguably, this is the more relevant case for studying employer information networks. Outside of the laboratory, traditional ‘old boys’ networks’ are not formed by employers first asking each other whether or not they want to form a network. Instead, regular contacts and exchange of information lead to the endogenous emergence of information networks. A second difference between our and previous studies of network formation 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.

The studies just discussed involve network formation but no issues of trustworthiness, while this is a central focus of our research. In contrast, Kollock (1994) provides a seminal experimental sociological study on the importance of trustworthiness in trading relations, albeit without any role for networks. He analyzes how the establishment of fixed trading partnerships depends on the uncertainty about the quality of the good to be traded (see Brown et al., 2004 for an example of economists interested in very similar issues). While Kollock’s paper is about the establishment of long-term relations between employers and workers, ours is about the initial hiring of workers and especially the role that relations amongst employers may play. Aside from our focus on networks, a crucial difference with this work is that the kind of trust generated in repeated employer–worker relations cannot play a role in our setting. Kollock foresaw the importance of the kind of research we present. 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 the exchange process” (Kollock, 1994: p. 342).

In our setup, the information shared in a network of employers may affect the exchange between an employer and a new worker. We have shown elsewhere (Schram et al., 2010) 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. A fundamental limitation of the setup in that previous work is that information was exogenously given to all employers, whereas in the present study information flows emerge endogenously. Other experimental studies have dealt directly with how behavior in a social relation is affected by information provided by others (see Buskens and Raub, 2010 for a more general overview of experimental and other research on the effects of embeddedness on trust in social dilemmas). For example, Buskens et al. (2010) have two trustees play a standard trust game sequentially with one trustee, with this sequence taking place 15 consecutive times. In one situation each trustee 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 trustee and the trustee (‘network embeddedness’). Both types of embeddedness are exogenously imposed. The authors conclude that both dyadic and network embeddedness affect behavior. 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).

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. 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. The results show evidence in support of the ‘richer pool hypothesis’: the pool of

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5 The literature that has directly influenced our research is discussed in the Sections 1 and 3. We discuss here other studies that address specific aspects of our research questions in different settings than ours. A third part of the 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 Senen 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.

6 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.

7 In a trust game, a trustee may transfer money to a trustee. The experimenter adds to this amount and then the trustee decides whether to transfer money back to the trustee.
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. Erickson (2001) adds to this by observing that for many upper-level jobs employers consider having 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.

3. Theory

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 (e.g., in public employment agencies), 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 such contacts, 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). Our experimental design will incorporate this trade-off by allowing employers to choose between these two recruitment channels. The dichotomy between two channels is, of course, a stylization of the recruitment process. In practice, many recruitment procedures are likely to use both channels, but some will rely more heavily on the formal market and others on informal networks.

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 any previous employer B of this worker and even less likely that in addition B will at some point in the future contact one of A's previous workers through an official channel.

We therefore focus on the social relations in the informal channel. We first provide a theoretical discussion of the formation and effects of employer information networks. We then provide a general basis and derive more specific hypotheses. The theory centers on the underlying mechanisms relevant for our research questions. Our point of departure is social exchange theory (Emerson, 1962; Blau, 1964; Yamagishi and Cook, 1993; Molm, 2003).

Recall that our main interest covers two dimensions. On the one hand, we focus on the emergence of employers' information networks; on the other, we are interested in the effect of such networks on worker recruitment. As a consequence, two distinct types of social exchange play a role. First, either 'generalized' or 'reciprocal' exchange may take place between employers, whose contributions (i.e., providing information about former workers) are individually performed and non-negotiated (i.e., they do not involve binding agreements; Molm et al., 2000). Generalized exchange is characterized by the lack of a one-to-one correspondence between what two actors directly give and receive from each other. This correspondence does exist in reciprocal exchange, though it involves the performance of individual acts that provide benefits for another without knowing whether the other will reciprocate (Molm et al., 1999: p. 876). Second, a social exchange between employers and prospective workers takes place. We will discuss the nature of this exchange shortly, but note here that at least partly it is what is known as 'negotiated' exchange. One way to interpret some of what we do in this paper, is that we investigate how the social exchange between employers affects the one between employers and workers. This adds a new dimension to social exchange theories, which have developed from only considering negotiated exchange to comparing negotiated with reciprocal exchange (see Molm, 2003 for an overview). To the best of our knowledge, we are the first to consider the relationship between the two.

The social exchange between employer and worker requires a more detailed discussion. In a typical case, they will bargain explicitly to reach a binding agreement on the exchange of labor for wage (Emerson, 1981; Molm et al., 2000). This negotiated exchange yields an explicit and guaranteed (labor) contract. As is common in negotiated exchange, trust among the actors with respect to this contract is unnecessary (e.g., Cook et al., 1983; Markovsky et al., 1993; Bonacich, 1995). Often, there is more to the exchange between employer and worker, however. As mentioned above, both theoretical arguments and empirical evidence (Williamson, 1981; Milgrom, 1988; Baker, 1992; Fehr et al., 1993; Goldthorpe, 2000) show that employment relationships are often necessarily incomplete (e.g., characterized by moral hazard). This creates an element of uncertainty that is typically not considered in cases of negotiated exchange and introduces the need to study mechanisms (such as trust) that are more typically considered important in reciprocal exchange (Molm, 2003) touches upon this issue, but only implicitly. Note that it is precisely the uncertainty in their social exchange with workers that motivates employers to engage in social (information) exchange amongst each other.

