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IZA DP No. 17852

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ABSTRACT

Informal Labor Exchange Teams and Participation in the Labor Market: Evidence from Rural Tanzania*

We investigate labor exchange teams in rural communities, which are prevalent in many developing countries. We show theoretically that these teams are beneficial to employers, who can outsource the monitoring of workers. Team members are incentivized to exert high effort because any deviation would lead to the dissolution of their production team. Data from Tanzania support the model's predictions: members of labor exchange teams are more likely to obtain paid work and are often hired to perform tasks for which monitoring is costly. Consequently, this informal arrangement helps reduce moral hazard in the context of employment relationships.

JEL Classification: D86, J43, J46, L14

Keywords: relational contracts, labor exchange, labor market, information asymmetries, Tanzania

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1 Introduction

Labor markets are inherently incomplete. Employers face the challenge of finding the right employees and motivating them to perform accordingly. While these problems are pervasive, they are exacerbated in the rural economies that characterize poor countries, in which financial frictions, seasonality and the limited scaling of production processes lead to strong fluctuations in the demand for labor. As a result, the benefits of long-term employment relationships in managing these frictions – by decreasing search and incentive costs – often cannot be realized. Instead, we investigate whether long-term *personal* interactions among community members, which have been successfully used to mitigate credit and insurance market imperfections in remote areas, can also improve the efficiency of rural labor markets.[1]

In this paper, we demonstrate that informal long-term arrangements in which community members help each other with their own farm production, which are known as *labor exchange teams*, improve members' attractiveness on the labor market. In the villages of our study, some women (and only women) engage in labor exchange. We observe that individuals who are part of such a team are more likely to be hired when paid labor is available compared to women who are not part of a team. This finding, however, holds only if they are hired as a team as opposed to individually, and it is particularly pronounced for tasks that are costly for the employer to monitor.

We propose a theoretical explanation that is rooted in the claim that forming a team is beneficial with respect to individuals' own farm production. Members help each other, and cooperation is enforced by an informal relational contract. Importantly, we suggest that membership in such a team can also alter the employment relationship when team members are hired to perform paid labor. In this case, team members can collectively agree that any member who exhibits a low level of effort on the job will be penalized by suspending cooperation within the labor exchange team. This increased penalty for low effort strengthens the employer's incentives for the team, thereby encouraging greater

[1] Besley (1995); Coate & Ravallion (1993); Ligon et al. (2002); Besley et al. (1993)

effort on the part of team members. As a result, employers find it more appealing to hire these teams, especially when monitoring is expensive. Therefore, ongoing interactions among team members in support of their own farm production serve as a substitute for long-term employment relationships.

More precisely, we analyze an infinitely repeated game in which two agents engage in their own farm production and can achieve efficiency gains by helping each other. Cooperation requires a self-enforcing agreement between them, which is maintained by the threat of dissolving the team in cases of deviation. Since workers are risk averse, individuals with less wealth have more to lose from such deviation and are therefore more likely to be included in such an agreement ("team"). Each period, agents may also receive employment offers, thus allowing them to earn a market wage, and they must decide how much effort to exert. Greater effort increases the likelihood of high-value output for the employer (principal). The employer faces two decisions: the level of monitoring and whether to hire individuals or groups.

The employer can choose limited monitoring, in which only the output value is observed, or extensive monitoring, which is costlier but allows effort to be observed directly. Workers are incentivized by punishments for nonperformance, which is defined as low-value output under conditions of limited monitoring or low levels of effort under conditions of extensive monitoring.

In the context of hiring, the employer can choose to hire individuals or a team. Under limited monitoring, hiring a team proves to be beneficial, as team members can monitor each other's effort. Teams can form side agreements to exert higher levels of effort than they would individually, thus benefitting both the team – by internalizing the positive impact of one member's effort on another's utility – and the employer. This agreement is enforceable because deviations not only increase the risk of employer-imposed penalties but also lead to the dissolution of the team for own farm production. This additional punishment encourages higher levels of effort on the part of the agents, thus leading to increased profits for the employer.

We derive predictions from this model, which we test using data collected from 300

households in several rural villages in northwest Tanzania. Data were collected from both women and employers. The sample was designed to ensure that half of the women were part of a labor exchange team. We first established a baseline at the beginning of the agricultural season and subsequently interviewed the respondents every week for eight consecutive weeks. This approach allowed us to obtain precise information regarding their farming activities, including individual farm production, team production or transactions in the agricultural labor market. We find that the predictions of the model are verified by the data: women from lower socioeconomic backgrounds, i.e., those who are from a less affluent environment, are more likely to participate in labor exchange teams. Moreover, being a member of such a team provides women with additional opportunities to obtain paid employment, especially in the context of tasks for which effort is more difficult to observe.

Given that our dataset is fully observational, we address the risk of omitted variable bias as follows. We include additional covariates, which could presumably capture heterogeneity in individuals' willingness and ability to work, as well as differences in productivity. Second, we use a matching estimation to account for a possible misspecification in our covariates. Finally, we follow Cinelli & Hazlett (2019) to determine the extent to which our results might be driven by unobservable characteristics. We thus demonstrate that to explain our result, an extreme confounder that could explain 100 percent of the residual variance in the outcome would have to explain at least 23 percent of the residual variance of the treatment to account fully for the observed estimated effect. In other words, even if we cannot establish that our estimate is fully causal, we can reject the possibility that the true causal effect of labor exchange teams on the likelihood of being hired is null.

Other mechanisms may also explain some of our results, but our overall findings are unlikely to be explained by these alternative mechanisms. In particular, given that team participation increases only the likelihood of being hired as a group, particularly in the context of tasks that are more difficult to monitor, signaling, lower transaction costs and networking mechanisms cannot fully account for our results. We also provide evidence

indicating that the benefits of hiring a team are limited by the liquidity constraints faced by employers, who are thus unable to hire a whole group despite its efficiency.

Our research contributes to several streams of literature. First, our research addresses the question of the link between community ties and the market. Recent microeconomic data have provided conflicting views regarding whether social ties have a positive influence on labor market outcomes (Mas & Moretti, 2009), a negative influence (Bandiera et al., 2013; Akerlof et al., 2023; Ashraf, 2022), or ambiguous effects (Bandiera et al., 2009, 2010).[2] These findings suggest that these social links can have different results depending on the nature of the link in question, the market environment and the type of pressure exerted on individuals. In our case, we are interested in the consequences of private informal arrangements among individuals on their employment prospects in the context of a developing country.

