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Using Social Connections and Financial Incentives to Solve Coordination Failure: A Quasi-Field Experiment in India's Manufacturing Sector*

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Abstract

Production processes are often organized in teams, yet there is limited evidence on whether and how social connections and financial incentives affect productivity in tasks that require coordination among workers. We simulate assembly line production in a lab-in-the-field experiment in which workers exert real effort in a minimum-effort game in teams whose members are either socially connected or unconnected and are paid according to the group output. We find that group output increases by 18% and coordination improves by 30-39% when workers are socially connected with their co-workers. Connected groups also coordinate better when we introduce a lump sum bonus, suggesting that financial and social incentives can be complementary in this setting. These findings can plausibly be explained by trust between co-workers in socially connected teams.

Keywords: caste-based networks, social incentives, financial incentives, minimum effort game, coordination, trust
JEL Classification: C93, D20, D22, D24, J33

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1 Introduction

It is well acknowledged that labor productivity in developing countries is low compared to the developed world (Bloom et al. (2013)). Recent research has looked inside the black-box of the factory to understand the determinants of worker performance, including the role of social networks.[1] In this paper, we use caste categorization in India as an exogenous determinant of workers' social connections with co-workers to investigate individual and group performance in a coordination task using a lab-in-the-field experiment in the garment manufacturing sector.[2] Unlike the existing literature, our focus is on production processes characterized by complementarities between workers, as in assembly lines in manufacturing units. We not only highlight the potentially positive role of social connections in tasks requiring coordination, but also throw light on the possible complementary effects of financial incentives on improving the productivity and coordination of socially connected workers.

Our study attempts to bridge the disconnect between field experiments on social networks and labor productivity, which have focused on non-complementary production functions, and the large literature on laboratory experiments on coordination games (Van Huyck et al. (1990)) in several ways.[3] Unlike Bandiera et al. (2009, 2010) who study team incentives when workers are substitutes in production or Hjort (2014) who examines team incentives in settings where production is sequential and there is both substitutability and complementarity in production, our study design is

[1] Social networks (Bandiera et al. (2009)); management practices (Bloom et al. (2013)); worker ethnicity (Hjort (2014)).

[2] As we discuss later, usually workers refer others of the same caste to factory jobs, and also live in the same residential neighborhoods. They are, therefore, more likely to be in the same social networks.

[3] Minimum-effort (or weak-link) coordination game with multiple Pareto-ranked equilibrium effort levels, was first introduced by (Van Huyck et al. (1990)), and has been widely used in the laboratory to understand coordination problems faced by organizations (Brandts and Cooper (2006), Weber (2006)). In addition, much of the experimental literature has also focused on how to improve coordination and efficiency by altering the payoff structure of the game (Brandts and Cooper (2007), Goeree and Holt (2003), Devetag and Ortmann (2007), Van Huyck et al. (2007)), or by introducing communication (Blume and Ortmann (2007), Brandts et al. (2007), Kriss et al. (2016)) or group identity salience (Chen and Chen (2011)).

suited to contexts where workers simultaneously engage in a production task and may not be able to observe each other's effort or coordinate on output. Our experiment randomly assigns subjects to teams with or without pre-existing social ties based on caste in an incentivized coordination task which replicates assembly line production using garment factory workers as subjects. Furthermore, we examine the role of financial incentives as an instrument for overcoming coordination failure (Brandts and Cooper (2006, 2007)) and their interaction with social incentives by introducing a lump sum bonus if a threshold level of group output is produced that incentivizes a feasible focal point for the workers. We then investigate if workers' response to the bonus varies by their social connectedness to co-workers in the group.

While we simulate the environment within an assembly line in our controlled experiment, our experimental design mainly isolates the effect of trust - the belief that co-workers will do their best for the group - on coordination and productivity. We therefore abstract from peer effects by not allowing observability of effort or communication between workers.[4] Note that the scope for such observability and communication or repeat interactions is limited in many factories which have very large assembly lines, and whose composition changes frequently due to high worker absenteeism and turnover (Ministry of Textiles, GOI (2018)). Furthermore, defining social connections based on caste, which is determined at birth allows us to circumvent any selection issue - social connections that arise endogenously may result in connected groups that are sorted on ability.

In the context of developing countries, where social networks are very strong, the question of how social connections affect productivity is key to the development process (Munshi (2014)). Social ties among co-workers are particularly relevant when

[4] Mas and Moretti (2009) show that observability of co-worker productivity, particularly those with whom a co-worker interacts frequently, can result in strong spillover effects.

workers are organized in groups, such as an assembly line, and when firms are concerned with group rather than individual output. In such a setting, if some workers put in low effort it can lead to the entire team being trapped in a low effort equilibrium. Munshi (2014) notes that members of social networks may respond to the threat of social sanctions by sacrificing individual gain (i.e., by incurring higher effort cost) in favor of group objectives. On the other hand, individuals may feel altruistic towards group members or trust co-workers with whom they are socially connected (Basu (2010)), resulting in greater cooperative behavior when they are matched with workers with similar social background.

In our setting of a minimum effort production function, subjects respond positively to being with co-workers with whom they have social connections - being in a socially connected group leads to 18% higher group output and a 30-39% decline in wasted individual output and dispersion in within-group individual output, relative to an unconnected group. Our findings therefore suggest that stronger social connections among co-workers can enhance coordination when incentives are group based. Since we eliminated peer effects and did not allow for any communication within group members in our experiment design, the estimates we obtain here might be a lower bound on the impact of social connections on individual and group productivity in our context (Menzel (2018)). Analysis based on our worker level garment factory data indicates significantly larger effects of caste homogeneity on individual and assembly line output.

Our results also indicate that social and financial incentives complement each other, unlike previous research. We find that team-based monetary incentives interact positively with group composition - giving a bonus to the socially unconnected groups does not help in overcoming the coordination gap between them and the connected groups. The socially connected continue to coordinate better, relative to the unconnected, with high powered financial incentives.

We show theoretically that our results can plausibly be explained by pro-social behavior driven by trust in socially connected teams. When peer effects and communication channels are absent we argue that the mechanism underlying our results is mutual trust whereby connected groups believe that their team members care about the group sufficiently to be willing to put in higher effort even at higher personal cost of effort. Using post-experiment survey data we find that beliefs or knowledge about co-workers' productivity do not explain our findings.

Laboratory experiments on team identity conclude that manipulating saliency of group membership contributes to higher level of team cooperation (Eckel and Grossman (2005), Charness et al. (2007), Goette et al. (2006), Chen and Li (2009), Chen and Chen (2011)). In contrast, field experiments on social networks give mixed results on its impact on labor productivity. Bandiera et al. (2010) study a UK based soft fruit producing firm and find that having a more able, self-reported friend as a co-worker increases productivity of lower ability workers by 10% but decreases productivity of higher ability workers. Overall, in the presence of individual piece rates, heterogeneous ability types and substitutability in production, their findings indicate that social networks may not improve team productivity if peer pressures lead to conformity on a low effort norm.

Our study comes closest to Hjort (2014) who examines the ethnic homogeneity of production teams in a flower assembly plant in Kenya where the production process was sequential - suppliers prepared flowers which were then passed on to processors who put the flowers together in bunches. Suppliers and processors could have similar or different ethnic identities. He finds that inter-ethnic rivalries in Kenya lowered allocative efficiency in the plant, particularly during a period of ethnic conflict. Shifting from fixed pay to performance pay based on group output reduced allocative inefficiencies in multi-ethnic teams. Thus, Hjort (2014) shows that in this context financial incentives can substitute for identity motivation. Our paper, on the other hand, is focused squarely on the issue of coordination and how social networks and financial incentives can interact to improve group coordination. While our setting is static, new research suggests that social connections and ethnicity can impact group coordination in repeated interactions as well (e.g. Brooks et al. (2018)).

The findings of our paper not only extend the literature on worker incentives but also speak to the existing research on management practices and firm behavior. First, our results suggest that management practices that create avenues for co-worker interactions to foster affinity among them can further enhance productivity if individual payoffs are contingent on group output. Second, we show that financial incentives do not always substitute for social incentives but can have positive effects in contexts when teams are socially connected. The interaction between financial and social incentives, thus, depends on both the social context as well as the nature of the production function. Our findings have implications both for large assembly lines with limited scope for communication and repeat interactions and for emerging contemporary work practices such as O-Desk where work is performed in online teams and where face to face interactions and scope for communication is limited. In such settings, our results point to the increased productivity from team based social and financial incentives.

The remainder of the paper is organized as follows. Section 2 outlines the context and background of the study while section 3 discusses the theoretical framework that we take to the data. We describe the experiment design in detail in section 4. The empirical methodology and results are discussed in section 5 while section 6 concludes.

2 Context and Background

Historical and economic factors suggest that formation of social networks based on caste and homophily is salient in the Indian context. Chandavarkar (1994) documents that historically migration to industrial hubs occurred within the framework of caste, kinship and village connections in India.[5] Migrants to the city lived with their co-villagers, caste-fellows and relatives and sought work with their assistance (Gokhale (1957), Cholia (1941), Burnett-Hurst (1925)). While caste and kinship formed indivisible social networks in the city's working-class neighborhoods as industrialization progressed, social networks continue to play a significant role in the functioning of labor markets (Afridi et al. (2015a)) and in ensuring migrants' economic mobility in the modern age in low income countries (Munshi (2014), Beaman and Magruder (2012)). Migrants tend to find employment through referrals from their caste-based networks and hence often locate within the same residential units post migration. Given this sociological context, we focus on co-worker connections based on the caste system in India.[6]

In our study we draw on India's textile industry, specifically, garment manufacturing, which employed more than 45 million people in 2016-17.[7] Labor-intensive, assembly line production technology is common in garment manufacturing, making it the most prominent employer in manufacturing and also a major contributor to exports, not just in India but also in several developing countries such as Bangladesh,

[5]30% of the Indian population has migrated from another part of the country at some point, of which almost 15% migrate for employment purposes (Census, GOI (2011)).

[6]The caste system was introduced thousands of years ago, but continues to socially stratify Indians even today into four hierarchical categories (*varnas*) each of which is further sub-divided into *jatis*, having a common origin in terms of occupations, languages, and social practices. At the top of the social hierarchy are Brahmins (the priestly caste), followed by the Kshatriyas (the warrior caste), Vaishyas (the trading caste) and finally Shudras (the service caste such as farmers, and craftsmen) in the *varna* system of social categorization. The caste system is endogamous, hence one's caste is determined at birth. Inter-caste marriages are virtually non-existent even today (India Human Development Survey, 2014 (https://ihds.umd.edu/)).

[7]Ministry of Textiles, GOI (2018), (http://www.texmin.nic.in/study-garment-sector-understand-their-requirement-capacity-building)

Pakistan and China (Lopez-Acevedo and Robertson (2016)). This sector thus provides a natural choice for advancing our understanding of worker performance in the Indian and other developing country context.

Garment production entails the strongest type of complementarity and performance of the weakest worker determines overall firm productivity. In a typical garment factory, production is organized into vertical lines (i.e., an assembly line is like a team). Often these lines have 50-70 workers who can be classified into operators who sit behind one another on sewing machines and are responsible for stitching. Each worker is allotted a machine and is responsible for performing at least one operation, producing a targeted level of output per hour, usually higher than she can achieve.[8] The line composition changes across work days due to absenteeism and turnover amongst primarily migrant workers (more than 65% of the workforce in the National Capital Region (NCR) factories). Thus communication and repeat interactions play a limited role in generating workplace cooperation. Workers are aware of co-workers located physically close to them in the line even though they may not know the composition of the entire line. Multiple workers in the assembly line simultaneously produce different pieces of a garment, e.g. while one worker produces collars, another stitches the cuffs of a shirt. With each operation a part of the garment is made. Pieces of the garment are then assembled to produce the entire apparel, viz. a shirt. Managements often offer lumpsum bonuses if a threshold level of output is reached by an assembly line to encourage workers to meet production targets, particularly since low worker productivity is quite common, as evidenced by data we have gathered from garment factories and discuss later. All the above features lend to our experiment design.

[8] Our on-going research on garment factories in the National Capital Region suggests that tight work schedules do not permit workers to check on the performance of other workers in the line - indeed workers barely get a few minutes to have their lunch.

We formally elaborate on the challenge of co-ordinating workers' effort in a minimum effort game, exemplified by assembly line production, in our theoretical model below.

3 Theory

Let worker i produce output $y_i = e_i$ where $e_i \in \{\bar{e}, \underline{e}\}$ measures effort. Workers are characterized by their network - either L or H. There are 4 workers in total, two of group H and two of group L. Teams are of size 2, and can be either socially connected - both workers belong to the same group (L, L) or (H, H) - or unconnected where workers belong to different groups (H, L) or (L, H). To avoid excess notation we will only mention the group of workers where it is not clear from the context. The production function is a minimum effort game: group output is equal to the minimum effort across workers in the team, $Y = min[e_i, e_j]$. Individual payoffs in the unconnected group are given by $U_i = DY - \frac{c}{a_i}e_i$, where a_i measures worker ability where $a_i \in [\underline{a}, \bar{a}]$, $c > 0$ is a constant that affects the marginal cost of effort, and $D > 0$ measures the strength of financial incentives (group based piece rates).[9] We will assume that worker abilities are identical for the benchmark model. Thus, when workers are unconnected the game is the standard minimum effort game (Van Huyck et al. 1990).