In what follows, we elaborate on these theoretical points of departure and derive general predictions organized around our three sets of research questions. The first two columns of Table 1 summarize the research questions and the mechanisms that we propose will be at work.

3.1. How much information do employers share and what determines their decisions to share?

The main issue here is to understand what influences an employer's decision to share information about former workers. A traditional assumption in exchange theories is that actors (i.e., employers) are rational in their decision making, in the sense that they are capable of selecting the best of all available options. If they are also guided by short-term self-interest, this leads to the prediction that employers will not share information, since there are no direct benefits from doing so. If self-interested employers assume that others pursue short-term self-interest, then the long-run will not provide reasons to share information, either. Recent contributions provide alternative reasons for the long-run, however, like risk avoidance and reciprocity (Molm et al., 2000; Molm, 2003). The risk avoidance argument takes into account that actors may simply value the continuation of

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8 In a large part of this literature, the term 'rationality' is used to indicate both the pursuance of self-interest and the choice of the most favorable of all available options, given this self-interest. It is more precise to distinguish between the two: one can at the same time be cooperative and rational, for example.

9 Molm sees reciprocity as an element of an individual's preferences. Here we take a more general view and consider reciprocity as an individual's action. This may or may not be based on a simple preference to reciprocate.
an exchange. While we maintain the assumption of rationality (employers will make the most preferred decision), we will allow for such an alternative reasons. Moreover, individuals may provide information in the expectation that their own future request will then more likely be met with a favorable response. In this view, an employer may well consider it to be in her long-term self-interest to provide information. Note that this does not require that an employer herself intends to deviate in the future from short-term self-interest. It suffices that she expects that others may do so, if she sacrifices short-term interests in the current period to obtain long-term benefits when others reciprocate.

There are two situations in which expectations of future interaction may be important in our setting. We argue that distinct mechanisms underlie an employer’s decision to provide information in these two situations. First, information may be seen as a collective good to which each individual may contribute. This characterizes a social dilemma situation, where all may benefit if all share information (a ‘cooperative gain’; Brandts and Schram, 2001), yet there is a temptation to reap immediate benefits by free riding (i.e., saving costs by not providing information). One important mechanism through which the former may dominate the latter is ‘conditional cooperation’ (Brandts and Schram, 2001; Diekmann and Lindenberg, 2001). This describes how individuals are willing to contribute to a collective good, as long as they are not the ‘sucker’; i.e., as long as they perceive sufficient others contributing (and expect these others to keep contributing in the future).

Fischbacher et al. (2001) estimate that roughly 50% of people can be considered conditional cooperators in social dilemma situations. In the case of employers’ networks, an employer that is a conditional cooperators will make the effort to provide information if enough others are expected to do the same (now or in the future). This does not require knowledge of which particular others are doing so, as long as sufficiently many are. Note, however, that standard backward induction arguments imply that conditional cooperation is not an equilibrium strategy for fully rational self-interested actors playing a finite number of rounds (as they do in our experiments). Instead, we see conditional cooperation as a motivation that some people may have. If sufficiently many others are conditional cooperators, this may make it a strategic best response for a self-interested player to also cooperate in a repeated game.10 The presence of conditional cooperators then provides a mechanism that can drive (anonymous) information sharing. Whether conditional cooperators do boost the level of cooperation in this way depends strongly on the parameters of the game, however. For example, if the gains from cooperation (i.e., sharing information) are relatively high, fewer conditional cooperators are needed to maintain cooperation than when they are relatively low. It is then an empirical question whether the benefits in our treatment without identifiability suffice for conditional cooperation to enhance cooperation.

The second situation involves knowing who is providing information when asked. In this case, direct reciprocation may take place, reducing conditional cooperation to a series of bilateral situations. Direct reciprocity involves individual A conducting a cooperative (non-cooperative) act in an interaction with another individual B, in response to a cooperative (non-cooperative) act or acts by B in past interaction(s) with A. An employer that is a direct reciprocator will provide information to those, and only those others who themselves have provided information when asked. Note the difference with conditional cooperation, where information is not directed at specific others, but is provided if sufficiently many others do so. One mechanism that enhances direct reciprocation is reputation building (Coleman, 1988). In our case, an employer’s reputation specifies her past willingness to provide information. This allows another employer to reciprocate. Note that this requires that one can identify both the requestors and the givers of information over time (Raub and Weesie, 1990).