We also contribute to a second stream of literature on labor market imperfections in rural areas of poor countries, which have been widely documented (Shapiro & Stiglitz, 1984; de Janvry et al., 1991; Bharadwaj, 2015; Dillon et al., 2019). In addition to tests of market efficiency, a smaller stream of literature has focused on how informal arrangements may help achieve or approach efficiency. For instance, Stiglitz (1974) showed that sharecropping can be an efficient solution when the landowner/employer cannot observe the level of effort exhibited by the worker. Reductions in information asymmetry among the community also imply that the worker has a comparative advantage with regard to supervising all the hired labor (Eswaran & Kotwal, 1985). We document a similar informational advantage in the context of labor exchange teams involving women. Takasaki et al. (2014) reported that labor exchange in Amazonia can substitute for the market and allows to reach an efficient allocation of labor. However, the mechanism through which such an efficient allocation is achieved cannot be tested on the basis of the method employed by those authors, and it is not clear whether this effect is solely the result of the flexibility that this arrangement provides or whether it can be explained by reduced

[2]Additional aspects of this question include a historical perspective, which suggests that social ties are important for establishing transactions in contexts in which it is difficult to enforce them (Greif, 1989, 1993; Landa, 1981), as well as theoretical contributions (Kranton, 1996; Ishiguro, 2016; Bodoh-Creed, 2019).

information asymmetries, as we suggest.

Third, we contribute to the literature on labor exchange, which remains scarce, although this practice remains common in various sub-Saharan countries and other developing countries worldwide. In SSA, labor exchange groups have been documented in Cameroon (Geschiere, 1995), Zimbabwe (Worby, 1995), the DR Congo (Suehara, 2006), Uganda (Shiraishi, 2006), and Ethiopia (Mekonnen & Dorfman, 2017). Labor exchange has been reported to take two main forms (Krishnan & Sciubba, 2009). The symmetrical form consists of a well-defined group of individuals who join forces and rotate the person who benefits from the work performed according to a preestablished schedule (this form is also known as a rotating labor association (Wang, 2019)). The asymmetrical form consists of "work parties", in which context many individuals work on a plot in exchange for food and drink; reciprocity is expected but may take place in the distant future. The organization pertaining to the exchange of labor that we describe in this article belongs to the former category and has been reported to require homogeneous groups (Krishnan & Sciubba, 2009).

The mere existence of labor exchange is interesting because it does not increase the amount of work performed on the farm (since, by design, every hour received must be compensated for by an hour spent working on someone else's plot). First, it seems that team members benefit from increased motivation as a result of the process of sharing tedious tasks with peers (Bevan & Pankhurst, 1996; Mekonnen & Dorfman, 2017). The arrangement also makes it possible to ensure that more labor is available to a given farm at a key time, even when no paid labor market is available (Moore, 1975) or when such labor is impossible to hire as a result of a lack of cash (Bassett, 2002). Although the total workforce does not increase, working in a team may increase relevant actors' ability to perform time-sensitive tasks.

Finally, our qualitative interviews, which were conducted before the data collection process, revealed that economies of scale may be achieved through a larger workforce. The estimates of the benefits of belonging to a labor exchange agreement are strikingly high; for example, Mekonnen & Dorfman (2017) reported an increase in productivity

of 30% in Ethiopia.[3] Our paper contributes to this stream of literature by identifying additional benefits of labor exchange: its ability to reduce monitoring costs and provide women with more opportunities to engage in paid work.

The remainder of the paper is organized as follows: Section 2 describes the data and highlights facts that are crucial to our understanding of this context. Section 3 focuses on the theoretical model and the corresponding predictions, and Section 4 presents the empirical analysis and tests of these predictions. Section 5 presents a battery of validity tests that were performed to determine the robustness of the results. Section 6 discusses alternative explanations and other market effects. Section 7 concludes.

2 Data and Context

2.1 Data

We used data collected in the Bukoba Rural district (Kagera region) in northwestern Tanzania (see the map presented in Figure B1). Ten villages were surveyed, and 89 labor exchange teams were identified in these villages during the listing phase. In each village, we sampled ten women who participated in labor exchange teams (WLTs), ten women who did not participate in such teams (WNLTs) and ten richer farmers who hired workers on a regular basis ("employers"). This sample allows us to compare labor outcomes between women who formed such teams and those who did not, and to identify preferences regarding different types of labor supply. The women included in the sample were also required to meet the following criteria: they farmed their own plots and were between 18 and 55 years old. In addition, no more than two women from the same team could be included in the survey. The total sample consisted of 300 respondents, 200 of whom were women.[4]

[3]Fumagalli & Martin (2023) also reported that the establishment of labor exchange groups reduced child labor in Mozambique; this finding is consistent with the claim that labor exchange teams reduce imperfections in the labor market (Dumas, 2013; Bharadwaj, 2015). Several studies have also investigated whether the existence of labor exchange teams is explained by trust and social capital; however, these studies have reported conflicting results (Tu & Bulte, 2010; Wang, 2019).

[4]The stratification of the sample on participation in a labor exchange team could induce bias. Appendix A3 explains how we may reweight the observations to obtain a representative sample of women

We focus on women because previous qualitative interviews have revealed that only women engage in labor teams in Bukoba and because the majority of the agricultural labor supply in our context is provided by women. Men tend to seek alternative jobs in neighboring towns, such as working as mechanics or carpenters. Women, because they are less mobile than men (van den Broeck & Kilic, 2019), must find jobs in their villages.

The survey consists of a baseline survey that was conducted in the last two weeks of February 2023 and an eight-week follow-up survey that began in March 2023. The baseline survey was conducted in person, and the follow-up survey was conducted by telephone. The entire survey was conducted during the long rainy season, when most agricultural activities take place.

The baseline questionnaire contained a household roster alongside modules pertaining to the education and labor of household members, land and agriculture, housing and assets, and welfare and assistance measures pertaining to all the respondents. The women's survey include two extra modules concerning empowerment and health measures. Core to our analysis, each survey incorporated a set of targeted questions that focused on landlords' hiring practices in addition to women's farming and economic activities. Additionally, specific questions pertaining to labor exchange were posed to team members.

The follow-up questionnaire included two modules, which asked respondents each week about the activities that they had completed in the past seven days and the activities that they anticipated performing in the upcoming week.[5] This design aimed to limit the measurement error associated with long-term recall in standard end-of-season agricultural questionnaires (Arthi et al., 2018). Given that most activities are divided into half-days (e.g., morning and afternoon), we collected information concerning each half-day over the previous week. Importantly, we systematically asked women who performed paid work whether they were hired individually or as a group. A group that is hired is paid jointly and bears joint responsibility for the assigned tasks; however, this concept could differ

in these villages; we show that the results hold after poststratification.