Socially connected groups have social preferences towards each other. These take the form $U_i = DY - \frac{c}{a_i}e_i + G^i_{ij}e_i$. $G^i_{ij} > 0$ when i, j belong to the same group and captures pro-social motivation towards the group - the sense of wanting to do the best for the team. Below we depict the game between workers who can be socially connected or not, assuming that $G^i_{ij} = G$, the parameter $G > 0$ denotes the pro-social preferences of being socially connected. G is zero if the group is unconnected.

[9] Output can also be interpreted as a positive linear function of effort, which does not change the results.

	$\overline{e}$	$\underline{e}$
$\overline{e}$	$D\overline{e} - (\frac{c}{a} - G)\overline{e}, D\overline{e} - (\frac{c}{a} - G)\overline{e}$	$D\underline{e} - (\frac{c}{a} - G)\overline{e}, D\underline{e} - (\frac{c}{a} - G)\underline{e}$
$\underline{e}$	$D\underline{e} - (\frac{c}{a} - G)\underline{e}, D\underline{e} - (\frac{c}{a} - G)\overline{e}$	$D\underline{e} - (\frac{c}{a} - G)\underline{e}, D\underline{e} - (\frac{c}{a} - G)\underline{e}$

In the standard minimum effort game, where $G = 0$, it is well known that when $D - \frac{c}{a} > 0$, there are two pure strategy Nash equilibria: one where both players coordinate on the higher effort and one where they coordinate on the lower effort. Both equilibria are stable. Which equilibrium is more likely to occur depends on the basin of attraction. Let p_j denote the probability on high effort by player j and $EU_i(e)$ denote the expected utility of player i when his effort level is e. Let $\underline{p} = \{\min p_j | EU_i(\bar{e}) > EU_i(\underline{e})\}$. $\underline{p}$ denotes the minimum expected probability (belief) of the opponent playing high effort, which would lead to each player playing high effort. Note that by symmetry of the game $\underline{p}$ is the same for both players. The lower is $\underline{p}$ the bigger the basin of attraction for the high effort equilibrium. In this sense, we say that the lower is $\underline{p}$ the more likely it is that the high effort equilibrium is selected. When $\underline{p} \geq 1$ then the high effort equilibrium does not exist while if $\underline{p} \leq 0$ then the low effort equilibrium does not exist. We interpret $\underline{p}$ as a measure of trust: when $\underline{p}$ is low it means that players believe others are more likely to do their best for the group, i.e. they have high levels of trust.[10] Clearly coordination on the high effort equilibrium is higher when $\underline{p} \to 0$ and coordination on the low effort equilibrium is higher when $\underline{p} \to 1$. We will say that coordination is higher for a selected (risk dominant) equilibrium when the corresponding condition on $\underline{p}$ is satisfied. For example, if the risk dominant equilibrium is the high effort equilibrium then coordination is higher for the group with the smaller $\underline{p}$ and vice versa when the low effort equilibrium is risk dominant.

[10] See e.g. Gambetta (1988) "it is necessary not only to trust others before acting cooperatively, but also to believe that one is trusted by others."

We denote by $\underline{p}^U$ ($\underline{p}^C$) the minimum expected probability (belief) of the opponent playing high effort, in the unconnected (connected) game. We then have the following claim:

Claim: *Assume that workers are homogeneous in ability and connected workers are homogeneous in* $G > 0$*:*

(1) If $\frac{D}{2} > \frac{c}{a}$*, then (a)* $\underline{p}^i < \frac{1}{2}$ *for* $i \in \{U, C\}$*, and* $\underline{p}^C = \frac{c}{Da} - \frac{G}{D} < \underline{p}^U = \frac{c}{Da}$ *;*

(b) Both groups have a unique high effort risk dominant equilibrium and the probability of coordinating on the high effort equilibrium is higher in the connected relative to the unconnected group. Moreover $\underline{p}^C$ *is increasing in* G *so the probability of coordinating on the high effort equilibrium in the connected group is increasing relative to the unconnected group as* G *increases. Thus, coordination is higher in the connected group relative to the unconnected group if the high effort equilibrium is risk dominant.*

(2) If $\frac{D}{2} + G > \frac{c}{a} > \frac{D}{2}$*, then* $\underline{p}^U > \frac{1}{2}$ *while* $\underline{p}^C < \frac{1}{2}$*, i.e. the high effort equilibrium is the unique risk dominant equilibrium in the connected group while the low effort equilibrium is the unique risk dominant equilibrium in the unconnected group. Coordination is higher in the connected group iff* $\frac{D+G}{2} > \frac{c}{a}$*, since* $p^C < 1 - p^U$*, i.e. if* G *is sufficiently large.*

(3) If $G > \frac{c}{a}$*, then indeed there is perfect coordination on the unique dominant strategy high effort equilibrium.*

(4) Suppose initially we have $\frac{D}{2} + G < \frac{c}{a}$ *and suppose a bonus is given for high effort, i.e. payoffs are* DY *for low effort and* $(D + B)Y$ *for high effort, which satisfies* $\frac{D+B}{2} + G > \frac{c}{a} > \frac{D+B}{2}$*, then the connected group moves from a unique low effort to a unique high effort risk dominant equilibrium while the unconnected group has a unique low effort risk dominant equilibrium before and after the change. The bonus* B *needed to move from a low to high effort risk dominant equilibrium is higher for the unconnected group than the connected group. The higher is* G *the lower is the*

bonus needed in the connected group relative to the unconnected group. Finally, if $\frac{D+B}{2} > \frac{c}{a}$*, then both connected and unconnected groups have a unique high effort risk dominant equilibrium. The coordination in the connected group is higher with bonus if both groups play the high effort equilibrium. If* G *is sufficiently high then coordination is always higher in the connected group (and the connected group has a unique risk dominant equilibrium).*

These results can be generalized to more than 2 workers and multiple effort levels (for proof and extensions see Appendix A). Based on the above claim our theoretical model predicts the following:

1. Socially connected groups are more likely to coordinate on a higher effort equilibrium than unconnected groups. The higher the trust among co-workers, the higher the probability of coordinating on a higher effort equilibrium.

2. Group coordination is higher in connected groups than unconnected groups.

3. The bonus required to move from a unique risk dominant low effort equilibrium to a unique risk dominant high effort equilibrium is lower in socially connected groups relative to unconnected groups. Thus a lump sum bonus can have a larger positive effect on group output and coordination in socially connected groups.

We find strong support for the above theoretical predictions using data on worker level productivity gathered by us from two garment factories in the National Capital Region (NCR) of Delhi. Taking advantage of idiosyncratic variation in the daily caste composition of assembly lines due to worker absenteeism, we find that the higher the proportion of own caste workers in the line (Figure 1a) and the more homogeneous the caste composition of the line on a work day (Figure 1b), the higher the productivity of the worker and the assembly line on that day (see Figure 1).[11] This suggests that pre-existing social connections amongst co-workers, mediated through caste, can indeed have a significant impact on group productivity. However, in this real world setting it is challenging to separate out the effects of social composition of production teams from other unobservables such as worker - line supervisor interactions that may influence line composition and productivity. We, therefore, design a controlled, lab-in-the field experiment which captures the effect of social connections and is described in detail next.

4 Experiment design

Since our research question is how team productivity is influenced by workers' social connections and financial incentives, our lab-in-the-field experiment (Harrison and List (2004)) uses a 2x3 factorial, between-subject design. Each session consisted of a work team of 4 subjects of the *same* gender. In the Socially Connected treatment, the team had the same caste based network. In the Socially Unconnected treatment, the team members belonged to different caste based networks. In addition, we used two different incentive schemes - Piece Rate and Bonus (with two different framings - Gain Framing and Loss Framing). The experimental design is outlined in Table 1. We conducted both men and women only sessions in our experiment but focus on the men only sessions due to the cultural constraints in priming women's social connections.

Subjects and recruiting The subjects of our experiment were garment factory workers, with at least primary education, in the NCR's garment fac-

[11] In Table A1 in Appendix B, using our garment factory data we find that a 1 percentage point increase in the caste homogeneity of the assembly line increases individual worker efficiency by 9.5-10 percentage points and the efficiency of the assembly line by 11-16 percentage points. This is robust to individual and assembly line fixed effects, respectively. Note that the average worker efficiency is low at about 32%. We do not find significant differences in productivity by caste groups (Table A2, Appendix B).

tory hub. The experiment was conducted between May and July 2016. Recruiting pamphlets were distributed among the workers during our visits to their factories and residential clusters (see Figure A1 in Appendix B). The advertisement mentioned Rs.200 as participation fee which was about the daily wage of garment factory workers in our sample.[12] Workers registered over phone, and the information on their residential address, native state, caste, sub-caste or *jati*, and gender were collected at the time of registration.

We classified subjects on two dimensions to proxy for social networks. First, each subject was categorized according to his *jati* into one of the three main caste groups using the official categorization by her native state (1) **L** type consisted of the historically marginalised *jatis* that belonged to Scheduled Castes (SC) the lowest in the social hierarchy; (2) **M** type constituted the other backward castes (OBC) that are socially and economically disadvantaged; and (3) the **H** type were subjects whose *jatis* belonged to the high castes.[13]

The second dimension of subject categorization was current residence. A residential cluster, in our context, represented a lane or *mohalla* in a particular worker colony. For instance, lane number 7 of Kapashera slum formed a residential cluster in our study. Visits to residential clusters during the study indicated that migrant workers of the same *jati* and native village resided in the same neighborhood. Hence the probability of workers sharing the same caste ethnicity and being socially connected as friends, relatives, and/or co-workers was high if they had the same residential address. Subjects were given a specific date and time to visit the experiment site which

[12] 1 USD = Rs. 67 (approximately) in 2016

[13] Both the L and M type typically have public sector jobs and political positions reserved for them under India's affirmative action policies (Deshpande (2013)). Factory jobs in the private sector are coveted by all castes and social groups of migrants in urban areas. Data collected by us from garment factories in the National Capital Region show that almost 50% of the workers were H type, 30% M type, and the remainder L type.

was in a building in the garment manufacturing hub where most of these subjects worked. A subject was allowed to participate only once and was required to show his garment factory employment ID at the time of experiment.

Task and incentives The experimental task involved subjects independently stringing beads on beading wires of a specific length in their private workstations partitioned by opaque curtains. To capture purely the effect of pre-existing social connections and beliefs about other workers in the team, neither communication amongst subjects nor information on the productivity of subjects was made public at any time during the experiment.[14] This design also conforms to the actual factory assembly line setting where workers have low probability of coordinating effort and output level through verbal communications or repeat physical interactions, as discussed in Section 2.

In each session the 4 subjects of a team were randomly assigned ID numbers from 1 to 4 which further mapped into their private workstations and their allotted bead colors - red, blue, green or silver. Their ID numbers, workstation numbers, and bead colors were kept private to ensure anonymity of their individual performance throughout the experiment. The subjects were also informed that the identity of individual performances would not be disclosed at any point during or after the session. This was done to be able to assess the role of trust or beliefs about co-workers on own productivity and group coordination. Note that since each session consisted of only one group we use the term "session" and "group" interchangeably.[15]

The experiment started with each subject being seated at his assigned workstation with a covered bowl containing beads of a single color and equal size along with a

[14]See experiment instructions, translated from Hindi into English, in Appendix C.

[15]In each session there was one main instructor and an assistant instructor of different genders. Both instructors were graduate students whose caste categories were kept private throughout the experiment.

bunch of 20 cm long wires.[16] The subjects were told that their task was to string the wire with the beads in privacy such that the wire was fully covered with beads. The beaded strings of the four colors were to be combined to make bracelets by the experimenter at the end of the experiment. In other words, each bracelet, the team product, consisted of 4 strings of 4 colors, each string made by a subject. Thus, the minimum number of strings (of a color) produced would determine the number of bracelets per team and thus the team output (see Figure A2 in Appendix B for a completed bracelet). By experimental design, therefore, group productivity was determined by the least productive worker of the team.

Once the task was explained and demonstrated using beads and a wire by the experimenter, information on the payoff functions were given. We used two financial incentive schemes - Piece Rate and Bonus. All the payoffs were based on the team output - the number of bracelets.[17] Under Piece Rate every subject received Rs.100 per completed bracelet produced by the team. For instance, if 5 red, 6 green, 4 blue, and 8 silver strings were produced in a session the team's output would be 4 bracelets and the payoff would be Rs.400 for each subject.