As discussed in the introduction, the costs of exchange (Raub and Weesie, 1990) may also have an important effect on the emergence

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10 Consider as an extreme example a group with three conditional cooperators and one self-interested player. If the conditional cooperators preferences are such that they will cooperate if and only if all four group members did in the previous period, the fourth player can basically choose between (1) being the only one to defect in the current period and having no cooperation in future periods; or (2) having full cooperation now and in the future.
of information networks. Consider the costs related to contributing to a network (e.g., by sharing information). A rational (but not necessarily selfish) actor will weigh these costs against the benefits (including benefits to be derived from conditional cooperation or direct reciprocation). An individual may then rationally calculate that at some cost level the benefits from network participation will be insufficient to compensate for the corresponding costs. As an extreme example, consider an employer hypothetically facing costs of sharing information that exceed any worker’s lifetime productivity for a firm. It is unlikely that any considerations of conditional cooperation or direct reciprocation would compensate these costs in her mind. The prediction we derive from this reasoning is milder, and states that – other things equal – the extent of information sharing amongst employers is non-increasing in the costs of provision. As explained here, the mechanism underlying this effect of costs is rational calculation.

Our experiments will provide individual-level data on employers’ response to information requests in contexts that vary whether or not other employers can be identified and whether or not there are costs associated with providing information (more details about the experiment are presented below). With these data, we will test the following hypotheses (1) and (2) (cf. Table 1).

(1) Identifiability will yield more giving of information. The underlying rationale is that when identity is not known, only one mechanism, i.e., conditional cooperation will be at play. Conditional cooperation is equally possible in both cases (even if identifiability allows one to condition a cooperative response on a specific other’s previous choices, one does not need to; one can still decide based on others’ average level of cooperation). In contrast, reputation building and reciprocal responses to positive reputations are only possible with identification. With both mechanisms at work with identifiability and only one mechanism without, we expect to see more information shared in the former case.

(2) Information sharing costs will reduce the provision of information. This is based on the idea that (some) 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.

3.2. What information networks are formed, and what mechanisms are consistent with the formation of various kinds of networks?

Conditional cooperation and the combination of reputation building with direct reciprocity not only affect the possible benefits of sharing information, they also allow distinct kinds of information networks to arise. At one extreme, if employers cannot identify who is asking for information then they cannot commit to sharing information (only) with specific others. This situation makes reputation building and direct reciprocity impossible. Conditional cooperation may then generate ‘anonymity networks’, where information is provided as a collective good from which no one can be excluded. In this case, a ‘group-generalized’ exchange may take place where each employer contributes and no one is excluded from receiving the benefits generated by that collective good (Ekeh, 1974; Yamagishi and Cook, 1993). However, if some employers (who cannot be identified) decide not to provide information, then the information sharing in general may break down. Conditional cooperators in an anonymity network with too many free riders will not share information with anyone. A consequence of this behavior is that the variation across groups in contribution levels may be large.

At the other extreme, assume that employers can identify the source of a request for information (and of course, the decision to provide it). This allows for direct reciprocity of other employers’ past choices and for reputation building. As a consequence, what we call ‘reciprocity networks’ will be formed. In these networks, reciprocal exchanges take place in a series of dyadic relationships characterized by reciprocal transactions (Molm, 2003). Note that such networks can only be based on dyadic relationships, because we assume that knowledge of a response to a request for information is restricted to the employers concerned (and our design implements this). In other words, employer B’s response when A asks for information remains unknown to employer C. This restriction is made to simplify the analysis and the experimental environment. Relaxing it is certainly an interesting avenue for future research.

Based on this discussion, we can now present hypotheses (3) and (4) on how the treatment variables in our experiments will influence the structure of observed networks:

(3) Without identifiability there will be high variation across groups in the extent of information sharing; we expect to see some groups with successful anonymity networks and others without. As a consequence, there will be a positive correlation across employer pairs in the provision of information (because those that share will tend to be in the same groups as will those that do not share).

(4) With identifiability, there will be a high correlation in information sharing across employer pairs; this is because identifying those who do and do not share information allows employers to form reciprocity networks that exclude those who do not share.

3.3. What effects do employer information sharing networks have on employer–worker relations?

Here, we link the social exchange generated in employers’ information network to that between employers and workers. Recall from our discussion above that the presence of moral hazard introduces uncertainty in the negotiated exchange between an employer and worker, which in turn introduces features such as (dis)trust into their social exchange.

How will the exchange amongst employers affect this? We will relate employers’ information exchange to outcomes in the worker–employer relationship. Such outcomes include, on the one hand, the agreed upon wages and the trustworthiness of workers, and on the other hand, the employers’ and workers’ earnings from the exchange. Recall the stylized representation of the labor market, where recruitment takes place either through a centralized formal market or decentralized informal (bilateral) negotiations between employers and workers. It is mainly in the latter case that employers’ information sharing will affect the social exchange between employers and workers, by providing more detailed information about the worker’s trustworthiness. The extent to which this is the case depends on the amount of information shared in the employers’ networks. We will see below that exchange in the centralized market may be affected as well. This will occur, for example, if worker’s anticipate that their behavior may affect future relationships in bilateral negotiations.