[5]The enumerators were instructed to choose a day of the week (e.g., Tuesday) that was convenient for the respondent and to call systematically on that day.

from the notion of a team (such as a labor exchange team), as workers could constitute groups that perform paid work without exchanging labor. To ensure that these two concepts remain distinct, we refer to group work for paid employment and team work for labor-sharing arrangements separately. However, as discussed below, hired groups usually consist of labor exchange teams.

Finally, attrition in this study was extremely limited. Over the course of the eight weeks of interviews, the response rate ranged between 98% and 100%. A total of 95% of the participants were interviewed in all rounds, 4.5% missed one round of interviews, and 0.5% missed five rounds.[6] The entirety of the sample was maintained in the data analyses, and for most of the analyses, we simply aggregated the labor supply over the eight weeks; therefore, the impact of missing data pertaining to one week implies that the total amount of farm work may have been slightly underestimated. Most importantly, the degree of attrition was extremely similar between the two groups of women on which this study focused: in both groups, 95% of the women were interviewed in all rounds.

2.2 Labor Teams

We first document the existence and organization of labor exchange teams. In the ten villages included in the survey, all women who participated in such a team were listed. A comparison of the number of participating women to an estimate of the female population in these villages revealed that approximately 9% of women between the ages of 18 and 55 engaged in labor exchange.[7] This figure ranged from 3% to 21% in our sample of villages.

The teams included in our survey are relatively large, featuring an average of ten women per team. In the week prior to the baseline survey, women worked on their own plots for an average of six half-days per week. Additionally, team members spent an average of 1.38 half-days farming together, thus highlighting the significance of the team

[6]The woman who missed five rounds was conducting business in a city and presumably not performing any farm work during these rounds.

[7]The detailed census for 2022 has not yet been released. However, we combine the 2012 Tanzanian census (which contains information at the village level) with the 2022 census (which contains information at the ward level) to estimate the population of each age and gender in the ten villages included in the survey. Further details regarding the available information and the computation process are provided in Appendix A3.

for its members. Among team members, the majority (89%) participates in only one team, whereas 9% participates in two teams.

The organization of team activities is relatively fixed. Namely, the women follow a predetermined schedule for their meetings. Typically, they gather on several specified mornings to farm a member's plot. The schedule outlining who would benefit from the joint work is usually well defined, although discussions could occur if some members were willing to switch.[8] In addition to this standard predefined organization, which was chosen by 83% of the groups, women report that they could meet spontaneously on additional days to work together (86%). Exclusions from the team are rare[9], and the teams are long-lasting, as the average (censored) duration of an existing team in our sample is 6.3 years. These statistics suggest that the bonds among members of labor teams are persistent and quite strong.

Table 1 presents the motivations of women for their participation in labor exchange teams. Most such reasons pertain to gains resulting from either returns to scale or increased motivation resulting from working with other people. A total of 46% of women say that being a member of such a team offers them access to wage work. This aspect is particularly interesting in the present paper, as, to our knowledge, it has not previously been documented.

Table 1: Reasons to join a labor exchange team

Reason	(%)
It allows me to cultivate a larger plot than alone	70
We support each other while working together	52
It allows me to have wage work and get extra money	46
It allows me to cultivate the plot, otherwise I could not do it myself	43
It is more efficient to work with other women	19
It allows me to work independently of my husband	6

Sample: All 100 women who were members of a WLT.
The survey asked the respondents the following question: *"Why did you decide to join/create this labor exchange group?"*. Multiple answers were allowed.

[8] This understanding is based on qualitative interviews that were conducted prior to the collection of the surveys in May 2022.

[9] Only 8 of the labor-sharing teams in our sample reported experiences of exclusion or the replacement of a previous member. Only one case of such exclusion resulted from "the person being lazy or not productive enough", whereas the remainder involved the member leaving the group voluntarily.

2.3 Labor Demand

Very few employers hire workers on a permanent or long-term basis. The main reason for this choice is that agricultural activities fluctuate on a seasonal basis, and the demand for work is very low at certain times. Table B1 presents the share of surveyed employers who may hire workers to perform each farming task. The main task for which hired labor is required is land preparation (73%), followed by weeding (52%) and sowing/planting (40%). Only one quarter of employers hire external labor for harvesting. As a result, workers are mostly hired on a casual basis, either by the day (or half-day) or by the task to be performed. The labor market is therefore best characterized as a spot market, and the low level of connectivity observed between villages makes it unlikely that workers will be hired from outside the village.

The survey collected information concerning the perceived benefits of group versus individual hiring from the perspective of the employer. Recall that the definition of group work focuses on several workers who are hired jointly. If the payment is task-based, the entire group is paid jointly. These groups can be a team, but not necessarily. Table 2 presents various reasons why employers might prefer to hire individuals. The main reasons given in this context are that the employer does not have a sufficient need to hire a full group and that individual workers are easy to find and hire. Interestingly, 35% of employers indicate that they would not be able to hire a group as a result of their lack of liquidity. However, employers also identify clear advantages in hiring groups (Table 3): 77% claim that groups are more efficient, 39% claim that group members monitor each other, and 37% claim that group members usually work together. While some of these options may cover multiple mechanisms, the monitoring argument that we develop in the following sections suggests that employers may be able to outsource the supervision of workers when they hire a team.

Table 2: Why employers prefer to hire individuals

Reason	(%)
I just need one or two individuals	47
I do not have enough money to hire a group	35
I can find them easily	34
They are available when needed	23
I am used to working with them	6
Groups can create problems	3
Other reason	2

Sample: All employers who declared that they had hired individuals to perform at least one agricultural task.
The survey asked the respondents the following question: *"Why do you prefer to hire individuals for [TASK]?"*. Multiple answers were allowed.

Table 3: Why employers prefer to hire teams

Reason	(%)
They do larger task in the same amount of time	77
They monitor each other	39
They usually work together	37
I have known them for a long time	9
I have more trust in a group	8
Easier to hire a full group	6
Reliability	3

Sample: All employers who declared that they had hired teams to perform at least one agricultural task.
The survey asked the respondents the following question: *"Why do you prefer to hire labor teams for [TASK]?"*. Multiple answers were allowed.