Our bonus incentive was motivated by the typical bonus schemes used in garment factories. Managements incentivize production of a target level of group output by offering a discrete bonus if the target is achieved by the line. In view of this factory setting, our experimental Bonus scheme offered each subject a bonus of Rs.150 above and beyond the Rs.100 piece rate if they reached a group output of 5 or more bracelets. This design feature was motivated by our finding in our pilot experiment, using Piece Rate payments, that the median performance of a team was 4 bracelets. We, therefore,

[16] The bowl was covered so the bead color could not be seen while the experimental instructions were being delivered.

[17] Although workers receive fixed wages based on their daily attendance at work in most garment factories in NCR, in the real world factory setting the presence of the assembly line supervisor implicitly creates team based productivity incentives, as the supervisor is interested in line level output.

used 5 bracelets as the threshold for the Bonus scheme. Given that the average daily wage of the subjects was approximately Rs. 200, the bonus incentive was high powered. Since such a scheme could also create a focal level of output, it provides us with a weak test of the impact of financial incentives on raising group output to a feasible level.

The Bonus framing used was different, however. Under Bonus with Gain Framing, it was announced that if their team made 5 or more bracelets, each team member would receive a coupon of Rs.150 which could be encashed at the time of payment. In contrast, under Bonus with Loss Framing, for instilling a sense of loss, each subject was given a coupon equivalent to Rs.150. But if their team made less than 5 bracelets the Rs.150 coupon would be taken away so they would lose this extra money and only get paid Rs.100 for each bracelet. The description of the financial incentives and payoffs is given in Table 2. Every subject in his workstation was given a payoff table corresponding to the assigned incentive scheme. The experimenter gave specific examples that elucidated the calculation of individual payoffs. Before proceeding with the experiment, each subject was provided with a sheet and a pen to answer several questions to ensure their understanding of the payoff calculation.

Social connections To study how team productivity is influenced by workers' social connections at work, we manipulated the caste and residence composition of the 4-person team in the sessions. Subjects were randomly assigned into the Socially Connected and the Socially Unconnected treatments. In a Socially Connected session, all 4 subjects belonged to the same caste category and currently resided in the same residential cluster to ensure that they shared similar social backgrounds. Specifically, they belonged either to the same or similar *jati* in the low caste category (**L** type), the middle caste category (**M** type), or the high caste (or **H** type). In contrast, a Socially Unconnected session consisted of subjects belonging to different caste categories and different residential clusters. We used the following criteria in selecting four subjects for the Socially Unconnected sessions - one L, one M, and one H type. The fourth subject could belong to any of the three types.[18]

One crucial part of our design was to make the subjects aware of the caste composition and thereby the strength of social connections of their work team. Since in India the last name of a person reflects the *jati* (i.e., sub-caste) of an individual, this was done through public announcements of each subject's name and residential address. After ensuring that the task and payoffs had been clearly understood by the subjects, the experimenter announced in public the first and last name as well as the residential address of each subject with the workstation curtains drawn apart so that the subjects could see each other. Each subject raised his hand when the name was called. [19]

Note the caste composition and the degree of social connections of the team was made public in both the Socially Connected and the Socially Unconnected treatments.[20]

Procedure Once the task was explained and the experimenter announced the subjects' names and addresses, curtains were drawn and subjects remained in separate, adjacent work stations during the rest of the experiment. Subjects were asked to remove the cover on the bowls containing their allotted color of beads and practiced the beads stringing task. Once the experimenter ensured that every subject understood the task, 10 minutes were given for them to string beads in as

[18]For instance, a socially connected session of M type may have consisted of 4 Yadav *jati* or 3 Yadav and 1 Kurmi *jati* subjects, all of who are 'other backward castes' in Uttar Pradesh. The within session variation in the *jati* of the 4 subjects in the socially connected sessions was 0.37 as opposed to 1.23 in the socially unconnected sessions, different at 1% significance level.

[19]In all sessions the main experimenter followed a prepared script and said the following: "Now I will announce your name and your residential address. As I call out your names please raise your hand. If there is any error in the announcement, please tell us."

[20]Unlike some previous studies that use subjects' names as identity prime (Hoff and Pandey (2006), Afridi et al. (2015b)) this study uses public announcement of names and residential addresses to ensure common knowledge of the caste composition and related social connections among the team members.

many wires as they desired. After 10 minutes, beaded wires were collected one by one by the experimenter in an opaque envelope and kept in front of the workstations on a desk.

Thereafter subjects were requested to complete a post-experiment survey on additional information such as age, caste, religion, employment status, relationship (if any) with their team members, and beliefs about the productivity of co-workers they knew before the experiment.[21] Once all four subjects completed their questionnaires, the partition curtains were drawn apart. The envelopes with the beaded strings were opened one by one, and the number of complete strings of each color was counted without revealing each subject's performance. The number of bracelets produced by the team was determined. Subjects received their payment in cash and were dismissed.

As shown in Table 1, we conducted 67 independent sessions consisting of male subjects, including 33 Socially Connected sessions and 34 Socially Unconnected sessions. Among these sessions, 16 used Piece Rate, and 51 used the Bonus Incentive - 25 Bonus with Gain Framing, and 26 Bonus with Loss Framing. Between-subject design was used, hence no subject participated in more than one session. The experiment lasted about one hour. The average individual output was 4.5 beaded wires, and the average group output was 3.5 bracelets. The average payment was Rs.565.8 (including the Rs.200 participation fee) which was more than twice the average daily wage of the subjects. See Appendix E for discussion of the conduct and findings of women only sessions.

[21] Post-experiment questionnaires, translated from Hindi into English, are attached in Appendix D.

5 Data, methodology, and results

5.1 Data

The summary statistics from the post-experiment survey are shown in Table 3. Our subjects were approximately 29 years old with almost 89% Hindu. The proportion of Hindus was comparable between treatments.[22] Marginally fewer men had completed high school or more in the Socially Unconnected group. Almost the entire sample consisted of migrants from outside Delhi of which more than $\frac{1}{2}$ had migrated from the north-eastern state of Bihar. We were successful in recruiting subjects who were currently working (more than 97%), 98.5% of whom were currently employed in garment factories. Subjects' perception of task difficulty did not differ by treatment. Subjects knew almost 2 (1.9 out of possible 3) co-workers by name in the Socially Connected treatment, significantly more than in the Socially Unconnected treatment (by design). 93% (31%) of the known subjects had the same state of origin, 54% (0%) came from the same state-district and 90% (0%) shared their *jati* in the Socially Connected (Unconnected) treatment.[23] There was no variation in the caste group (i.e. H, M and L) of subjects within the Socially Connected treatment as designed. The experiment design was, therefore, effective in creating the connected and unconnected groups. Overall, Table 3 indicates that most of the average subject characteristics are comparable across the treatments, which suggests successful randomization of subjects into treatments. In our analyses we, nevertheless, control for the observable characteristics of the subjects that either are different across treatments or may

[22] In this study, 11% of our subjects were Muslim. Of these, 53% were M type while the remaining were H type. Although the caste system is a feature of Hinduism, social identities are strong even amongst religious minorities who are often SCs and STs who converted to Islam or Christianity. In the Socially Connected treatment sessions we held religion constant. Hence, M (H) Muslim subjects were matched with M (H) Muslims. Nevertheless, throughout our analysis we control for religion. Our results are also robust to restricting the sample to Hindus (available on request).

[23] The co-subjects known by name in the socially connected treatment were most often described as neighbor (94%), followed by friend (84%), co-worker (32%), and relative (30%) in the post-experiment survey which allowed for multiple relationships between subjects (see Appendix D).

influence the outcomes in our study.[24]

We are interested in two categories of outcomes - output and coordination. They are summarized in Figure 2 for the Socially Connected and Socially Unconnected treatments, respectively. Output is measured at the individual level by the number of completed wires (Figure 2(a)) and at the group level by the minimum individual performance in each group (Figure 2(b)). Coordination is measured at the individual level by excess individual output (which is individual output minus the group output, Figure 2(c)) and at the group level by within-group output dispersion (which is the standard deviation in the number of completed wires by each subject within the group, Figure 2(d)). Since an individual's output above and beyond the minimum output of his group is not counted toward the group output any excess individual output would be wasted. Therefore, lower level of excess individual output (or wasted output) or within-group output dispersion signifies better coordination.

Figure 2(a) shows that subjects respond positively when they are in a socially connected group by raising individual (p<0.10) and group output (p<0.05). Figures 2(c)-(d) show that subjects coordinate better when they are socially connected with their co-workers (p<0.01 for excess individual output and within-group output dispersion).[25]

5.2 Empirical methodology and results

We use the following OLS specification to study the impact of social and financial incentives on the above mentioned outcomes:

$$Y_{is} = \alpha_0 + \alpha_1 Socially\ Connected_s + \alpha_2 Bonus\ Incentive_s + \alpha_3 \mathbf{Z}_{is} + \epsilon_{is} \qquad (1)$$

[24]In Table A3, Appendix B, we show the average characteristics of subjects by the financial incentive.

[25]In the Socially Unconnected (Connected), Piece Rate sessions more than 52% (25%) of individual subjects and more than 88% (71%)of the groups produced less than 5 bracelets. 36% of groups made exactly 4 bracelets. Hence there was substantive scope for a lump-sum bonus to raise the average group output to or above 5 bracelets.

The dependent variable is Y_{is} i.e., individual *i's* output or excess output in session s for the individual-level analysis. 'Socially Connected' is a dummy variable for the Socially Connected treatment (with the Socially Unconnected treatment in the omitted category). 'Bonus Incentive' is the treatment dummy variables for the high powered bonus incentive (with Piece Rate in the omitted category). **Z** is a vector of individual characteristics such as separate dummy variables for the H and M caste categories (with L in the omitted category), age, religion, native state, employment status, and education. The coefficient α_1 gives an estimate for the average effect of being in a socially connected group on the individual or group outcomes relative to the socially unconnected group, unconditional on the financial incentives. Similarly, the coefficient α_2 provides the estimate of the average effect of the Bonus Incentive relative to Piece Rate, unconditional on the social incentives. The standard errors are clustered at the session (i.e. the group) level for individual-level outcomes.

Equation 1 can be further augmented by incorporating the interaction terms between the social and financial incentives:

$$\begin{aligned} Y_{is} &= \beta_0 + \beta_1 \textit{Socially Connected}_s + \beta_2 \textit{Bonus Incentive}_s \\ &+ \beta_3 \textit{Socially Connected}_s * \textit{Bonus Incentive}_s + \beta_4 \mathbf{Z}_{is} + \epsilon_{is} \end{aligned} \tag{2}$$

Note that subscript i drops out for the group-level analysis (i.e., group s's output or within-group output dispersion) in both equations 1 and 2.

Table 4 reports the results of equation 1 on individual and group output. We find that the Socially Connected treatment has a positive but insignificant effect on individual output (α_1= 0.114, $p>$ 0.10 in column 1), but it has a positive and statistically significant effect on group output (α_1= 0.574, $p<$ 0.05 in column 2). Since these estimates are unconditional on the financial incentives, it shows that being in a socially connected group increases the group output by 0.574 bracelets or by 18%, on average, for the two financial incentives.[26]

Table 5 focuses on coordination - excess individual output and within-group dispersion. We find that the coefficient estimate of 'Socially Connected' is -0.457 for excess individual output ($p< 0.01$ in column 1) and -0.325 for within-group output dispersion ($p< 0.05$ in column 2). That is, on average across the two financial incentives, the wasted output and the within-group dispersion is more than 39% and 30%, respectively, lower in the Socially Connected treatment, relative to their counterparts in the Socially Unconnected treatment. These findings indicate that subjects coordinate significantly better when they are with co-workers with whom they feel more socially connected.[27]

The findings in Tables 4 and 5, therefore, validate the theoretical prediction 1.[28] They lead to Results 1 and 2.

Result 1: Being in a socially connected group leads to an increase in the group output.

Result 2: Being in a socially connected group improves within-group coordination.

Next we analyze the effect of social connectedness conditional on the financial incentives using equation 2.[29] These results are reported in Table 6 on output and

[26]This estimate is lower than the 11-16 percentage point increase suggested by our factory data, given average minimum line efficiency of 5% in Table A1 (columns 4-6), Appendix B.

[27]Our results are unaltered when we include additional control variables in the analysis, e.g. dummy variables for "having done similar kind of task earlier" and the months when the experiment was conducted. These robustness checks with the estimates of all the explanatory variables are reported in Tables A4 and A5, Appendix B. The conclusions are unchanged when we bootstrap the standard errors (results available on request).

[28]We explore heterogeneity of the impact of social connectedness by caste groups in Table A6 in Appendix B. Interestingly, the L type respond significantly to being socially connected by raising individual output relative to the M and H types. But the H type also significantly improve group output and reduce within-group dispersion when they are socially connected, relative to the L and M type.