Significant information exchange gives an employer information about a worker’s trustworthiness. The more trustworthy the worker was in the past, the higher the probability that employers will offer high wages. Two mechanisms play a role, here. First, the employer may indirectly reciprocate the worker’s past trustworthiness for other employers. Indirect reciprocity (rewarding a stranger

\footnote{Note that by only considering initial hiring we exclude the possibility of an employer directly reciprocating a former high effort by the worker in their relationship.}
for prior kind acts to third parties) is a powerful mechanism in the interaction between strangers (Seinen and Schram, 2006; Ule et al., 2009). Second, past trustworthiness may be informative about the trustworthiness to be expected in a new employment relationship. Hence, in recruitment through an informal channel, where information shows that the worker was previously trustworthy, a high wage may be offered due to a combination of an indirect reciprocal response and a calculative response to the estimated probability that a high wage will be met with trustworthy behavior.

This high wage may subsequently be responded to by highly trustworthy behavior by the worker. The mechanisms at work here are also two-folded: (i) direct reciprocity by the worker of the high wage offered by the employer; this phenomenon has been observed in the field (Falk, 2007) and in many laboratory experiments (see Schram et al., 2010 for references); (ii) the worker’s concern for her reputation in future job negotiations; note that this second mechanism will become less effective if there is a finite number of interactions and the final round approaches, i.e., there may be an end effect.

The increase in trustworthy behavior implies higher effort delivered by a worker, which yields higher surplus from an employment relationship between this worker and an employer. How is this surplus shared between the two? It is not a priori obvious that both should benefit. Take as a benchmark the hypothetical case where the worker always has to provide high effort, due perhaps to tight control by the employer. In this case market conditions are crucial and the surplus is mainly absorbed by whoever is on the short side of the market, i.e., the employer (for evidence, see Schram et al., 2010 and references therein). In contrast, in our case where the worker can freely choose the effort level, trustworthiness develops endogenously and the exchange between an employer and worker is expected to produce higher levels of mutual commitment than in the case where the worker has no choice but to provide high effort (Kollock, 1994; Lawler and Yoon, 1996; Molm et al., 2000). This in turn will lead to a fairer sharing of surplus. As argued by Molm (2003), power use by the advantaged actor is decreased in this case, since both actors are better off when a high wage is reciprocated by high effort, yielding higher welfare.

Finally, these effects (more trustworthiness and more and fairly divided welfare for employer and worker) are stronger when recruitment takes place through the informal channel. This is because information is assumed to be more detailed than in the centralized market. In our experiments, information on trustworthiness is only provided in the informal channel.

Our data will allow us to examine how wage levels, earnings, surplus, and trustworthiness (measured by workers’ effort levels), depend on the degree of information sharing and on the types of networks that emerge. Using the discussion above, these yield hypotheses (5)-(7):

(5) Workers choose high effort more often after trading through the informal channel than through the formal channel. Whereas reputation concerns for future jobs can play a role in both channels, reciprocation of a high wage is more prominent in the informal channel. The latter is the case because there are more high wage offers in the informal channel, where an employer can condition the wage offer on the (known) worker’s reputation.

(6) Earnings are higher for both workers and employers trading through the informal channel than through the formal channel. This is a consequence of the higher surplus generated through higher effort and a fair sharing of this higher surplus.

(7) More information exchange leads to more trading through the informal channel. This is because it is the information about workers’ past effort choices that drives the high wage offers in the informal channel. The mechanisms that yield high effort depend on this information being shared.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Experimental treatments.</th>
<th>Costless information</th>
<th>Costly information</th>
</tr>
</thead>
<tbody>
<tr>
<td>No identifiability</td>
<td>6 groups</td>
<td>6 groups</td>
<td></td>
</tr>
<tr>
<td>Identifiability</td>
<td>5 groups</td>
<td>9 groups</td>
<td></td>
</tr>
</tbody>
</table>

4. Method

The labor market environment we study is one with more workers than employers, i.e., of excess supply for workers. This has received most attention in previous literature, including Kollock (1994). Schram et al. (2010) and Brands and Charness (2004) also consider the case of more employers than workers. Excess supply is also empirically the more relevant case. In this situation, workers have a market disadvantage because some remain unemployed, but they have an advantage in the employment relation, because they can independently determine their performance after the wage has been established. Together, this creates a power balance in the social relation between employers and workers, making it an interesting environment to study.

4.1. 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 of the more than 2000 potential participants in the CREED subject pool 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 2). 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 min, and participant earnings were performance based, with an average of €29.75 (including a €7 show-up fee).

4.2. Design and procedures

4.2.1. 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. (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. Nevertheless, given our focus on recruitment, we will henceforth maintain the reference to ‘employers’ and ‘workers’ in this paper.