2.4 Constraints in the Labor Market

Although groups have been reported to be more efficient, 87% of the labor market transactions that we observe are individual hires. We explain this finding by reference to the liquidity constraints faced by employers. Using the follow-up survey, we compare the planned activities of landlords for the upcoming week with the actual activities reported in the subsequent interview. In most weeks, such discrepancies are reported by the employer.[10] In 86% of these cases, the stated reason was that the employer was unable

[10] A total of 57% of the employer-week observations featured activities for which the employer had planned to hire workers during the previous seven days but that did not ultimately take place.

to hire as a result of liquidity constraints. Only 9% of the cases were the result of the unavailability of workers.

We also asked the women whether they would be willing to work the following day. The job description included in the question was well defined and referred to a very common task for women in the area (i.e., planting beans). A total of 60% of these women would accept, whereas 40% indicated they had other activities planned. In additional questions, we asked them to indicate their reservation wage for this task. We interpret the fact that a majority of women were willing to accept paid work the following day as evidence indicating an excess supply in the labor market (Breza et al., 2021). First, far fewer than the 60% of women reported in this context would have the opportunity to work. Second, we believe that this figure underestimates the actual willingness of women to engage in wage work, as we asked the question about the following day, thus offering these women only limited possibilities to reorganize. Therefore, we believe that in these village economies, labor demand is usually binding. This assessment is consistent with the findings reported by Dillon et al. (2019) with regard to the excess labor supply identified for rural Tanzania.

3 Model

Next, we construct a theoretical model based on the findings presented above. The model is simplified in some dimensions with the goal of capturing the relevant trade-offs while ensuring tractability. We then use this model to derive predictions regarding who is more likely to participate in labor exchange teams and how membership in exchange teams affects labor market prospects.

3.1 Setup

There are two workers/agents $i \in \{1, 2\}$ ("she"), each of whom possesses some wealth that generates a continuous consumption flow W^i, as well as one employer/principal ("he"),[11]

[11] Please note that, while this approach differs from the usual conventions employed in the literature, we use the pronoun "she" for agents and "he" for principals. This choice reflects our empirical setting, in

who can potentially interact over an infinite time horizon with periods $t = 1, 2, ...$ All players share a common discount factor δ.

The principal is risk neutral, agents are risk averse, and their per-period preferences are characterized by the utility function $u(c_t^i)$, where c_t^i is agent i's per-period consumption and where $u'(\cdot) > 0$, $u''(\cdot) < 0$.

Agents can either focus on their own farm production or – if they are offered employment – work for the principal. In the following, we first describe farm production and subsequently explore the fundamentals underlying paid labor.

3.1.1 Farm Production

In every period, agents can engage in *individual* farm production and generate a net value $\theta > 0$. They can also help each other at private cost $\alpha > 0$. If agent j helps agent i, agent i's value from farm production is $\gamma\theta$, with $\gamma > 1$. This specification is based on the evidence provided above, which indicates that the main reasons for women to join teams are the returns to scale or the enhanced motivation that they can obtain from working with other people. For the sake of simplicity, we assume that the agent can still create her own value if she helps the other; moreover, transfers between agents are not possible. We refer to situations in which agents help each other a "team"; the details of the team arrangement are indicated more precisely below.

Note that we choose this specification of teamwork in which mutual help can occur in every period solely for the sake of simplicity. A model in which agents can take turns helping each other (and subsequently not work on their own farm) would generate the same qualitative results. However, such an analysis would involve more cases since we would have to distinguish between an agent providing help and an agent receiving help.

3.1.2 Paid Labor

In any period, the principal requires the input of both agents with some probability. We allow this probability to depend on the arrangements among agents with the aim of

which workers are predominantly female, whereas employers are predominantly male.

accounting for the subsequent results that the principal may prefer to hire agents who work as part of a team; we do not fully endogenize the respective values but rather use p_I to indicate the agents' probability of being hired if they engage in individual production, whereas p_T indicates their probability of being hired if they have formed a team.

If the agents are hired by the principal, they cannot engage in their own farm production. Instead, they choose an effort level $e \in [0, 1/2)$ at individual effort costs $e^2/2$. In this case, an output with value $\theta \leq 1/2$ is realized with probability $e_1 + e_2$, and no output with probability $1 - e_1 - e_2$. Thus, the total net value generated by the agents' effort is $(e_1 + e_2)\theta - e_1^2/2 - e_2^2/2$, and efficient, "first-best," effort is characterized by

$$e_1^{FB} = e_2^{FB} = \theta.$$

The principal pays a salary s to each agent; this salary is exogenously given and determined by factors that lie outside our model, such as norms or market conditions.[12]

Moreover, the principal can choose between limited and extensive monitoring. With *limited monitoring*, the principal merely observes the output; in contrast, with *extensive monitoring*, he observes the effort exhibited by each agent. We normalize the costs of limited monitoring to zero, the costs of extensive monitoring are $m > 0$. Agents, however, are able to observe each other's effort at no cost.

To provide incentives to exert effort, the principal can impose a punishment on agents for nonperformance and reduce each agent's utility by a value q, with $0 < q < \theta/2$. Nonperformance refers to low output in the case of limited monitoring and to "low" effort in the case of extensive monitoring (below, we refine our definition of low effort). We assume that q is exogenously given; namely, it may originate from reduced future employment opportunities, lower future payments, reputational losses, and other such factors. This formulation, which involves an exogenous punishment q, is a shortcut for a more complicated informal long-term employment contract, which, however, would yield qualitatively very similar results. For the sake of simplicity, we assume that q is

[12] See Breza et al. (2019) for the role of norms in the process of sustaining high wages in labor markets, and Fahn & Murooka (2025) for a theoretical microfoundation.

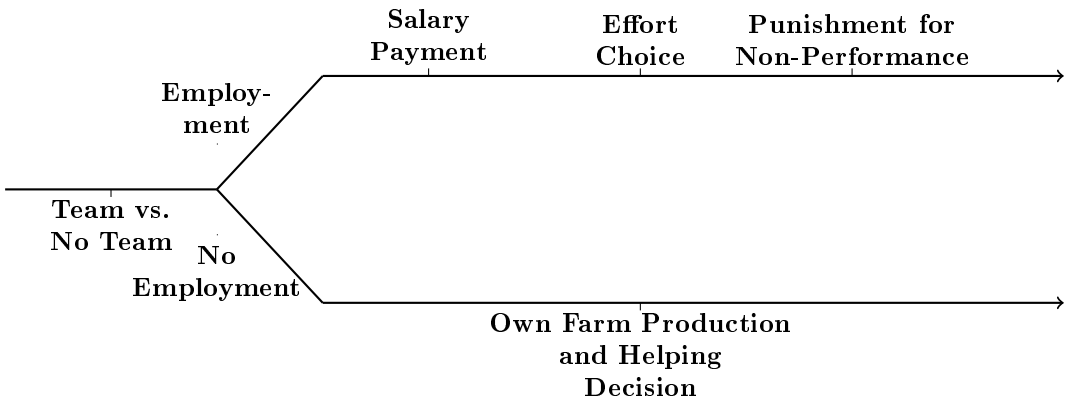
not subtracted from the principal's utility and that, once such a punishment has been imposed on agents, nothing changes in the future relationship between the parties.