[29]The coefficients of 'Bonus Incentive' are statistically insignificant throughout in Tables 4 and 5, suggesting that higher financial incentives neither increase (individual or group) output nor improve coordination within the group, irrespective of social connectedness of the group. This may not be surprising given the

Table 7 on coordination. The bottom panels of the tables report the results of F tests for the impact of the Bonus Incentive, relative to Piece Rate, conditional on the socially connected groups, as well as the impact of social connectedness conditional on the bonus. In Table 6 the coefficient of 'Socially Connected' β_1 indicates that under Piece Rate, being in a socially connected group leads to an increase in individual output by 0.561 bracelets ($p< 0.10$, column 1) and an increase in group output by 1.172 bracelets ($p< 0.05$, column 2), relative to being in a socially unconnected group. Conditional on the high powered bonus incentive, however, the impact of social connectedness is statistically insignificant for individual output in column 1 ($\beta_1+ \beta_3 =$ -0.029, $p = 0.845$) and for group output in column 2 ($\beta_1 +\beta_3 = 0.407$, $p = 0.170$).

Therefore, the positive impact of social connectedness on group output summarized in Result 1 is mainly driven by its impact under Piece Rate, but it also holds qualitatively, albeit statistically insignificantly (perhaps due to the lack of power), under the Bonus Incentive as shown in column 2, row 5. In addition, we find that the bonus may reduce individual output relative to the piece rate incentive, conditional on social connectedness. Specifically, the impact of social connectedness on individual output under Bonus is significantly lower than under Piece Rate ($\beta_2 + \beta_3 = -0.411$, $p> 0.05$) and marginally lower for group output ($\beta_2 - \beta_3 = -0.869$, $p>0.10$) as shown in columns 1 and 2, row 6 of Table 6.[30]

results of Brandts and Cooper (2006) who show that financial incentives work only to improve coordination if they are large enough or if agents are allowed to learn over time. Our real-effort minimum-effort game is one shot, which may explain the lack of immediate impact of stronger financial incentives on output and coordination of the group.

[30] To understand this result more closely, we estimate the impact of the Bonus relative to Piece Rate in two samples (1) individuals/groups producing below the focal point of 5 completed wires/bracelets in Piece Rate and (2) those producing at or above 5. Table A7, Appendix B, shows that indeed the Bonus Incentive increased individual effort significantly and group effort insignificantly relative to those individuals or groups whose output was less than 5 under Piece Rate (columns 1 and 2, row 2). The impact of the Bonus relative to those producing 5 or more output under Piece Rate was the opposite (columns 3 and 4, row 2). These results highlight the fact that the Bonus, as devised by managements, creates a focal point for the workers. But this focal point effect may be smaller for the socially connected groups as suggested by the negative point estimate of β_3 and the fact that connected groups continue to coordinate better both below and above the threshold output of 5, relative to the unconnected whose coordination worsens (results available on request).

In Table 7 we estimate equation 2 for the coordination outcomes. Column 1 of Table 7 shows that the excess individual output is lower and hence individual coordination is better in the Socially Connected treatment than in the Socially Unconnected treatment under Piece Rate (β_1= -0.275 in column 1, p>0.10) and Bonus Incentive (β_1+ β_3 = -0.515, p = 0.002). These observations confirm that Result 2 of the positive impact of social connectedness on coordination manifests itself under the two financial incentives. This impact, however, is statistically significant for the Bonus Incentive but holds only qualitatively under a relatively low powered incentive - Piece Rate. It suggests that social connectedness effectively reduces workers' wasted output and promotes their coordination under high powered financial incentives, implying that strong financial incentives may not weaken the strength of social incentives in improving coordination. Column 2 of Table 7 further shows that the impact of social connectedness is along the same lines for the within-group output dispersion (β_1 = -0.359, p>0.10 for Piece Rate; β_1+ β_3 = -0.316, p = 0.029) for Bonus.

Therefore, the observations in Tables 6 and 7 (columns 1-2, row 5) can be summarized in the next result.

Result 3: In line with theoretical prediction 3, socially connected subjects exhibit significantly better coordination and insignificantly higher group output under the high powered bonus incentive (regardless of framing), relative to the unconnected.

One interesting question is whether workers would respond to different framing of the bonus incentive. We find that the coefficient estimates of Bonus with Gain Framing and Loss Framing, unconditional on workers' social connectedness, do not significantly differ from each other (F test, p> 0.10). Specifically, in Table A8 in

We also analyzed the effect of social connectedness on whether the group output crossed the threshold of 5 bracelets or not. We do not find any significant effects for this outcome. In our theoretical model, therefore, we abstract from the focal point explanation.

Appendix B, Loss Framing relative to Piece Rate and conditional on being socially connected lowers individual output significantly (column 1, $\beta_4 + \beta_5$=-0.462, p=0.037). This finding leads to our final result.

<u>**Result 4**</u>: The group performance based bonus incentive does not increase subjects output or coordination when it is framed as a loss, compared to when it is framed as a gain.

In contrast to previous field experiments that find positive impacts of the loss frame on worker productivity (Hossain and List (2012)), our result indicates that workers in our experiment do not respond to the framing of the bonus. This may occur because the bonus incentive in our experiment is offered based on the group performance, rather than individual performance as in the previous field experiments. This finding thus calls for future research on the conditions under which a loss frame may or may not outperform a gain frame.

To summarize, our main results show that socially connected groups produce higher group output due to better coordination, relative to the unconnected groups. Introducing a lump-sum bonus does not reduce the within-group coordination advantage that the socially connected have over the socially unconnected. This suggests that financial incentives may complement social incentives in contexts where individuals have to co-operate with each other.

5.3 Discussion of results

As elucidated by the theoretical model, trust among co-workers in socially connected teams can potentially explain our results. When workers have trust in their co-workers, they believe that others are going to do their best for the team. As a result, their own incentive to put in high effort increases. Our survey data from a census of workers employed in two garment factories in the catchment area of our experiment suggests greater trust between socially connected workers - 32% (24%) of workers who have a co-worker with whom they are socially connected (neighbor/relative/same village) as opposed to 16% (18%) of those with a co-worker friend who they met on the job recently, report lending Rs. 500 or more to that friend (asked for help in medical emergency).

There may, however, be alternative explanations. First, when ability levels are heterogeneous, working harder is not optimal for all workers due to the nature of the production function. If connected groups have beliefs or better information about abilities of co-workers, however, they may be able to coordinate better and thus have lower wasted effort. But belief about co-worker ability is not sufficient for higher individual and group effort seen in the connected groups in our experiment, unless there is trust regarding reciprocity among co-workers. Note that our experiment involved a task that subjects had not engaged in collectively before. Hence their beliefs about co-worker productivity is unlikely to be accurate, irrespective of connections. Indeed, in our post-experiment survey, we asked subjects to state how many beaded wires they expected a co-worker to make in the allotted time of 10 minutes. Subjects in both the socially connected and unconnected groups overestimated the productivity of the co-workers they knew by name before the experiment session.[31] We do not find any statistical difference in this gap between beliefs and actual productivity by groups' connectedness. This reinforces our claim that knowledge or beliefs about co-workers productivity cannot explain our results.

Another possible explanation is that our experimental design merely sorts on ability, i.e. if L, M, and H types have differential abilities the socially connected groups would produce both higher group output and show better coordination just

[31] The difference between actual and expected co-worker output was -0.40 and -0.25 in the connected and unconnected groups, respectively.

by experiment design. But we do not find significant differences in productivity (or ability) by caste groups either in our experiment sample (Socially Unconnected treatment) or in the real world factory data (see Table A2 in Appendix B). Moreover, in our robustness check we control for ability by including a dummy variable for whether the subject has previous experience of performing the assigned task.

A third alternative mechanism that could plausibly explain our results is the potential threat of sanctions for low effort in socially connected groups. If socially connected subjects have a better idea of the distribution of abilities in their group, and this is common knowledge, then the low ability subjects may put in higher effort in the socially connected treatment due to fear of punishment by the team, raising both group output and improving coordination. To guard against this possibility, in our experiment we not only explicitly kept information on individual performance private throughout our experiment, we also informed subjects upfront that individual performances would not be revealed at any point during the session. We, therefore, discount these three possible alternative mechanisms and emphasize the role of trust among connected co-workers as a valid explanation of our results.

6 Conclusion

We conduct laboratory experiments in the field to study the impact of caste based social connections on output and coordination amongst workers engaged in a minimum effort game. Our results suggest that being socially connected to co-workers significantly improves group coordination and output though not individual productivity. Further, we find that high powered incentives such as a lump-sum bonus may continue to lead to higher group coordination and productivity when workers are socially connected with their co-workers relative to when they are not. Our results are driven by those socially connected groups in which all subjects belonged to the same *jati* (results available on request).

These findings can be explained by trust between socially connected workers. However, in our survey of garment factory workers we find that 16% of workers report having no friends in the workplace, while the average worker reports less than 2 co-workers as friends. These data and our findings underline the need for managements to create avenues for greater social interactions among co-workers at the work place to enhance productivity.

Our research not only connects the laboratory literature on group coordination with the field experiments on labor productivity, it adds to the growing body of work on the relevance of personnel economics within firms to economic growth. Our results provide strong evidence of the role of co-worker relationships in resolving coordination issues inside the workplace, particularly in contexts where average worker productivity is poor, as is true in most low income countries. Future research could study how worker coordination evolves over time in teams with heterogeneous ability and social connectedness to better understand why some firms get more productive over time and others don't.

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Table 1: Experiment design and sample

	Number of sessions			Number of Subjects
Financial Incentive	**Socially Connected**	**Socially Unconnected**	**All**	
Piece Rate	7	9	16	64
Bonus	26	25	51	204
Bonus with Gain Framing	13	12	25	100
Bonus with Loss Framing	13	13	26	104
	33	34	67	268

Note: 'Bonus' includes both 'Bonus with Gain Framing' and 'Bonus with Loss Framing'. The break-up of bonus sessions by framing is described in rows 3 and 4.

Table 2: Financial incentives and payoffs

Number of bracelets produced by group	Subject payoff (Rs.)	
	Piece Rate	Bonus
1	100	100
2	200	200
3	300	300
4	400	400
5	**500**	**500 + 150 =650**
6	600	600 + 150 =750
7	700	700 + 150 =850
….	…	…

Notes: Each subject was given Rs.200 as participation fees in all sessions. As depicted above, the payment scheme was the same in Bonus with Gain Framing and Bonus with Loss Framing. The only difference was that in the Bonus with Loss Framing the payment schedule was presented to subjects in the reverse order, i.e. starting with 7 or more bracelets and moving down to 1 bracelet to produce a sense of 'loss' if they did not meet the threshold of 5 bracelets.

Table 3: Summary statistics by gender and social connectedness

Characteristics	Socially Connected	Socially Unconnected	Difference
	[N=132]	[N=136]	
	(1)	(2)	(2) - (1)
Age (years)	28.341	29.022	0.681
	(0.583)	(0.594)	(0.833)
Hindu	0.878	0.897	0.018
	(0.028)	(0.026)	(0.039)
Married	0.727	0.713	-0.014
	(0.039)	(0.039)	(0.055)
Completed high school or more	0.333	0.228	-0.105*
	(0.041)	(0.036)	(0.055)
Migrant from Bihar	0.598	0.691	0.092
	(0.042)	(0.040)	(0.058)
Currently employed	0.977	0.971	-0.007
	(0.013)	(0.014)	(0.020)
Found task easy	0.742	0.654	-0.088
	(0.038)	(0.041)	(0.056)
Knew at least one team member by name	0.848	0.080	-0.767***
	(0.031)	(0.023)	(0.039)
Number of co-workers known by name	1.894	0.125	-1.769***
	(0.098)	(0.041)	(0.105)
Caste dispersion in a session	0.000	1.184	1.184***
	(0.000)	(0.026)	(0.027)

Note: Standard errors reported in parentheses. t tests of differences reported in column 3. Significant at *10%, **5%, and ***1%.

Table 4: Impact of group composition on output (unconditional estimates)

	Individual Output	Group Output
	(1)	(2)
Socially Connected (α_1)	0.114	0.574**
	(0.129)	(0.261)
Bonus Incentive (α_2)	-0.062	-0.353
	(0.194)	(0.315)
Constant	5.605***	6.186***
	(0.592)	(1.873)
Mean for Socially Unconnected	4.375	3.206
Number of observations	268	67
Number of sessions	67	67
R^2	0.102	0.196

Note: In columns 1 the dependent variable is *individual* output defined as the number of completed wires made by a subject. In column 2 the dependent variable is *group* output defined as the number of bracelets (i.e., the minimum number of completed wires) made by a group. 'Bonus Incentive' is a dummy that equals 1if the bonus was offered to the group and 0 if the incentive was piece rate. Other control variables include age, Hindu, dummy for H type, dummy for M type, and dummies for primary schooling complete, native state Bihar and currently employed. The estimates of these control variables are omitted for brevity but are similar to those in the analysis of robustness checks reported in Table A4 in Appendix B. Standard errors (clustered at the session level in column 1) are reported in parentheses. Significant at *10%, **5%, and ***1%.