4.2.2. Treatments

In line with the discussion above, our design consists of four separate experimental treatments, varying along two dimensions. The first consists in whether or not employers can identify each other when sharing information. In all cases, participation is anonymous. As explained below, identifiability is based on fixed participant codes and enables keeping track of another participant’s decisions over time. The second dimension along which our treatments differ is whether information is costless or costly. We ran a full

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12 The loss of external validity that this cause is considered to be minor (e.g., Fehr et al., 1993). For a discussion of the trade-off between internal and external validity, see Schram (2005).
2 × 2 combinatorial design. It is a between-subject design, meaning that each participant takes part in only one group of one of the treatments. Table 2 summarizes our design and gives the number of experimental groups we ran per treatment cell. As explained below, the larger number of groups in the identifiability/costly condition was chosen to allow us to study the network structures for this case in more detail.

4.2.3. 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 (see Brandts et al., 2010 for a study involving larger groups in a different context). 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 though 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.

4.2.4. Effort
After all trading activity has ended, each worker involved in a labor contract chooses the ‘effort’ she is willing to give.13 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 effort choice. The two possible effort levels are ‘high’ (e = 1) and ‘low’ (e = 0).

The experimental ‘currency’ is ‘experimental franc’. Francs are exchanged for Euros at the end of the experiment at the rate 15 francs =€1. Choices affect the payoffs of employers and workers in the following way. An employer’s payoff (πf) 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. A worker’s payoff (πw) is equal to the wage received, w, minus the cost of effort c(e), with c(1) =20 and c(0) =0. Note that high effort maximizes the joint earnings of the worker and employer, which is 30 francs (50–20) for high effort and 10 francs (10–0) in case low effort is chosen. The wage determines how these joint earnings are divided between the two. Summarizing:

\[ π_f = r(e) − w \]
\[ π_w = w − c(e). \]

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

4.2.5. 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. 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. This design choice reflects our interest discussed in the introduction that lies not so much in information used in searching for a candidate as in information used for evaluating a candidate. 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. Note that with five workers and four employers there is always at least one worker not involved in bilateral negotiations.

4.2.6. 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. 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.

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 s to reach agreements. After all possible contracts have been realized or 90 s have passed (whichever comes first), the market closes. For the cases where an agreement has been reached the worker then determines an effort level (e), with resulting payoffs as explained above. The chosen effort level is communicated only to the employer and worker concerned. Neither knows the identity of those making or accepting offers, nor do they know the history – of wage or effort levels – of any of the other market participants. Note that the double auction is not intended to precisely replicate markets observed in the field. Instead, they are what Granovetter (1985, p. 484) calls “idealized markets” void of any significant effects of social exchange between employers. The only social exchange that can occur between any specific employer and worker is the one arising after a wage proposal has been accepted (i.e., a work relationship has been established). Taking this idealized market form allows us to experimentally isolate the effects of social exchange in the alternative – informal – channel, the bilateral negotiations.

4.2.7. 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

13 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).
an integer between 0 and 50.\textsuperscript{14} 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.

4.2.8. 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.

4.2.9. 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’ willingness to share information and not so much in their desire to request it.\textsuperscript{15} 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. Outside of the laboratory not all information need be truthful, of course. Note, however, 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.

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. One interpretation of this design choice is that we are considering recruitment from a set that excludes the employer’s former workers. 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.

4.2.10. Identifiability
As explained above, our treatments differ with respect to the conditions under which information can be released (see Table 2). 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. 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 over time.

4.2.11. 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 earnings from any single labor contract (10 or 30 francs). In the sessions with costless information there are no charges associated with information flows.

4.2.12. 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 Fig. 1. See Appendix A for a translation of the instructions.

5. 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.

5.1. Information sharing and information networks
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.

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

\textsuperscript{14} 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).

\textsuperscript{15} 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.
When each worker shows the employer (Mann–Whitney test) that the worker will return to the 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 = 31.00, 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 = 45, 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 1.

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.

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.

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

---

16 Because subjects interact in markets and across rounds, we use market averages as units of observation, unless indicated otherwise.

17 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.
X gives information to Y and f_{XY} the fraction with which Y gives information to X. For example, in Table 4, f_{XY} = 1 and f_{YX} = 0.73. For each treatment we then determine the partial correlation coefficient (correcting for dependencies within groups) 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.

First consider the treatment without identifiability where information is given costlessly. Here, the correlation between information given and information received is –0.28 with a two-sided significance of 0.103. This lack of statistically significant correlation (which does not support hypothesis (3), because as argued above a high variation across groups would imply correlation between pairs) 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 0.28 with a two-sided significance of 0.099. This is the case discussed in Table 1 where a positive correlation results from the fact that groups as a whole vary in their behavior. In some groups a generalized exchange (e.g., Yamagishi and Cook, 1993) or ‘collective’ reciprocity arises as a consequence of conditionally cooperating employers. Differences across groups then provide (weak) support for hypothesis (3).

In the treatment with identifiability where information is costless the correlation coefficient is 0.03 with a two-sided significance of 0.887. 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 0.53 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 hypothesis (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 probit regression with robust standard errors clustered at the group level. 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 5

<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>-0.28</td>
<td>0.103</td>
</tr>
<tr>
<td>No identifiability, costly</td>
<td>0.28</td>
<td>0.099</td>
</tr>
<tr>
<td>Identifiability, costless</td>
<td>0.03</td>
<td>0.887</td>
</tr>
<tr>
<td>Identifiability, costly</td>
<td>0.53</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: The partial 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, correcting for interdependencies within groups.