Finally, we assume that s is sufficiently high and/or that q is sufficiently small for the agents to view working for the principal while forgoing the value from own farm production to be worthwhile. This assumption incorporates evidence indicating that paid labor is very popular among the individuals on whom our data focuses.

3.1.3 Timing

At the beginning of the game, the principal chooses between extensive and limited monitoring. The timing within any period is as follows. First, agents decide whether to form a team or not. Then, they may receive an offer from the principal. If they accept this offer, they are paid a salary s and subsequently choose their effort. At the end of the period, they receive the punishment q if their performance has not been satisfactory, after which the period ends. If they reject an offer or do not receive an offer at all, agents engage in their own farm production and simultaneously decide whether to help each other or not. The timing of such a period is summarized in Figure 1.

Figure 1: Decisions within a period



Our aim is to characterize subgame perfect equilibria with a particular focus on the conditions that are needed to sustain cooperation between agents and on arrangements that can maximize the principal's profits.

3.2 Team Arrangement

In this section, we explore the conditions under which agents find it optimal to form a team. Arrangements among agents are not verifiable; thus, cooperation requires a self-enforcing agreement. If paid labor is not offered in a period, agents engage in their own farm production. Accordingly, if the agent works on her own, her per-period utility is $u(W^i + \theta)$, where W^i is an exogenous consumption flow generated by the agent's wealth and θ is the net benefit from individual farm production. If, in addition, both agents help each other, an agent's per-period utility is $u(W^i + \gamma\theta) - \alpha$.[13] Therefore, cooperation is desired if $u(W^i + \gamma\theta) - \alpha > u(W^i + \theta)$ holds. In addition, it must be optimal for each agent to cooperate (instead of not helping the other agent and merely enjoying the benefits of being helped). Any such arrangement cannot be enforced legally; thus, we derive the conditions under which a standard grim trigger strategy can sustain cooperation. It follows that, after one agent deviates and does not cooperate with the team, the team breaks up, and agents must engage in individual farm production in all subsequent periods. In addition, we take into account the fact that the utility resulting from being hired by the principal in future periods can also depend on whether the agents are part of a well-functioning team. Therefore, we refer to the utility that agents obtain when they are employed as u_a^E, where $a \in \{I, T\}$ captures the nature of the agents' arrangement for their own farm production; furthermore, $a = I$ indicates individual production, and $a = T$ indicates team production. As discussed below, $u_I^E \neq u_T^E$.

From now on, we omit i-subscripts to simplify the notation. Then, an agent's expected utility stream if the team arrangement is honored in every period equals

$$\begin{aligned}&\sum_{\tau=t}^{\infty} \delta^{\tau-t} \left[(1-p_T)\left(u(W+\gamma\theta)-\alpha\right) + p_T u_T^E\right] \\ =&\frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right) + p_T u_T^E}{1-\delta}.\end{aligned}$$

If an agent is not part of a team, her expected utility stream is

[13] We assume that an agent's utility is additive in consumption and helping costs for the sake of simplicity.

$$\frac{(1-p_I)u(W+\theta)+p_I u_I^E}{1-\delta}.$$

If an agent decides to deviate from the agreement, she merely receives help but does not provide help in the given period. Subsequently, the team breaks up. Therefore, an agent's utility in the period when she deviates is $u(W+\gamma\theta)$ (instead of $u(W+\gamma\theta)-\alpha$ if she also provides help), and – given that cooperation is desired – it is optimal for an agent to help the other if

$$\begin{aligned} &u(W+\gamma\theta)-\alpha+\delta\frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right)+p_T u_T^E}{1-\delta} \\ &\geq u(W+\gamma\theta)+\delta\frac{(1-p_I)u(W+\theta)+p_I u_I^E}{1-\delta} \end{aligned}$$

$$\Leftrightarrow \alpha \leq \bar{\alpha} \equiv \delta\frac{(1-p_T)u(W+\gamma\theta)-(1-p_I)u(W+\theta)+\left(p_T u_T^E-p_I u_I^E\right)}{1-\delta p_T}.$$

Thus, $\bar{\alpha}$ determines the threshold of the cost of helping, above which cooperation within a team is not feasible. If the threshold is higher, it is "easier" to sustain teamwork; thus, we are interested in how several variables affect its size. Relatedly, we define

$$\Delta \equiv \frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right)-(1-p_I)u(W+\theta)+p_T u_T^E-p_I u_I^E}{1-\delta}$$

as an agent's expected (net) benefit of teamwork. The size of Δ will be particularly relevant at a later point, when we establish connections between teamwork and paid labor. Comparative statics of $\bar{\alpha}$ and Δ are provided in Proposition 1.

Proposition 1 *Assume that $p_T \geq p_I$ and that $\bar{\alpha}, \Delta > 0$. Then, $d\bar{\alpha}/d\delta, d\Delta/d\delta > 0$. Moreover, $d\bar{\alpha}/dW, d\Delta/dW < 0$ if p_T is sufficiently small.*

A higher δ makes the future more valuable, thereby enhancing the (future) benefits of cooperation and consequently increasing $\bar{\alpha}$. Importantly, the discount factor δ reflects not only time preferences but also the frequency of interaction, in which context more frequent interactions correspond to a higher δ. This connection will become important

at a later point when we analyze the principal's benefits of hiring a team. A higher wealth level W reduces an agent's marginal utility. Therefore, the benefits of cooperation decrease when all other factors remain equal. The overall effect of a higher W on $\bar{\alpha}$ and Δ must consider the facts that $p_T \neq p_I$ and that the benefits obtained from paid labor are also affected in this context. Notably, according to our data, the frequency of paid labor is low in comparison with that of own farm production, suggesting that the impact of W on paid labor can be neglected. Moreover, we anticipate subsequent (theoretical and empirical) results indicating that the principal prefers to hire teams; thus, $p_T \neq p_I$. On this basis, we make our first prediction:

Prediction 1 *Women from wealthier households are less likely to be part of a team.*

3.3 Employment Relationship

With probability p_T/p_I, the principal offers an employment contract to the agents. We abstract from the possibility that the principal needs only one agent or that he might choose someone else. We interpret the following results under the assumption that a more profitable arrangement is more likely to be chosen by the principal. As described above, an employment offer contains a salary s for each agent, levels of effort e_i associated with effort costs $e_i^2/2$, and a punishment q for nonperformance. Moreover, the principal chooses between limited monitoring, in which context he observes the output at no cost, and extensive monitoring, in which context he observes each agent's effort at cost m. In the following, we first analyze the optimal arrangements under both limited and extensive monitoring, and then discuss the principal's decision.