Table 5: Impact of group composition on coordination (unconditional estimates)

	Excess Individual Output	**Within-Group Output Dispersion**
	(1)	(2)
Socially Connected (α_1)	-0.457***	-0.325**
	(0.154)	(0.124)
Bonus Incentive (α_2)	0.112	-0.027
	(0.183)	(0.15)
Constant	1.411***	0.757
	(0.524)	(0.89)
Mean for Socially Unconnected	1.169	1.056
Number of observations	268	67
Number of sessions	67	67
R^2	0.087	0.132

Note: In column 1 the dependent variable is the excess *individual* output defined as individual output minus group output. In column 2 the dependent variable is within-*group* output dispersion defined as the standard deviation of individual output within a group. 'Bonus Incentive' is a dummy that equals 1if the bonus was offered to the group and 0 if the incentive was piece rate. Other control variables include age, Hindu, dummy for H type, dummy for M type, and dummies for primary schooling complete, native state Bihar and currently employed. The estimates of these control variables are omitted for brevity but are similar to those in the analysis of robustness checks reported in Table A5 in Appendix B.Standard errors (clustered at the session level in column 1) are reported in parentheses. Significant at *10%, **5%, and ***1%.

Table 6: Impact of group composition on output by incentive (conditional estimates)

	Individual Output	Group Output
	(1)	(2)
(1) Socially Connected (β_1)	0.561*	1.172**
	(0.331)	(0.549)
(2) Bonus Incentive (β_2)	0.179	-0.104
	(0.300)	(0.372)
(3) Bonus Incentive x Socially Connected (β_3)	-0.590	-0.765
	(0.383)	(0.619)
(4) Constant	5.465***	6.378***
	(0.584)	(1.871)
Mean for Socially Unconnected	4.375	3.206
F tests [*p*-value]		
(5) *Impact of Social Connectedness conditional on Bonus Incentive* ($\beta_1 + \beta_3$)	-0.029	0.407
	[0.845]	[0.170]
(6)*Impact of Bonus relative to Piece Rate conditional on Social Conn.* ($\beta_2 + \beta_3$)	-0.411	-0.869
	[0.052]	[0.102]
Number of observations	268	67
Number of sessions	67	67
R^2	0.115	0.218

Note: as elucidated in Table 4 above. *p*-values of F tests is square brackets.

Table 7: Impact of group composition on coordination by incentive (conditional estimates)

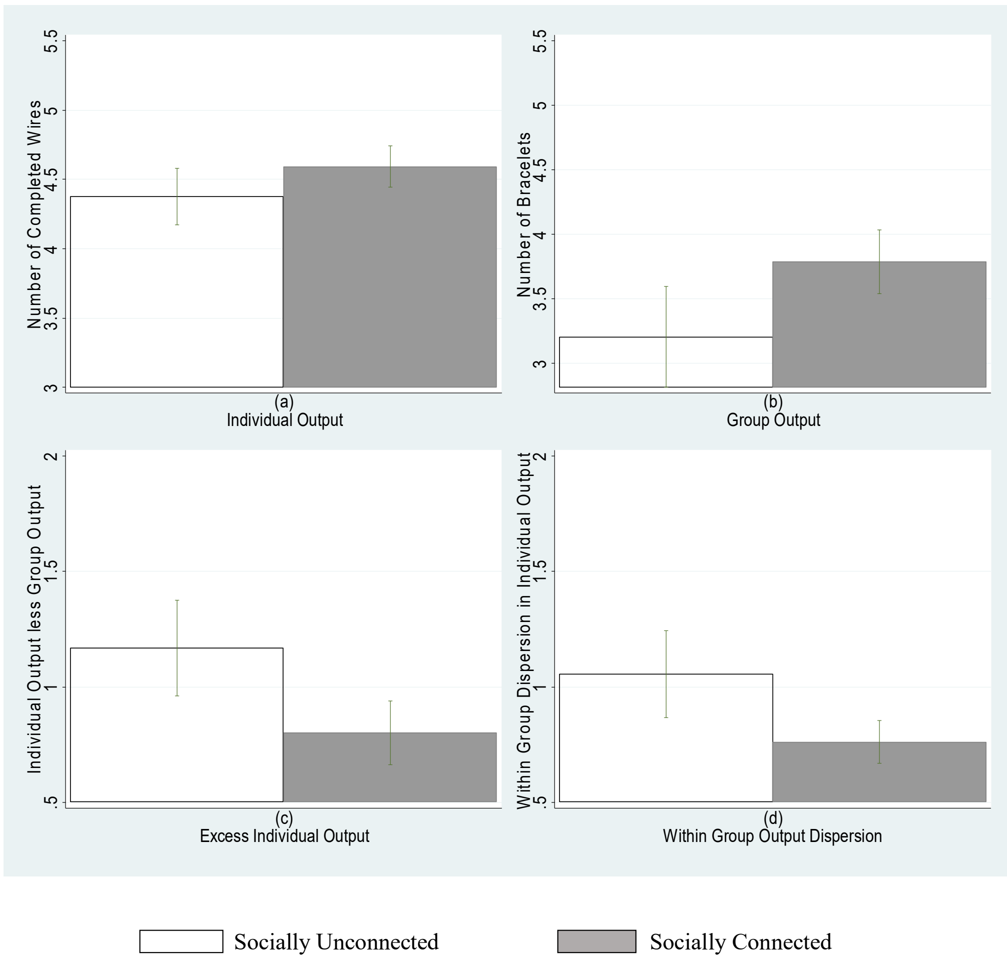
	Excess Individual Output	Within-Group Output Dispersion
	(1)	(2)
(1) Socially Connected (β_1)	-0.275	-0.359
	(0.319)	(0.265)
(2) Bonus Incentive (β_2)	0.210	-0.041
	(0.253)	(0.179)
(3) Bonus Incentive x Socially Connected (β_3)	-0.239	0.043
	(0.338)	(0.298)
(4) Constant	1.355**	1.741**
	(0.515)	(0.707)
Mean for Socially Unconnected	1.169	1.056
F-tests [*p*-value]		
(5) *Impact of Social Connectedness conditional on Bonus Incentive* ($\beta_1 + \beta_3$)	-0.515	-0.316
	[0.002]	[0.029]
(6) *Impact of Bonus relative to Piece Rate conditional on Social Conn.* ($\beta_2 + \beta_3$)	-0.029	0.002
	[0.901]	[0.993]
Number of observations	268	67
Number of sessions	67	67
R^2	0.089	0.132

Note: as elucidated in Table 5 above. *p*-values of F tests in square brackets.

Figure 1: Caste connections and efficiency in garment manufacturing

Note: Fig. 1(a) shows worker level efficiency for 34,641 worker days; Fig. 1(b) shows the minimum worker efficiency in an assembly line on a production day for 1043 line days. Own caste proportion = Number of workers belonging to own caste category/ Total number of workers in the line on a day. Caste concentration index=$\sum c_i^2$, i.e. the sum of squared share of each caste group (L, M, or H) among the workers in an assembly line on a day. Linear fit depicted in both figures. The sample consists of 1744 workers in 37 assembly lines in two garment factories. Worker level production data obtained for September-October 2015 from factory records and caste data collected through a census survey of workers during August-October 2015.

Figure 2: Output and coordination by group composition



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APPENDIX A

Proof of Claim

We use two lemmas to prove Claim

We show the equilibria in the unconnected game in the following lemma:

Lemma 1 *(1) Assume that* $D > \frac{c}{a}$*. There are two pure strategy equilibria -* $(\bar{e}, \bar{e})$ *and* $(\underline{e}, \underline{e})$*. Worker i prefers to play* $\bar{e}$ *iff the opponent has a probability* $p_j \geq \underline{p}^U = \frac{c}{Da}$ *of playing* $\bar{e}$*. If* $\frac{c}{a} < \frac{D}{2}$*, then the high effort equilibrium is risk dominant. Moreover as the piece rate, D increases, the probability of playing the high effort equilibrium increases. (2) Assume that* $D < \frac{c}{a}$*, then, there is a unique low effort equilibrium in this game.*

Proof (1) It is easy to see from the game that there are two pure strategy equilibria. Worker i strictly prefers to play $\bar{e}$ iff $D(p_j\bar{e} + (1-p_j)\underline{e}) - \frac{c\bar{e}}{a} > (D - \frac{c}{a})\underline{e}$. This is true iff $p_j \geq \underline{p}^U = \frac{c}{Da}$. Risk dominance requires $\underline{p}^U < \frac{1}{2}$ and this is the case iff $\frac{c}{Da} < \frac{1}{2}$, or $\frac{c}{a} < \frac{D}{2}$. $\frac{\partial \underline{p}^U}{\partial D} = -\underline{p}^U \frac{1}{D^2}$, so as piece rates increase, $\underline{p}^U$ decreases. (2) Assume that the opponent is playing $\bar{e}$. If $D < \frac{c}{a}$, then playing $\bar{e}$ gives a payoff of $(D - \frac{c}{a})\bar{e} < 0$ while playing $\underline{e}$ gives a payoff of $(D - \frac{c}{a})\underline{e} > (D - \frac{c}{a})\bar{e}$. Suppose the opponent plays $\underline{e}$ then playing $\underline{e}$ gives a payoff of $(D - \frac{c}{a})\underline{e}$ while deviating to $\bar{e}$ gives a payoff of $D\underline{e} - \frac{c}{a}\bar{e} < (D - \frac{c}{a})\underline{e}$.

■

We now show the equilibria in the connected game:

Lemma 2 *(1a) Assume that* $D + G > \frac{c}{a} > G$*. There are two pure strategy equilibria -* $(\bar{e}, \bar{e})$ *and* $(\underline{e}, \underline{e})$*. Worker i strictly prefers to play* $\bar{e}$ *when the opponent has a probability at least* $\underline{p}^C = \frac{1}{D}(\frac{c}{a} - G) > 0$ *of playing* $\bar{e}$*. Moreover* $\frac{\partial \underline{p}^C}{\partial D} < 0$*. As financial incentives increase, the probability of reaching the high effort equilibrium increases. (1b) Assume that* $G > \frac{c}{a}$*. Then there is a unique high effort equilibrium. (1c) If* $\frac{D}{2} + G \geq \frac{c}{a}$*, the high effort equilibrium is risk dominant.*

(2) Assume that $D + G < \frac{c}{a}$*, then there is a unique low effort equilibrium in this game.*

Proof (1a) It is easy to check that there are two pure strategy Nash equilibria. For the high effort equilibrium to be played by i, beliefs on high effort, p_j must satisfy: $D(p_j\bar{e} + (1-p_j)\underline{e}) - (\frac{c}{a} - G)\bar{e} > (D + G - \frac{c}{a})\underline{e}$. This is true iff $p_j \geq \underline{p}^C = \frac{c}{Da} - \frac{G}{D}$. Moreover, $\frac{\partial \underline{p}^C}{\partial D} = -\underline{p}^C \frac{1}{D^2} < 0$.

(1b) is obvious.

The high effort equilibrium is risk dominant iff $\underline{p}^C \leq \frac{1}{2}$, i.e. iff $\frac{D}{2} + G \geq \frac{c}{a}$.

(2) We show first that there is no high effort equilibrium. Assume that the opponent plays $\bar{e}$ then the payoff from $\bar{e}$ is $(D + G - \frac{c}{a})\bar{e}$, while the payoff from $\underline{e}$ is higher

at $(D+G-\frac{c}{a})\underline{e}$. The low effort equilibrium exists if $D\underline{e}+(G-\frac{c}{a})\underline{e} > D\underline{e}+(G-\frac{c}{a})\bar{e}$, i.e. $\frac{c}{a} > G$, which is satisfied whenever $\frac{c}{a} > D+G$.

■

The proof of Claim parts 1-3 follows from the two lemmas: For part (4) when $\frac{D}{2}+G < \frac{c}{a}$ then both connected and unconnected groups have a unique low effort risk dominant equilibrium. With the bonus B if $\frac{D+B}{2}+G > \frac{c}{a} > \frac{D+B}{2}$, the connected group has a unique high effort risk dominant equilibrium while the unconnected group has a unique low effort risk dominant equilibrium. Finally, if $\frac{D+B}{2} > \frac{c}{a}$, then both connected and unconnected groups have a unique high effort risk dominant equilibrium.

With a bonus $p^U = \frac{c}{a}\frac{(\bar{e}-\underline{e})}{D(\bar{e}-\underline{e})+B\bar{e}} < p^C = \frac{(\bar{e}-\underline{e})}{D(\bar{e}-\underline{e})+B\bar{e}}(\frac{c}{a}-G)$. It can be seen from this expression that coordination is higher with bonus relative to piece rate. Moreover, the bonus has a larger effect on coordination in the connected group than the unconnected group conditional on the high effort equilibrium being played after the bonus is introduced.

■

Extensions To analyze the discrete bonus scheme we look at a simple example with three effort levels to demonstrate how the bonus affects incentives. Suppose there are three effort levels $e \in (0, \underline{e}, \bar{e})$. Below we demonstrate the result for an unconnected group.