Table 6

<table>
<thead>
<tr>
<th>Employer’s response to information request</th>
<th>Coefficient</th>
<th>Marginal effect</th>
<th>Absolute z-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.89</td>
<td>-</td>
<td>1.89</td>
</tr>
<tr>
<td>Round</td>
<td>-0.07</td>
<td>-0.028</td>
<td>4.41</td>
</tr>
<tr>
<td>Type of channel giver is in a</td>
<td>0.37</td>
<td>0.147</td>
<td>1.17</td>
</tr>
<tr>
<td>Most recent decision of requester b</td>
<td>0.89</td>
<td>0.343</td>
<td>4.06</td>
</tr>
<tr>
<td>Most recent earning from contract c</td>
<td>0.01</td>
<td>0.003</td>
<td>0.96</td>
</tr>
<tr>
<td>n</td>
<td>521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log pseudo-likelihood</td>
<td>-296.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The table presents the results of a 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 \( Pr_i^t = \Phi (X_i^t \beta + \mu_i^t) \) where \( Pr_i^t \) 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, \( \mu_i^t \) is an error term. We use robust standard errors clustered at the group level (nine clusters).

a 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.

b The requester’s history of transactional relationship with the employer asked for information is represented by her decision the last time she was asked for information by this same employer.

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

Denotes statistical significance at the 5%-level.

Note that two of the variables have no significant effect on the decision to provide information when asked. First, we thought a priori that an employer active in the idealized market may be less likely to provide information, since such an employer is more likely to prefer this channel than the average employer and therefore less likely to have any use for information sharing. We find no such effect. Second, we find no effect of previous earnings on the decision to share information, i.e., there is no income effect. The other two coefficients in Table 6 are strongly statistically significantly different from zero. 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. The marginal effect is -2.8%-points per round, i.e., other things equal, an employer is 56%-points less likely to provide information in the final round (20) than in the first. This effect may be explained by the fact that these networks are no longer important after the experiment has ended. Second, 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). Here, the estimated marginal effect shows that an employer is 34.3%-points more likely to provide information to someone who previously gave her information when she asked than to someone who did not.

As for 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. There is only one group where information is given 100% of
the time, however. The 6% of the information requests that are not
honored are equally spread across the other groups.

The treatment with the highest divergence of information
networks formed is with 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 oppor-
tunities. 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 four 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).

5.2. Employer–worker exchange

We first give an overview of the recruitment channel used,
the time, however. The 6% of the information requests that are not
honored are equally spread across the other groups.

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are possible for each group (because there are four 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).

Table 7 shows average values of key variables for all four treat-
ments.

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 chan-
nels to the level of information sharing (Table 3), shows that distinct
levels of information are not the sole cause of differences in channel
choice. For example, without identifiability, much more informa-
tion 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 trust-
worthy behavior in all treatments. The difference is statistically
significant in each of the four treatments. This rejects a null of no
difference across channels in favor of alternative hypothesis (5). 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’ pat-
terns 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 infor-
mal channel in rounds 11–30, one can see that both employers and
workers earn more after recruitment through the informal chan-
nel. 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 compari-
son 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
market. For the workers the comparisons are different. Their earn-
ings increase from rounds 1–10 to rounds 11–30 only if in the latter
case they engage in contracts through the informal channel. Earn-
ings 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 (6) (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 sig-
nificantly 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 (6).

Turning to the costly information treatments, we will take
account of the observed variation in the extent of information pro-
vision when investigating the social exchange between employer
and worker. Recall that for these treatments we found positive
 correlations in information sharing, indicating reciprocal patterns
between particular employers. We start with the case without iden-
tifiability, for which we concluded that this reciprocity was based
on generalized exchange 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.

One can see by inspection how the average fraction of infor-
mation given is directly and positively related to the percentage
of contracts agreed upon in the informal recruitment channel. The
partial correlation coefficient between the average fraction of infor-
mation given in a group and the percentage of contracts obtained
via bilateral negotiations is 0.92 (p < 0.01). This provides support
for the above. For each treatment, a Wilcoxon signed rank test was run on group aver-
age effort levels in bilateral negotiations versus idealized markets. The results
are as follows: 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); cost-
less/unidentifiable: (Z = −2.201, N = 6, p = 0.028).
for hypothesis (7) 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 10 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. A probit regression of channel choice on the number of connections (with robust standard errors clustered at the group level) yields a positive marginal effect of 15.2%-points per