3.3.1 Limited Monitoring

Under limited monitoring, we distinguish between two possible agreements. The first such agreement, *bilateral agreements*, assumes that either the agents have not formed a team or that the events that occur within the employment relationship have no effect on the team. The second, *multilateral agreement,* assumes that agents have formed a team and made the following side-agreement: they promise each other to exert a given level of

effort in the employment relationship (recall that they can mutually observe each other's effort at no cost). If one agent deviates, the team breaks up.

In the following, we use B or M superscripts to indicate bilateral and multilateral agreements.

Bilateral Agreements Under a bilateral agreement, each agent receives a punishment q if her output is low. Therefore, agent i's optimal effort e_i^B maximizes her utility

$$\begin{aligned}
&(e_i^B + e_j^B)u(W+s) + \left(1 - (e_i^B + e_j^B)\right)(u(W+s) - q) - (e_i^B)^2/2 \\
=&u(W+s) - \left(1 - (e_i^B + e_j^B)\right) q - (e_i^B)^2/2 \\
\Rightarrow& e_i^B = q.
\end{aligned}$$

As noted, our data suggest that paid labor is very popular among individuals; hence, we assume that an agent's participation constraint,

$$u(W+s) - \left(1 - (e_i^B + e_j^B)\right) q - (e_i^B)^2/2 \geq \bar{u}, \tag{PC}$$

, where $\bar{u} = u(W + \gamma\theta) - \alpha$ if the agents are members of a team, and $\bar{u} = u(W + \theta)$ otherwise, is satisfied.

Therefore, under limited monitoring and bilateral agreements, the principal's per-period profits are $\pi^B = \left(e_1^B + e_2^B\right)\theta - 2s$, or

$$\pi^B = 2\left(q\theta - s\right).$$

An agent's utility is

$$u^{EB} = u(W+s) - \left(1 - \frac{3}{2}q\right) q.$$

Importantly, if the principal decides to hire only one agent (perhaps as a result of financial constraints), this agent would still exert a level of effort of q, resulting in profits of $q\theta - s$. Thus, if hiring one agent is profitable, the same applies to hiring two agents. Additionally, since the production function is additive with respect to the agents' efforts,

no intrinsic complementarity is evident between them. However, we will demonstrate how a multilateral agreement can endogenously generate complementarity between agents.

Multilateral Agreement In the context of a multilateral agreement, agents who have formed a team for farm production "promise" each other to exert some level of effort e^M. Before we describe the multilateral agreement in more detail, we first discuss why agents would prefer to commit to levels of effort that exceed the level of effort exerted in bilateral agreements, $e^B = q$. Under limited monitoring, each agent receives a punishment q if her output is low, and the probability of this situation depends on the sum of effort levels. Therefore, each agent's likelihood of being punished depends not only on her own level of effort but also on that of the other agent. In other words, an agent's effort exerts a positive externality on the other agent's utility, and this externality is not taken into account in the process of making individually optimal decisions in a bilateral agreement.

Therefore, each agent's utility is maximized if this externality is taken into account and if effort maximizes the agents' *joint* utility,

$$\begin{aligned} &2(e_1^M + e_2^M)u(W+s) + 2\left(1 - (e_1^M + e_2^M)\right)(u(W+s) - q) - (e_1^M)^2/2 - (e_2^M)^2/2 \\ =&2u(W+s) - 2\left(1 - (e_1^M + e_2^M)\right)q - (e_1^M)^2/2 - (e_2^M)^2/2, \end{aligned}$$

i.e., if each agent chooses

$$e^{M*} = 2q.$$

Next, we derive the conditions under which e^{M*} can be enforced. Any level of e^M that exceeds e^B requires punishing deviations, which involves lowering the *future* utility of a deviating agent. In our case, agents who are part of a team can be punished through the dissolution of the team – and then having bilateral agreements in future cases of being hired by the principal. Furthermore, the optimal deviation for an agent is independent of the other agent's effort and equal to the bilateral effort $e^B = q$.

Therefore, an agent finds it optimal to exert some level of effort $e^M > e^B$ if the

following incentive compatibility (IC) condition is satisfied:

$$\begin{aligned} & u(W+s)-(e^M)^2/2-\left(1-2e^M\right)q+\delta\frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right)+p_T u_M^E}{1-\delta} \\ \geq & u(W+s)-(e^B)^2/2-\left(1-e^B-e^M\right)q+\delta\frac{(1-p_I)u(W+\theta)+p_I u_B^E}{1-\delta}. \end{aligned} \tag{IC}$$

The left-hand side indicates the utility of honoring the multilateral agreement, and the right-hand side displays the utility of a deviation. On this basis, we implicitly assume that the principal can observe whether agents work in a farm production team; therefore, the continuation utilities also reflect the corresponding probabilities of being hired by the principal. In light of $e^B = q$ and the definition

$$\Delta = \frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right)-(1-p_I)u(W+\theta)+p_T u_T^E-p_I u_I^E}{1-\delta},$$

the (IC) condition becomes

$$e^M q-(e^M)^2/2 \geq q^2/2-\delta\Delta. \tag{IC}$$

If $e^{M*} = 2q$ satisfies (IC), agents can enforce the corresponding effort. Otherwise, they will invest the highest amount of effort for which (IC) holds. Ultimately, this effort equals $e = q+\sqrt{2\delta\Delta}$, which implies that

$$e^M = \min\left\{q+\sqrt{2\delta\Delta},\, 2q\right\}.$$

In any case, $e^M > e^B$ for $\delta\Delta > 0$.