	$\bar{e}$	$\underline{e}$	0
$\bar{e}$	$D\bar{e}-\frac{c}{a}\bar{e}, D\bar{e}-\frac{c}{a}\bar{e}$	$D\underline{e}-\frac{c}{a}\bar{e}, D\underline{e}-\frac{c}{a}\underline{e}$	$-\frac{c}{a}\bar{e}, 0$
$\underline{e}$	$D\underline{e}-\frac{c}{a}\underline{e}, D\underline{e}-\frac{c}{a}\bar{e}$	$D\underline{e}-\frac{c}{a}\underline{e}, D\underline{e}-\frac{c}{a}\underline{e}$	$-\frac{c}{a}\underline{e}, 0$
0	$0, -\frac{c}{a}\bar{e}$	$0, -\frac{c}{a}\underline{e}$	$0, 0$

Suppose $D < \frac{c}{a}$. Then there is a unique equilibrium at $0, 0$. Now suppose a discrete bonus is introduced such that workers get payoffs $DY - \frac{c}{a}e$ for $e < \underline{e}$ and $DY + B - \frac{c}{a}e$ for $e \geq \underline{e}$. Assume that the bonus is sufficiently big so that $De + B \geq \frac{c}{a}e$. The payoffs change as follows:

	$\bar{e}$	$\underline{e}$	0
$\bar{e}$	$D\bar{e}+B-\frac{c}{a}\bar{e}, D\bar{e}+B-\frac{c}{a}\bar{e}$	$D\underline{e}+B-\frac{c}{a}\bar{e}, D\underline{e}+B-\frac{c}{a}\underline{e}$	$-\frac{c}{a}\bar{e}, 0$
$\underline{e}$	$D\underline{e}+B-\frac{c}{a}\underline{e}, D\underline{e}+B-\frac{c}{a}\bar{e}$	$D\underline{e}+B-\frac{c}{a}\underline{e}, D\underline{e}+B-\frac{c}{a}\underline{e}$	$-\frac{c}{a}\underline{e}, 0$
0	$0, -\frac{c}{a}\bar{e}$	$0, -\frac{c}{a}\underline{e}$	$0, 0$

While the zero effort equilibrium still exists, now there is another pure strategy equilibrium at $\underline{e}, \underline{e}$. However, notice that the higher effort level is not an equilibrium, regardless of the size of the bonus, since $D\bar{e}+B-\frac{c}{a}\bar{e} < D\underline{e}+B-\frac{c}{a}\underline{e}$.

Conditional on these parameter values, the effect of the bonus is therefore to create a higher effort equilibrium at the target level.

On the other hand, if $D > \frac{c}{a}$ then there are three pure strategy equilibria and different groups may be coordinating on different equilibria. In this case the bonus does not change the set of pure strategy equilibria. In addition, in the case $D > \frac{c}{a}$, recall that connected groups are also more likely to coordinate on the higher effort equilibrium due to their beliefs ($\underline{p}^C < \underline{p}^U$ when there are two effort levels).

This analysis suggests that if the payoffs were such that the target level of output was not an equilibrium, the bonus (if it is large enough) creates another equilibrium at the target level of production. However, if the payoffs were such that all three effort levels were equilibria to begin with, the bonus has no effect on the set of equilibria. On the other hand, if $D > \frac{c}{a}$ then there are three pure strategy equilibria and different groups may be coordinating on different equilibria. In this case the bonus does not change the set of pure strategy equilibria. If $D + G \geq \frac{c}{a} > D$ then the set of equilibria for connected groups does not change with the bonus while it may change the set of equilibria for unconnected groups for a large enough bonus. If $D \geq \frac{c}{a}$ then the set of equilibria does not change with the bonus for both connected and unconnected groups. Overall therefore, we predict that for a large range of parameters, output either increases or stays the same relative to piece rates and it is more likely to increase for connected groups.

Extending the result to many players and a continuum of effort levels is more complicated. However, it is well known that the risk dominant equilibrium in a 2X2 game coincides with the one that maximizes the "potential" of the game (Young (1993)). Andersen, Goeree and Holt (2001) generalised the concept of risk dominance for games with more than 2 players and more than two effort (but finite) levels. They use the idea of potential games adapted to the minimum effort game (Monderer and Shapley (1996)), but add some noise in players' behaviour. They show that the resulting refinement of Nash equilibrium - the "logit equilibrium" for the minimum effort game is unique and symmetric and maximizes the stochastic potential of a game. Chen and Chen (2011) further adapt the concept of a stochastic potential game to study a minimum effort game where players can be "in group", "neutral" or "outgroup". The adapted minimum effort game with a continuum of effort levels and $n > 1$ players is a potential game according to the Monderer and Shapley (1996) definition and has the potential function shown in equation (5) of Chen and Chen (2011) and reproduced below. Let $e_j \geq 0$ denote worker j's effort in the group:

$$P(e_1, e_2, ..., e_n) = D\min(e_1, e_2, ..., e_n) - \frac{c}{a}\sum_{1}^{n}(1 - G)e_i \tag{3}$$

where $G > 0$ denotes the level of altruism in the group according to Chen and Chen (2011). They assume that the in-group has a higher G than the neutral group which has a higher G than the outgroup. $D > 0$ represents any incentive payments as before. We can use the unique potential maximizing equilibrium as our prediction for the case of many effort levels, our predictions would be the same as Chen and Chen (2011). However we interpret G as being higher when people are socially connected, rather than having the same identity - denoting G^C as the parameter for a connected group and G^U for an unconnected group we assume that $G^C > G^U$. We would get qualitatively the same results with an alternative utility function used in Chen and Chen (2011) - players utility is a convex combination of own and other's payoffs with weights, $\alpha > 0$ on the other player's payoff. Thus $U_i = DY - \frac{c}{a}(\alpha e_j + (1-\alpha)e_i)$. The higher is α the greater the degree of altruism or pro-social motivation towards the other player in the connected group. Our Claim then follows from Chen and Chen (2011).

APPENDIX B

Table A1: Caste composition, worker and assembly line productivity

	Worker efficiency			Line efficiency		
	(1)	(2)	(3)	(4)	(5)	(6)
Own caste proportion	0.103**	0.103**	0.095**			
	(0.047)	(0.046)	(0.045)			
Caste concentration index				0.113**	0.121***	0.158**
				(0.045)	(0.028)	(0.042)
Constant	0.276***	0.259***	0.328***	0.214*	0.232**	0.163*
	(0.018)	(0.075)	(0.071)	(0.123)	(0.103)	(0.085)
Number of observations	34,641	34,641	34,641	1043	1043	1043
R^2	0.550	0.550	0.555	0.484	0.588	0.700
Individual FE	√	√	√			
Factory floor FE		√			√	
Assembly line FE			√			√

Note: In columns 1-3, Worker efficiency = Daily output/Daily target where target varies by style operation for each worker. Own caste proportion = Number of workers belonging to own caste category/ Total number of workers in the line on a day. In columns 4-6, Line efficiency is minimum of efficiency of workers sitting in line l on day d. Caste concentration index=$\sum c_i^2$, i.e. the sum of squared share of each caste (c) group (L, M, or H) among the workers in an assembly line on a day. The dependent variable in columns 1-3 is worker productivity on a day in a line (in person days). Controls in column 1 include worker characteristics such as age, gender, native state, education and experience. In columns 4-6 the dependent variable is the minimum of worker efficiency in a production line on a production day (in line days). Line level characteristics such as average age, proportion of females, proportion of Hindus, proportion of married works and average experience are controlled for. The average worker efficiency is 0.32 and the average minimum line efficiency is 0.05. Data collected by the authors on daily worker productivity and worker characteristics for 1744 workers in 37 assembly lines in 2 garment factories in NCR, Delhi from August-October 2015. Standard errors clustered at assembly line level in parentheses. Significant at *10%, **5%, and ***1%.

Table A2: Average productivity by caste

	Factory data		Experiment data	
	Number of worker days	Efficiency	Number of subjects in socially unconnected group	Number of completed wires
All	1744	0.312 (0.005)	136	4.375 (0.104)
L	384	0.308 (0.010)	30	4.300 (0.215)
M	543	0.300 (0.009)	60	4.550 (0.131)
H	817	0.321 (0.007)	46	4.196 (0.212)

Note: 34,641 person days map into 1744 workers in our factory data. No significant differences (at 5% level of significance) are found in average efficiency of workers by caste. The *p*-values of all pair-wise differences range from 0.06 to 0.58 in the factory data and 0.14 to 0.74 in the experiment data.

Table A3: Summary statistics by financial incentive

Characteristics	Piece Rate	Bonus with Gain Framing	Bonus with Loss Framing
	[N=64]	[N=100]	[N=104]
	(1)	(2)	(3)
Age (years)	28.44	28.86	28.67
	(0.846)	(0.654)	(0.701)
Hindu	0.78	0.88	0.96
	(0.052)	(0.033)	(0.019)
Married	0.69	0.75	0.71
	(0.058)	(0.043)	(0.045)
Competed high school or more	0.20	0.27	0.34
	(0.051)	(0.045)	(0.047)
Migrant from Bihar	0.66	0.69	0.60
	(0.060)	(0.046)	(0.048)
Currently employed	0.97	0.99	0.96
	(0.022)	(0.010)	(0.019)
No. of beaded wires	4.53	4.46	4.47
	(0.157)	(0.105)	(0.092)
Found task easy	0.72	0.72	0.66
	(0.057)	(0.045)	(0.047)
Knew at least one team member by name	0.42	0.44	0.50
	(0.062)	(0.050)	(0.049)
Number of co-workers known by name	0.77	0.96	1.17
	(0.129)	(0.125)	(0.129)
Caste dispersion in a session	0.93	0.76	0.78
	(0.052)	(0.055)	(0.054)

Note: Standard errors are reported in parentheses.

Table A4: Effect of group composition on output with additional controls

	Individual Output	Group Output
	(1)	(2)
Socially Connected	0.117	0.585**
	(0.129)	(0.263)
Bonus incentive	-0.046	-0.315
	(0.193)	(0.354)
Age	-0.038***	-0.04
	(0.012)	(0.043)
Married	0.098	0.092
	(0.171)	(0.653)
Hindu	-0.444	-1.229**
	(0.291)	(0.542)
Currently employed	0.025	-0.238
	(0.484)	(1.404)
Primary education complete	0.278	-0.617
	(0.169)	(0.693)
Migrant from Bihar	0.277**	0.478
	(0.128)	(0.367)
Done similar task earlier	-0.414	-0.912
	(0.262)	(0.588)
June	0.000	0.000
	(.)	(.)
July	-0.124	-0.203
	(0.149)	(0.282)
H type	-0.380	-1.089
	(0.236)	(0.692)
M type	0.098	-0.241
	(0.185)	(0.552)
Constant	5.777***	6.296***
	(0.615)	(1.982)
Number of observations	268	67
Number of sessions	67	67
R^2	0.122	0.233

Note: Standard errors (clustered at the session level in column 1) are reported in parentheses. Significant at *10%, **5%, and ***1%.

Table A5: Effect of group composition on coordination with additional controls

	Excess Individual Output	Within-Group Output Dispersion
	(1)	(2)
Socially Connected	-0.462***	-0.329***
	(0.156)	(0.123)
Bonus incentive	0.053	-0.008
	(0.207)	(0.166)
Age	-0.030***	-0.124
	(0.010)	(0.305)
Married	0.148	-0.124
	(0.166)	(0.305)
Hindu	0.145	0.288
	(0.274)	(0.254)
Currently employed	0.047	-0.028
	(0.476)	(0.656)
Primary education complete	0.462**	0.201
	(0.192)	(0.324)
Migrant from Bihar	0.091	-0.095
	(0.163)	(0.171)
Done similar task earlier	-0.077	0.580**
	(0.233)	(0.275)
June	0.000	0.000
	(.)	(.)
July	0.098	0.059
	(0.160)	(0.132)
H type	-0.019	0.198
	(0.198)	(0.324)
M type	0.151	0.145
	(0.168)	(0.258)
Constant	1.506***	0.572
	(0.525)	(0.927)
Number of observations	268	67
Number of sessions	67	67
R^2	0.092	0.198

Note: Standard errors (clustered at the session level in column 1) are reported in parentheses. Significant at *10%, **5%, and ***1%.