| Table 7 |
| Key statistics. |

| Rows 2–3 | % Contracts realized R1–10 | 94.2 | 95.4 | 95.5 | 96.1 |
| | % Contracts realized R11–30 | 95.0 | 95.0 | 95.5 | 92.9 |
| Row 4 | % Contracts in BN R11–30 | 52.4 | 54.4 | 62.3 | 37.7 |
| Rows 5–7 | Average wage (IM) R1–10 | 19.20 | 21.83 | 18.90 | 15.09 |
| | Average wage IM R11–30 | 21.41 | 18.62 | 15.88 | 17.19 |
| | Average wage IM R11–30 | 32.12 | 31.02 | 32.27 | 29.10 |
| Rows 8–10 | Fraction high effort (IM) R1–10 | 0.23 | 0.34 | 0.18 | 0.31 |
| | Fraction high effort IM R11–30 | 0.41 | 0.28 | 0.26 | 0.35 |
| | Fraction high effort BN R11–30 | 0.67 | 0.05 | 0.73 | 0.66 |
| Rows 11–16 | Average employer earnings (IM) R1–10 | 0.19 | 1.62 | −1.77 | 2.83 |
| | Average worker earnings (IM) R1–10 | 14.50 | 15.10 | 15.34 | 13.30 |
| | Average employer earnings IM R11–30 | 5.18 | 4.33 | 4.6 | 6.72 |
| | Average worker earnings IM R11–30 | 13.12 | 11.25 | 10.64 | 10.24 |
| | Average employer earnings IM R11–30 | 4.82 | 5.11 | 6.80 | 7.41 |
| | Average worker earnings BN R11–30 | 18.65 | 17.95 | 17.74 | 15.84 |

Notes: R1–10 = rounds 1–10 (only centralized market); R11–30 = rounds 11–30; IM = idealized market; BN = bilateral negotiations (i.e., informal channel). Employer earnings do not take information provision costs into account. These are relatively small and taking them into account does not 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>
</tr>
<tr>
<td>5</td>
<td>0.62</td>
<td>59.0</td>
<td>7.54</td>
<td>18.11</td>
<td>8.88</td>
<td>8.0</td>
</tr>
<tr>
<td>2</td>
<td>0.49</td>
<td>50.6</td>
<td>6.49</td>
<td>14.79</td>
<td>6.65</td>
<td>6.5</td>
</tr>
<tr>
<td>6</td>
<td>0.49</td>
<td>50.6</td>
<td>1.78</td>
<td>19.82</td>
<td>−3.24</td>
<td>21.52</td>
</tr>
<tr>
<td>4</td>
<td>0.14</td>
<td>47.4</td>
<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>Coefficient</th>
<th>Absolute z-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7.48</td>
<td>7.53**</td>
</tr>
<tr>
<td>BN</td>
<td>−1.11</td>
<td>0.67</td>
</tr>
<tr>
<td>#Network connections</td>
<td>−1.18</td>
<td>1.76</td>
</tr>
<tr>
<td>#Network connections’ BN</td>
<td>2.08</td>
<td>2.40*</td>
</tr>
</tbody>
</table>

Notes: The table presents the results of a generalized least squares 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 β in x^t = X^tβ + μ^t + ε^t where x^t gives employer ϵ's earnings in round t; X is the vector of independent variables described in the first column of the table; μ^t is an error term. We use robust standard errors clustered at the group level (nine clusters). BN = bilateral negotiations (i.e., informal channel).

* (**) Denotes statistical significance at the 5% (1%)-level.
As is idealized 5.3. 554 on clustered dummy results variables; significant notation through trading formal information sharing without a 19 Our effort is costly and the other cost is not. The effort to use the informal channel through the formal channel 90% shows the results of a GLS regression with clustered errors 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).19 In the environment that we study connections can only be useful if an employer recruits through the informal channel, so that our a priori prediction is that the coefficient for the (un-interacted) dummy for the number of connections will not be significantly different from zero. The same zero-prediction applies to the (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 (6) – we expect the interaction effect to be significantly positive; with connections, recruiting via the informal channel should be advantageous (and vice versa). The regression results are consistent with our predictions: there is a positively significant effect of the interaction term but not of the separate variables. In other words, employers that have built up a strong information sharing network benefit from recruiting through informal channels. One implication is that employers are able to use reciprocal exchange to create profitable networks for information sharing. These networks are profitable because of their influence on the worker–employer social exchange.

5.3. 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.20 As a consequence, employers that recruit through informal channels earn on average more than those who do not. Workers hired informally earn more than those hired through the formal channel. Together, these results at least partially support all of the hypotheses discussed in the Section 3 and depicted in Table 1, except for hypothesis (1). This is summarized in Table 10.

6. Discussion

We structure the discussion of the implications of our results along the lines of the three fundamental research questions. Note that while these research questions are general and the underlying mechanisms involve motivations such as conditional cooperation, reputation, and reciprocity, the formal testing was on hypotheses that reflect variables that are directly measurable with our experimental data, such as the fraction of information requests that was positively responded to. As argued in the introduction, one of the advantages of laboratory experiments is that one can study behavior under controlled variation of variables that may affect the role of motivation and therefore can deduce from behavior what motivations play a role. It is this deduction that we now turn to.

6.1. How much information do employers share and what determines their decisions to share?

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 in the following way. First, as hypothesized, the existence of costs reduces the extent of information exchange. Second, contrary to what

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19 Our main interest in this regression lies in the number of network connections and its interaction with the channel chosen. Because the number of connections is not available for the case without identifiability and there is little variation in the number of network connections when there are no costs, the regression is only provided for the case with identifiability and costs. Earnings for the case with costs and without identifiability are discussed in Table 8.