Finally, we once again assume that e^M satisfies an agent's (PC) constraint, which is

$$u(W+s)-(e^M)^2/2-\left(1-2e^M\right)q \geq u(W+\gamma\theta)-\alpha. \tag{PC}$$

Therefore, under limited monitoring and multilateral agreements, the principal's per-period profits are $\pi^M = 2e^M\theta - 2s$, or

$$\pi^M = 2\left[\min\left\{q + \sqrt{2\delta\Delta},\, 2q\right\}\theta - s\right]$$

An agent's utility is

$$u^{EM} = u(W + s) - (e^M)^2/2 - \left(1 - 2e^M\right)q.$$

It immediately follows that

$$\pi^M > \pi^B$$
$$u_M^E > u_B^E,$$

which is collected in the following proposition.

Proposition 2 *Assume that limited monitoring has been chosen. In this case, the levels of effort and utility (as well as the principal's profits under a multilateral agreement) are higher than the corresponding levels under conditions featuring bilateral agreements. Moreover, effort and profits with a multilateral agreement (weakly) increase alongside the frequency of interaction , δ.*

The principal prefers a multilateral regime because of the side arrangement between agents, in which context both parties promise each other to exert effort and deviation leads to a break-up of the farm-production team, thus increasing the level of effort that the agents exert in exchange for given levels of compensation and punishment levels. Note that this result would even be stronger if exerting the punishment q were costly for the principal since higher levels of effort reduce the likelihood that a given punishment must be implemented.

Discussion In our analysis of teamwork versus individual farm production, we derived the benefits of the former:

$$\Delta = \frac{(1-p_T)\left(u(W+\gamma\theta)-\alpha\right)-(1-p_I)u(W+\theta)+p_T u_T^E - p_I u_I^E}{1-\delta}.$$

The difference $p_T u_T^E - p_I u_I^E$ determines whether the benefits of teamwork increase in the probability of being hired by the principal. Hiring teams benefits the principal if effort is greater in this case; therefore, $p_T > p_I$ is consistent with our theoretical analysis, which implies that $p_T u_T^E - p_I u_I^E > 0$. The specific friction underlying the labor relationship, however, is *not* crucial for our results. If, for example, we also modeled employment as a repeated interaction that is governed by a relational contract (i.e., payments would not automatically be enforced but would rather need to be self-enforcing), then teamwork would still be beneficial. Namely, the relational contract between agents in which a deviation would lead to a breakup of the team would also increase the efficiency of a relational contract between principal and agents (see Che & Yoo (2001), Kvaløy & Olsen (2006)).

3.3.2 Extensive Monitoring

If the principal decides to monitor the agents extensively at cost $m > 0$, he can observe effort. In this case, q is contingent on effort, and the output realization is irrelevant with respect to the specifics of the arrangement. It is also irrelevant whether agents are in a team of farm production.

Now, the principal requires a level of effort e^{ext} from each agent, which must, once again, satisfy the agent's (IC) constraint,

$$u(W+s)-(e^{ext})^2/2 \geq u(W+s)-q. \tag{IC}$$

The highest level of effort for which this holds is $\sqrt{2q}$. As before, any e^{ext} must satisfy an

agent's participation constraint,

$$u(W+s) - (e^{ext})^2/2 \geq \bar{u}, \tag{PC}$$

which we once again assume to hold. It follows that

$$e^{ext} = \sqrt{2q},$$

which is larger than e^M (and consequently e^B).

Therefore,

$$\pi^{ext} = 2\left(\sqrt{2q}\theta - s\right) - m \quad \text{and}$$
$$u^{ext} = u(W+s) - 2q/2.$$

3.3.3 Principal's Choice

The principal must choose between limited and extensive monitoring. Extensive monitoring is costly but entails higher levels of effort, which the principal prefers (given that salaries and punishments are fixed). Clearly, extensive monitoring is optimal if m is sufficiently small. Therefore, the proposition presented below follows from the previously derived results.

Proposition 3 *There exist cutoffs m^1 and m^2, such that, for $m < m^1$, extensive monitoring is optimal in any case. For $m \in [m^1, m^2]$, extensive monitoring is optimal if the hired agents do not work in a team, whereas limited monitoring is optimal if they do work in a team. For $m > m^2$, limited monitoring is optimal.*

In other words, multilateral agreements among agents are particularly beneficial for the principal if monitoring costs are relatively high; in this case, lower levels of monitoring on average should be observed if teams are hired.

All these results lead to the following predictions.

Prediction 2 *Team members are more likely to be hired on the extensive and intensive margin; however, this claim holds only if they are hired as a group.*

Prediction 3 *The hiring propensity for group labor increases alongside the frequency of interactions within teams.*

Prediction 4 *Teams are more likely to be hired for tasks that involve high monitoring costs m. For these tasks, the employer must engage in less monitoring if teams are hired.*

Agents exert more effort in the context of a multilateral arrangement (for a given compensation) than in contexts involving individual, bilateral relationships with the principal. If we assume that agents who work in a team are embedded in such a multilateral arrangement, the principal clearly prefers to hire teams over individuals, albeit only as groups (Prediction 2). Finally, because the cost of hiring teams decreases in $\delta\Delta$, teams that interact more frequently are more likely to be hired (Prediction 3).

4 Empirical Analysis

In this section, we use data from the baseline and follow-up surveys to test the main predictions of the theoretical model.

4.1 Team Membership

We first identify the characteristics of women who are more likely to participate in labor exchange teams. Accordingly, we construct several variables on the basis of the baseline survey. All these variables are described in Appendix A2, and the descriptive statistics pertaining to these variables are provided in Table B2. Table 4 indicates that the main determinant of a woman's participation in a team is wealth (as proxied by her ownership of durable goods). This finding is consistent with prediction 1 and reflects the lower marginal utility of the benefits of cooperation for wealthier women. One standard deviation in the wealth score decreases the probability of participation by 20%. Conditional on wealth, women's other characteristics do not seem to affect their participation.

Table 4: Determinants of participation in a labor team (WLT)

	WLT
	(1)
Age	0.05
	(0.03)
Age sq.	-0.00*
	(0.00)
Household size	0.03
	(0.02)
Married	0.03
	(0.09)
No. of children below age 2	-0.11
	(0.10)
Literate	0.01
	(0.09)
HH total land (ha)	-0.06
	(0.07)
Health PCA score (std)	-0.05
	(0.03)
Housing PCA score (std)	0.03
	(0.06)
Durable goods PCA score (std)	-0.20***
	(0.07)
Prod. Assets PCA score (std)	0.02
	(0.07)
Median wage in the village (log)	-0.03
	(0.10)
Observations	200
Sample mean of Y	.5
R^2	.096

Sample: all women. OLS estimation. Robust standard errors are reported in parenthesis. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

4.2 Paid Work

Prediction 2 indicates that team members are more likely to be hired by a landowner and that this effect is likely to be driven by group work. Table 5 presents the probability of women having obtained paid agricultural work during the eight weeks included in the follow-up survey. We focus on farming activities to ensure consistency with the theoretical model; other types of activities are assessed in section 6.