Table A6: Impact of group composition on effort and co-ordination conditional on caste

	Individual Output	Group Output	Excess Individual Effort	Within-Group Output Dispersion
	(1)	(2)	(3)	(4)
Socially Connected (α_1)	0.445*	0.004	-0.403*	0.650
	(0.247)	(1.260)	(0.222)	(0.589)
H type (α_2)	-0.219	-3.178*	-0.006	1.874**
	(0.325)	(1.826)	(0.251)	(0.854)
M type (α_3)	0.166	-0.005	0.164	0.842
	(0.240)	(1.492)	(0.248)	(0.698)
H type x Socially Connected (α_4)	-0.568	2.115	-0.0435	-1.804**
	(0.460)	(1.865)	(0.328)	(0.872)
M type x Socially Connected (α_5)	-0.294	-0.272	-0.0719	-0.806
	(0.278)	(1.602)	(0.285)	(0.749)
Constant	5.596***	7.283***	1.392**	-0.489
	(0.628)	(2.323)	(0.534)	(1.087)
Effect of caste conditional on social connectedness:				
L type (α_1)	0.445*	0.004	-0.403*	0.650
	(0.247)	(1.260)	(0.222)	(0.589)
M type ($\alpha_1 + \alpha_5$)	0.151	-0.268	-0.474**	-0.156
	(0.160)	(0.724)	(0.230)	(0.339)
H type ($\alpha_1 + \alpha_4$)	-0.123	2.120**	-0.446*	-1.154**
	(0.355)	(1.022)	(0.246)	(0.478)
Number of observations	268	67	268	67
Number of sessions	67	67	67	67
R^2	0.109	0.231	0.087	0.195

Notes: Controls include age, dummy for Hindu, primary schooling complete, native state is Bihar, and currently employed. Standard errors clustered at session level in parenthesis, except when the unit of analysis is the group. Significant at *10%, **5% and ***1%.

Table A7: Impact of group composition on output by incentive (conditional estimates)

	Relative to less than 5 output in Piece Rate		Relative to 5 or more output in Piece Rate	
	Individual Output	**Group Output**	**Individual Output**	**Group Output**
	(1)	(2)	(3)	(4)
Socially Connected (β_1)	0.420	1.035*	-0.208	0.365
	(0.408)	(0.570)	(0.189)	(1.217)
Bonus Incentive (β_2)	1.165***	0.111	-0.894***	-1.736*
	(0.394)	(0.383)	(0.147)	(0.874)
Bonus Incentive x Socially Connected (β_3)	-0.431	-0.621	0.227	0.049
	(0.456)	(0.637)	(0.259)	(1.238)
Constant	4.519***	6.262***	6.569***	8.062***
	(0.530)	(1.825)	(0.591)	(2.099)
F tests [*p*-value]				
Impact of Social Connectedness conditional on Bonus Incentive ($\beta_1 + \beta_3$)	[0.937]	[0.156]	[0.898]	[0.140]
Impact of Bonus relative to Piece Rate conditional on Social Conn. ($\beta_2 + \beta_3$)	[0.000]	[0.352]	[0.002]	[0.046]
All controls	Yes	Yes	Yes	Yes
Number of observations	230	64	242	54
R^2	0.216	0.207	0.205	0.315

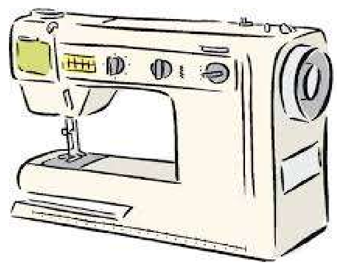
Note: as elucidated in Table 4. *p*-values of F tests in square brackets. In column 1 (column 3) we drop *individuals* who produced 5 or more (less than 5) beaded wires under Piece Rate from the sample. In column 2 (column 4) we drop *groups* that produced 5 or more (less than 5) bracelets under Piece Rate from the sample. Standard errors clustered at the session level are reported in parentheses (except in columns 2 and 4 where the unit of analysis is the group). Significant at *10%, **5%, and ***1%.

Table A8: Impact of group composition on output by incentive (conditional estimates)

	Individual Output	Group Output
	(1)	(2)
Socially Connected (β_1)	0.553	1.123**
	(0.333)	(0.555)
Bonus (Gain Framing) (β_2)	-0.004	-0.361
	(0.322)	(0.421)
Bonus (Gain Framing) x Socially Connected (β_3)	-0.335	-0.458
	(0.409)	(0.675)
Bonus (Loss Framing) (β_4)	0.360	0.154
	(0.318)	(0.421)
Bonus (Loss Framing) x Socially Connected (β_5)	-0.822**	-0.991
	(0.404)	(0.681)
Constant	5.522***	6.357***
	(0.592)	(1.902)
F tests [*p*-value]		
Impact of Social Connectedness conditional on framing:		
Conditional on gain framing (β_1+ β_3)	[0.298]	[0.101]
Conditional on loss framing (β_1+ β_5)	[0.150]	[0.738]
Impact of Bonus framing relative to Piece Rate :		
Impact of gain framing conditional on Soc. Con. (β_2+ β_3)	[0.160]	[0.141]
Impact of loss framing conditional on Soc. Con. (β_4+ β_5)	[0.037]	[0.151]
Number of observations	268	67
Number of sessions	67	67
R^2	0.127	0.242

Note: as elucidated in Table 4. *p*-values of F tests in square bracket.

Figure A1: Recruitment advertisement



ATTENTION!!!

OPERATORS/ TAILORS/HELPERS/PRESSMEN!!!

Garment factory operators, helpers and pressmen volunteers are required for a training-cum-research project. Participants will receive Rs.200 as show-up payment and can earn between Rs. 500-1000 in 30 to 45 minutes on the spot. Please register yourself by calling on following numbers:

9205369718

8800254317

Figure A2: A finished bracelet

APPENDIX C

EXPERIMENT INSTRUCTION MANUAL

I. **Setting of the "lab"**

The lab consists of 4 work stations, numbered 1-4 from the extreme left of the room. In each work station there is a covered bowl of beads of a single color (white, red, green or blue) and a bundle of wires. Each bundle consists of 10 wires, each 20 cms. in length and with one end twisted. All wires are of the same color (or distribution of colors) across work stations. Works stations are separated by curtains.

4 workers of the same sex in each session.

Before the 4 workers enter the 'lab' they are randomly handed an ID number between 1 to 4 (in a folded piece of paper) by the experimenter at the door. The worker takes this into the lab, opens the paper and shows it to the experimenter inside the lab. The experimenter seats the worker in the assigned work station. (Note: There is a fixed mapping of IDs to bead colors: 1=red, 2=green, 3=blue, 4=white).

II. Experimental Instructions:

(Notes for experimenters: Once the workers are seated by their ID numbers, ask the workers to keep the ID numbers to themselves, and not to show it to others. Go over the instructions and answer questions when everyone can see everyone else (DO NOT DRAW CURTAINS UNTIL EXPERIMENT BEGINS).

General Information:

Welcome! Today you are going to be a part of an experiment which will take approximately 30 minutes of your time. From now on and till the end of the experiment you are not allowed to communicate with each other. You are requested to switch off your mobile phones. You may raise your hand whenever you have a doubt.

When you entered this room you were given a number. This is your experiment ID. Do not share this ID number with your team mates.

You will be receiving Rs. 200 for coming here as a participation fees. You can earn more by performing a simple task in the experiment. You will individually receive the entire amount at the end of the experiment.

Description of the Task

Your team will be making strings for a bracelet that will look like this (show a sample bracelet). For making strings for this bracelet a box of beads and a bundle of wires have been placed in front of you. Please pay attention to what I am about to explain. As you can see this bracelet comprises of 4 colored breaded strings: red, green, blue and white. You have been given 20cm long wires which are twisted at the end. You are supposed to bead the wires fully from the non-twisted end. Wires will be counted for payment only if they are completely filled like this (show one sample). After filling up the wire, twist the upper part like this so that beads don't fall. (Demonstrate using one of the wires). You can make as many strings as you want by using the beads and wires that have been provided to you.

Each individual has been allotted beads of a different colour. You are required to be seated at the place alloted you for the entire experiment and work with your own box of beads and wires. We will separate you all by drawing the curtains lying at your sides so that you can't see each others' beads color and output.

You will get ten minutes to do the task. In the end you will be informed about the number of strings of each colour but not about which one of you made which color strings. After leaving the experiment room you may discuss each other's output if you wish.

Payoffs

(**PIECE RATE**)

We will collect the filled wires by coming to you after your ten minutes are over while you remain seated. **Please keep in mind that you are required only to fill the wires to prepare strings and not assemble them to make a bracelet.** As you can see, for assembling wires into a braclet we need completely filled four wires, one of each colour. Every team member will recieve Rs. 100 for each bracelet. Everyone will be paid according to the team output.

(**GIVE TABLE BELOW TO EACH SUBJECT**)

No. of bracelets by team	Individual payoff (plus Rs 200 for participation)
1	Rs. 100
2	Rs. 200
3	Rs. 300
4	Rs. 400
5	Rs. 500
6	Rs. 600
7	Rs. 700
…	…

Now, I am going to give you few examples to help you understand your team output and individual earnings: (EXPERIMENTER PLEASE PROVIDE EACH WORKER WITH A SHEET OF PAPER AND A PENCIL).

1. Suppose a team beaded 7 red, 7 green, 8 blue and 6 white coloured strings fully.Using these beaded wires we can prepare only 6 bracelets. Therefore, this team will get 100*6=Rs. 600.

2. Now suppose, in the same example, one of the green string is incomplete. Even now we can prepare 6 bracelets and therefore everyone will get 100*6=Rs. 600 rupees.

3. Continuing with the first example, now suppose, one of the white string is incomplete. In this case, only 5 bracelets can be made using strings produced by the team. Therefore, eveyone will recieve 100*5=Rs. 500

Based on these examples, I will now ask you two questions. Please write your answers on the sheet provided to you. If you haven't understood or don't understand anything then please raise your hand.

Payoff Quiz

(Experimenter, ask the participants to write down their answers to these questions, and then check on their answers. Explain the payoff rule again if there is confusion/misunderstanding.)

1. Suppose a team beaded 8 red, 9 green, 7 blue and 7 white strings fully. What is the team output in terms of number of bracelets and hence the individual earnings? (excluding the Rs. 200)

(Answer: 100*7=Rs. 700)

2. In the same example consider the situation wherein two blue strings are incomplete. In this case how, what is the team output in terms of number of bracelets and individual payoff? (excluding the Rs. 200)

(Answer: 100*5=Rs.500)

[THE FOLLOWING INSTRUCTIONS REPLACED ABOVE FOR…]

(**BONUS WITH GAIN FRAMING**)

Every team member will recieve Rs.100 for each bracelet. Everyone will be paid according to the team output.For example, if team output can prepare 1 bracelet then eveyone will recieve Rs.100 each, or, if team output is for 5(or more) braclets then everyone will receive Rs.150 as bonus which will be over and above Rs.500. In such case individual earnings will be Rs.500 for 5 bracelets plus Rs.150 as bonus i.e. everyone in the team will earn Rs.650....(discuss payoff table)

(**GIVE TABLE BELOW TO EACH SUBJECT**)

No. of bracelets by team	Individual payoff(plus Rs. 200 for participation)
1	Rs. 100
2	Rs. 200
3	Rs. 300
4	Rs. 400
5	Rs. 500+Rs. 150=Rs. 650
6	Rs. 600+Rs. 150 =Rs. 750
7	Rs. 700 +Rs.150 =Rs. 850
……	…..

[(AFTER discussing payoffs) Experimenter shows four tokens of Rs.150 each which the subjects will be given if they meet the threshold to collect the bonus. Don't put the tokens on their desk.]

Now, I am going to give you few examples to help you understand your team output and individual earnings: (EXPERIMENTER PLEASE PROVIDE EACH WORKER WITH A SHEET OF PAPER AND A PENCIL).

1. Suppose a team beaded 7 red, 7 green, 8 blue and 6 white strings fully. Using these we can prepare only 6 bracelets and therfore, everyone in the team will receive 100*6 rupees plus 150 rupees as bonus. So, in total every individual in the team will receive Rs. 750.

2. Now suppose, in the same example, one of the green string is incomplete. In this case also, team output can prepare 6 bracelets and therefore, everyone in the team will recieve 100*6=Rs. 600 plus Rs. 150 bonus. So, in total every team member receives Rs. 750.

3. Continuing with the first example, now suppose, one of the white string is incomplete. In this case, only 5 bracelets can be made using strings produced by the team. Therefore, eveyone will recieve 100*5=Rs. 500 plus Rs. 150 as bonus. So, in total every team member receives Rs. 650.

4. Continuing with the above example, now, consider a situation in which only 4 white strings are complete. Now only 4 bracelets can be prepared and thus everyone will get Rs. 400. In this case, no one will receive the bonus.

Based on these examples, I will now ask you two questions. Please write your answers on the sheet provided to you. If you haven't understood or don't understand anything then please raise your hands.

Payoff Quiz

(Experimenter, ask the participants to write down their answers to these questions, and then check on their answers. Explain the payoff rule again if there is confusion/misunderstanding.)