20 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).
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 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 self-interested motive, we find that a majority of the employers is also willing to share costly information, even when anonymity prohibits future reciprocal responses. The group-generalized exchange among employers in these anonymity networks seems to be operating on 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 a pro-social motivation generated by social relations that employers within a network are embedded in Granovetter (1985). In particular, we have argued that conditional cooperation with the others in their group is the principle mechanism at work.

The observation that the information networks emerging between employers that cannot identify each other is less driven by material self-interested incentives than a conditional pursuit of common interests provides more support for the social embeddedness line of reasoning (Granovetter, 1985; Uzzi, 1997) than for the ‘dyadic relationships’ view (Coleman, 1972) in which reputation building is an important precondition for a social exchange (cf. the introduction).

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. 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 aiding her decision. Identifiability enables dyadic reputation building, which in turn enables direct reciprocation. The combination of the two yields information sharing.

A question that remains is why we found no support for hypothesis (1), that more information will be shared with identifiability. Recall from the Section 3 above that the idea underlying this hypothesis is simply that effects of reputation building and reciprocal responses may come on top of the effects of conditional cooperation. In fact, the data show that the occurrence of self-interested material incentives like reputation building crowd out more pro-social incentives like conditional cooperation. As a consequence, conditional cooperation is reduced in an environment where sanctioning and rewarding is possible.

6.2. What information networks are formed, and what mechanisms are consistent with the formation of various kinds of networks?

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 as either ‘anonymity networks’ (i.e., group-generalized exchange) or ‘reciprocity networks’ (i.e., reciprocal exchange). 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 non-reciprocal provision becomes rare and employers look to form networks of bilateral 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 of the observed crowding out of pro-social motivations like conditional cooperation by more self-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. This shows that employers are able to endogenously form networks that meet the specific needs and characteristics of their group.

6.3. What effects do employer information sharing networks have on employer–worker relations?

As hypothesized, 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. The driving force is that in the informal channel, the information networks enable indirect reciprocity by employers of workers’ efforts in the past and a selectively offering of 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. 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 exchange between employers and workers, and in fact benefits both. These findings support our hypotheses and 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. Second, 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

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21 For evidence that it is really information sharing that causes these effects see Schram et al. (2010).
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.

7. Conclusions

Our results show the importance of employer networks for recruitment. When either of the general mechanisms is at play (either collective dissemination of information or reciprocal information exchange based on dyadic relationships), 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 reciprocity 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. In particular, 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 yield is shared more 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 do 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. One could also create a possibility of information sharing on the supply side of the labor market by letting workers share their experiences with specific employers. Another interesting direction for future research would be to consider the role of online networks such as LinkedIn. Such networks provide easily accessible platforms to share information about job candidates in a way that runs parallel to our experimental design. It is costly to provide such information (because one needs to find it) and it can be provided discriminately. It would be interesting to see whether information sharing networks emerge in such field environments.

Finally, we think that our work is an important example of the benefits of interdisciplinary research. It shows how sociological concepts like social exchange 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 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 conditional cooperation or reciprocity that are important to increase our understanding of the recruitment process. In this way, our research hopes to provide a demonstration of how interweaving of the two disciplines can benefit both (Gintis, 2009).

Acknowledgments

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22 We are grateful to an anonymous reviewer for pointing this out.
Appendix A. Experimental instructions

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

At the start of the experiment:

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

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

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

Next page

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

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

In total nine people will participate in the market. There are four buyers and five 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.

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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.

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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).

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Phase 1
Participation in the public market proceeds as follows. Buyers may post an offer for the good and this offer holds for every seller in the market. Sellers may post an ask price and this holds for every buyer.

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

You will recognize your own box by its yellow color.

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

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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 s. 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 (four goods have been sold) the clock automatically jumps down to 5 s.

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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.

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Appendix A (Continued)

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.

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Before Round 11:

An additional phase

We add a third phase to each of the 20 rounds that will follow. Therefore, from now on each round will consist of three phases. We will first give a brief overview and then provide more details about each phase.

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

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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.

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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.

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Phase 1

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

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

At the same time, as a buyer you may be asked about your experiences with certain sellers. More specifically, you will be asked to give your experiences with all sellers that are going to negotiate with other buyers. This is done one at a time. When you are asked, we will inform you about your previous experiences with that seller.

You will not be asked for information if you have no experiences with a seller.

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

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

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

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

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

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Phase 1

In summary, collecting information proceeds as follows:

For all sellers involved in negotiations, we will check with which buyers they have traded in previous rounds.

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.

If you as a buyer are asked for information, you choose whether (0.3 francs) 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.

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.

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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.
Appendix A (Continued)

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.

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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.

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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.

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Appendix B. Information patterns

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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References

Granovetter, M.S., 1973. The strength of weak ties. American Journal of Sociology 78 (6), 1360–1380.