1. Suppose a team beaded 8 red, 9 green, 7 blue and 7 white strings fully. What is the team output in terms of number of bracelets and hence the individual earnings? (excluding participation payoff of Rs. 200)

(Ans: 100*7=Rs. 700 + Rs. 150 as bonus = Rs. 850)

2. In the same example consider the situation wherein two blue strings are incomplete. In this case how, what is the team output in terms of number of bracelets and individual payoff? (excluding participation payoff of Rs. 200)

(Ans: 100*4=Rs. 400. No bonus**)**

[THE FOLLOWING INSTRUCTIONS REPLACED ABOVE FOR…]

(BONUS WITH LOSS FRAMING)

Every team member will recieve Rs. 100 for each bracelet.Everyone will be paid according to the team output and you can earn extra Rs. 150. For instance, if a team output can produce 5 complete bracelets then everyone will receive Rs. 500 plus Rs. 150 as the extra payment. But if team output is for less than 5 bracelets then the extra amount of Rs. 150 will be taken away from every individual. For instance, if team output is sufficient for making only 4 bracelets then every team member will receive Rs. 400 and the extra amount of Rs. 150 will be taken back. Or, let's say if team output is enough for only 3 bracelets then each team member will receive Rs. 300 and the extra amount of Rs. 150 will be taken back......(discuss payoff table)

(**GIVE TABLE BELOW TO EACH SUBJECT**)

No. of bracelets by team	Individual payoff(plus Rs. 200 for participation)
7	Rs. 700+ Rs. 150 = Rs. 850
6	Rs. 600+ Rs. 150 = Rs. 750
5	Rs. 500+ Rs. 150 = Rs. 650
4	Rs. 400
3	Rs. 300
2	Rs. 200
1	Rs. 100

[(AFTER discussing payoffs) Experimenter puts four coupons with Rs. 150 in each work station which the subjects are asked to use for getting the extra Rs. 150.]

Now I will give you few examples to explain the calculation of the team output and individual earnings: (EXPERIMENTER PLEASE PROVIDE EACH WORKER WITH A SHEET OF PAPER AND A PENCIL).

1. Suppose a team beaded 7 red, 7 green, 8 blue and 6 white fully. Using these we can produce 6 complete bracelets. Therefore, everyone in the team will receive 100*6= Rs. 600 along with extra amount of Rs.150. So, in total every team member receives Rs. 750.

2. Now suppose, in the same example, one of the green string is incomplete. In this case also, team output can prepare 6 bracelets and therefore, everyone in the team will recieve 100*6=Rs. 600 along with extra amount of Rs.150. So, in total every team member receives Rs. 750.

3. Continuing with the first example, now suppose, one of the white string is incomplete. In this case, only 5 bracelets can be made using strings produced by the team. Therefore, eveyone will recieve 100*5=Rs. 500 along with extra amount of Rs. 150. So, in total every team member receives Rs. 650.

4 Continuing with the above example, now, consider a situation in which only 4 white strings are complete. Now only 4 bracelets can be prepared and thus everyone will get Rs. 400 and extra amount of Rs. 150 will be taken back.

Based on these examples, I will now ask you two questions. Please write your answers on the sheet provided to you. If you haven't understood or don't understand anything then please raise your hands.

Payoff Quiz

(Experimenter, ask the participants to write down their answers to these questions, and then check on their answers. Explain the payoff rule again if there is confusion/misunderstanding.)

1. Suppose a team beaded 8 red, 9 green, 7 blue and 7 white strings fully. What is the team output in terms of number of bracelets and hence the individual earnings? (excluding participation payoff of Rs.200)

(Ans: 100*7=Rs. 700 + Rs. 150 extra = Rs. 850)

2. In the same example consider the situation wherein two blue strings are incomplete. In this case how, what is the team output in terms of number of bracelets and individual payoff? (excluding participation payoff of Rs. 200)

(Ans: 100*4=Rs. 400. In this case, extra amount of Rs. 150 will be taken back)

Now, I am going to announce your name and residence. Please raise your hand as your name is announced. If there is any error in the information then please get it corrected. You are not allowed to talk to each other.

(Notes for experimenters: Verify the information with each participant, and then continue onto the following instructions.)

All of you will get two minutes as practice time. Please fill only one wire for practice purpose. This string will not be counted in the final output. In case you experience any difficulty then please raise your hand without talking to each other.

We will be drawing the curtains now. You may open the boxes after you have been separated by the curtains and start practicing. (Experimenter, take away the practiced strings in an opaque manila envelope, and start the experiment by announcing the following reminder.)

You will now be given 10 minutes to string as many wires as you can to determine the final output.

You are again reminded that you will receive Rs. 200 for participation plus Rs. 100 for each complete bracelet. Your individual earnings depend upon the minimum number of one coloured strings produced by your team member.

[GAIN FRAMING: Please remember- you will receive Rs 200 for participation plus Rs. 100 for each complete bracelet. Your individual earnings depend upon the minimum number of one coloured strings produced by your team member. If the team output is sufficient for preparing 5 or more than 5 bracelets then everyone will receive a bonus of Rs. 150 as well.]

[LOSS FRAMING: Please remember- you will receive Rs. 200 for participation plus Rs. 100 for each complete bracelet. Your individual earnings depend upon the minimum number of one coloured strings produced by your team member. If the team output is sufficient for preparing 5 or more than 5 bracelets then everyone will receive an extra amount of Rs. 150 as well, otherwise extra amount of Rs. 150 will be taken away]

START STOPWATCH (Visible to all subjects)

(When time is up, experimenter collects the strings in a big, opaque, manila envelope. Experimenter closes bead bowls and removes wires and bowls from each work station. KEEP THE MANILA ENVELOPE IN THE ROOM ON THE TABLE VISIBLE TO ALL SUBJECTS.)

ANNOUNCE THIS PROCESS TO SUBJECTS IN THE SESSION TO ENSURE THAT THEY KNOW THEIR PERFORMANCE IS BEING KEPT PRIVATE AND IN THE ROOM.

"Please remain seated as I come to your place one by one to collect the beaded wires in this opaque envelope. It will be kept on this table."

III. Post-experiment questionnaire

Before counting the team output we request you to answer this questionnaire. Please tick the appropriate answers. In case you need any help in filling out the questionnaire then please raise your hand.

Experimenter goes over each question and checks all questions have been answered. Collects all filled up questionnaires

EXPERIMENTER REMOVES CURTAINS

THEN the envelope is opened in front of the 4 workers and the experimenter combines them into bracelets in front of the four workers. The workers are told about the productivity of each color (so they know the minimum number of strings being made in the group and hence the payoff). However, they are NOT told who made how many.

Experimenter announces payment of Rs. X+ Rs. 200 for each worker.

[GAINS FRAMING: Workers are asked to collect their coupons for bonus payment, if applicable.]

[LOSS FRAMING: Workers are asked to return coupons or take their coupons for bonus payment, whichever is applicable.]

Payments are made to workers in an envelope. They sign receipt sheet as they go out.

APPENDIX D

POST-EXPERIMENT SURVEY

Date:__ __/ ____ /__ __ Session type: T1/T2/T3/T4 Session no. ☐☐

Your experiment ID ☐1 ☐2 ☐3 ☐4

1. **First name** ____________________________ **Title**________________________

2. Age(in yrs) ☐☐ 3.Gender ☐[0]Female ☐[1]Male

4. Marital Status ☐[1] Married ☐[2] Unmarried ☐[3] Divorced ☐[4] Widow/er
   ☐[9]Other(specify)_____________

5. Religion ☐[1]Hinduism ☐[2] Islam ☐[3] Christianity ☐[4] Sikhism
   ☐[9] Other(specify)_____________

6. Are you currently employed? ☐[0] No ☐[1] Yes

7. If yes, then, in which among the following?
   ☐[1]Garment factory employee ☐[2]Other factory employee (specify) _________
   ☐[3]self employed ☐[9]Other (specify)_______________

8. Current factory address: a. Factory name ________________________
   b. Plot number ________________________________
   c. Colony ________________________________

9. Literacy status: ☐[0]Illiterate ☐[1]5th std or less ☐[2]6th to 10th std
   ☐[3]11th to 12th std ☐[4]B.A./B.Sc./B.Com.
   ☐[5]M.A./M.Sc./M.Com ☐[6] Vocational Training

10. Native address: a. Village_______________ b. District________________________
    c. State_______________________________

11. Current address: a. House No.______ b. Street No.________________
    c. Colony___________________ d. City_____________________

12. Have you done beading beads into wire kind of task ever before?
    ☐[0] No ☐[1] Yes

13. Please rate today's task in terms of difficulty?
    ☐[1] Very easy ☐[2] Easy ☐[3]Neither easy nor difficult ☐[4] Difficult ☐[5]Very difficult

14. Do you know any members from your team by name?

☐[0] No ☐[1] Yes

15. If yes, then please write their names and answer the following questions:

S.no.	a. Name	b. How do you know this person? (Tick as many as applicable)	c. In your opinion, in 10 mins, how many strings would have been completed by this person?	d. In your opinion, has this person ever done beading work?
1		☐[1] Neighbour ☐[2] Co-worker ☐[3] Relative ☐[4] Friend ☐[5] Other______________		☐[0] No ☐[1] Yes ☐[9] Don't know
2		☐[1] Neighbour ☐[2] Co-worker ☐[3] Relative ☐[4] Friend ☐[5] Other ______________		☐[0] No ☐[1] Yes ☐[9] Don't know
3		☐[1] Neighbour ☐[2] Co-worker ☐[3] Relative ☐[4] Friend ☐[5] Other ______________		☐[0] No ☐[1] Yes ☐[9] Don't know

----

16. FOR EXPERIMENT INSTRUCTOR:

1. Is worker from our original sample? ☐[0] No ☐[1] Yes

2. If yes, note worker card no.

APPENDIX E

WOMEN ONLY AND MIXED-GENDER SESSIONS

In our study we also conducted 64 women only sessions (30 Socially Connected and 34 Socially Unconnected). The experiment design for the women only sessions was very similar to what is described in the Experimental Design section except the priming. In India's patriarchal society women are typically referred to using a generic last name of *Devi* or *Kumari* (i.e. lady or girl) which would not signify their *jati* to other group members. Since caste is determined by birth and inter-caste marriages are virtually non-existent even today, in all female sessions after we announced a woman's first and generic last name we also mentioned the first and last name of the man whose wife or daughter she was, followed by her residential address. Thus, in all sessions the main experimenter followed a prepared script and said the following: "Now I will announce your name and your residential address. As I call out your names please raise your hand. If there is any error in the announcement, please tell us." In all the male (female) sessions the main experimenter announced the following: "NAME (wife/daughter of FIRST NAME, LAST NAME) and resident of...".

Table A9, corresponding to Tables 4 and 5 in the main text, reports the results for women only sessions. We do not find any significant effects of social connections on womens output or coordination. Our priming for women is indirect (it is through announcing her husbands or fathers name) and hence may not be salient enough to activate her social connection. This may have been confounded by the ceiling effect-women produced significantly higher output than men in our experiment task.

We also conducted an additional experiment of 30 *mixed-gender sessions* (15 sessions for Socially Connected and 15 for Socially Unconnected) under *piece rate* in March 2017 with different subjects from the same population. Each mixed-gender session consisted of 2 men and 2 women. When we pool the observations of women in this additional experiment with the data from the 14 *all-women* sessions with Piece Rate in the main experiment we find that in the Socially Unconnected treatment, men's individual output is marginally higher in the mixed-gender groups than in the all-men groups. This difference in men's performance between the mixed-gender and the all-men groups, however, disappears in the Socially Connected treatment. Wilcoxon rank-sum tests for the group-level outcomes between the pure and mixed-gender sessions for men and women separately are consistent with the individual-level results discussed in Tables 4 and 5 in the main text (results are available on request). Due to restrictions on womens mobility in India, its logistically challenging to conduct gender mixed sessions. So while our results for the mixed-gender sessions may be underpowered due to the small sample size the findings are qualitatively consistent with the pure gender sessions.

Table A9: Impact of group composition on output (unconditional estimates)

	Women' Output		Women's Coordination	
	Individual Output	Group Output	Excess Individual Output	Within-Group Output Dispersion
	(1)	(2)	(3)	(4)
Socially Connected (α_1)	0.054	0.034	0.235	-0.048
	(0.159)	(0.348)	(0.236)	(0.172)
Bonus Incentive (α_2)	-0.121	-0.211	0.194	-0.045
	(0.173)	(0.397)	(0.294)	(0.196)
Constant	6.898***	7.598***	0.195	0.410
	(0.448)	(1.804)	(0.582)	(0.893)
Mean for Socially Unconnected	5.162	3.912	1.250	1.132
Number of observations	256	64	256	64
Number of sessions	64	64	64	64
R^2	0.114	0.210	0.084	0.129

Note: In columns 1 and 3, the dependent variable is *individual* output (number of completed wires made by a subject) and excess *individual* output (number of completed wires made by subject less the number of bracelets made by the group). In columns 2 and 4, the dependent variable is *group* output defined as the number of bracelets (i.e., the minimum number of completed wires) and the dispersion in the number of completed wires made by subjects in a group. 'Bonus Incentive' is a dummy that equals 1if the bonus was offered to the group and 0 if the incentive was piece rate. Other control variables include age, Hindu, dummy for H type, dummy for M type, and dummies for primary schooling complete, native state Bihar and currently employed. The estimates are robust to additional controls reported in Tables A3 and A4. Standard errors clustered at the session level are reported in parentheses (except in columns 2 and 4 where the unit of analysis is the group). Significant at *10%, **5%, and ***1%.