Table 5: Paid farm work - Extensive margin

	Performed paid farm work		
	(1)	(2)	(3)
	Individual	Group	Total
Woman in Labor Team	-0.02	0.40***	0.12*
	(0.07)	(0.05)	(0.07)
Observations	200	200	200
Sample mean of Y	.45	.2	.52
R^2	.142	.284	.192

Sample: All women. Data were aggregated across the eight rounds.
OLS estimation. All estimations include the controls used in Table 4. Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.
Note. Column (3) = Column (1) + Column (2)

Column (1) provides estimates regarding individual paid work, Column (2) provides estimates regarding group paid work, and Column (3) provides estimates regarding any paid work. Nearly half of the women included in this analysis performed individual work during the survey, whereas only 20% performed paid group work during this period. Overall, slightly more than half of the women performed paid farm work. The results reveal that the presence of a labor-sharing agreement strongly affects the likelihood of paid group work but has no effect on individual work. In total, being member of a labor exchange team increases the probability of paid farm work by 12ppt. Table B3 in the Appendix presents the effects of the covariates, and shows that women from higher socioeconomic backgrounds are less likely to sell individual farm labor.

In Table 6, we analyze the number of times that the women performed each activity over the eight weeks included in the follow-up. This figure was collected in half-days of activity, which should be understood as roughly three hours of work. Panel A provides the OLS estimates. The results confirm that women in teams engaged in more paid farm work as a group (i.e., +1.22 half-days over these eight weeks), but we do not observe any effect on individual employment (Column (1)), which is consistent with prediction 2. In this specification, the effect on total paid farm work is not significantly different from zero. While these 1.22 half-days over eight weeks may seem to be marginal, it should be

Table 6: Paid farm work - Intensive margin

	No. of instances of paid farm work		
	(1) Individual	(2) Group	(3) Total
Panel A			
Woman in Labor Team	-0.45	1.22***	0.77
	(0.73)	(0.25)	(0.81)
Panel B			
Woman in Labor Team	0.25	19.31***	0.65***
	(0.26)	(0.72)	(0.24)
Panel C			
Woman in Labor Team	0.87	12.17***	2.67**
	(0.98)	(2.62)	(1.29)
Observations	200	200	200
Sample mean of Y	2.91	.61	3.52

Sample: All women. Data were aggregated across the eight rounds.
Panel A: OLS regression. Panel B: Negative binomial regression. Panel C: Marginal effects after negative binomial regression. All estimations include the controls used in Table 4.
Robust standard errors are reported in parentheses. Significance levels: * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

noted that an average woman obtains only 3.52 half-days of any paid farm work during the same period.

Panels B and C correspond to a negative binomial regression. A negative binomial regression may be more appropriate than a linear regression since the values of the outcome variables are constrained to be positive and are usually characterized by low values (in particular in the context of paid work).[14] Panel B provides the coefficients obtained from the negative binomial regression, and Panel C provides the average marginal effects. The effects obtained regarding paid group work are extremely large, which is due to the fact that women who are not in a labor-sharing arrangement (virtually) never perform group work. Therefore, the proportional increase is estimated to be extremely high. More interesting is Column (3) which combines individual work with group work. In this column, the estimates are more reliable because both WLT and WNLT provide some amount of paid work, albeit at a low level. Although the coefficient is not significant

[14] We tested whether a Poisson specification was rejected against the negative binomial, which was the case; thus we present only the negative binomial.

in the OLS specification, it is very significant in the negative binomial specification. The results reveal that participation in a labor-sharing arrangement increases the amount of paid farm work by 65%, or 2.67 additional half-days on average. In the remainder of the paper, we focus on the effects on paid group work and therefore use the OLS specification.

Finally, we tested prediction 3 (which posited that teams that interact more frequently are more likely to be hired) by focusing on women who are team members. For these women, we computed the number of team interactions (only labor exchange) in which they engaged during the eight weeks of the survey. We thus created a dummy variable that indicated whether the number of team interactions was greater than the median for the sample. The results are presented in Table 7.

Table 7: Paid farm work - Heterogeneity by the team interactions

	Performed paid farm work			No. of instances of paid farm work		
	(1)	(2)	(3)	(4)	(5)	(6)
	Individual	Group	Total	Individual	Group	Total
High Team interactions	-0.07	0.19*	0.09	-0.82	1.14**	0.32
	(0.11)	(0.11)	(0.10)	(1.19)	(0.51)	(1.35)
Observations	100	100	100	100	100	100
Sample mean of Y	.48	.4	.62	2.88	1.21	4.09
R^2	.106	.13	.114	.052	.188	.042

Sample: Women in labor teams (WLT). Data were aggregated across the eight rounds.
OLS estimation. All estimations include the controls used in Table 4. "High Team interactions" is an indicator of whether the woman belongs to a team where members exchanged labor more often than the median team during the follow-up survey. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table 7 indicates that high interactions within the team increase the probability of obtaining paid work and the number of paid work activities. This result is also interesting in light of its implications with regard to the validity of our model and estimation. First, through our focus on women who participate in labor teams, we eliminate the unobserved heterogeneity between women who were involved in labor exchanges and those who were not. Thus, among a more homogeneous group of women who chose to exchange labor, we observe that the intensity of this informal arrangement affects women's labor market prospects. Second, the number of interactions between women on a team is likely to be difficult for employers to observe. This situation suggests that the effect of team interactions is the result of changes in the behavior and incentives of team members

rather than being attributable to a signaling effect pertaining to the employer. We have developed this team self-monitoring mechanism as part of our model.

We now address the difference in wages between women who are hired individually and those who are hired as part of a group. Accordingly, we use all labor market transactions that are recorded in the woman's questionnaire. Table B4 reveals that the wage does not depend on whether the woman was hired in a group or individually, conditional on her characteristics. This finding justifies the hypothesis of fixed payment that was included in the model. Women's participation in labor teams increases their likelihood of being hired, but it does not increase their wages.

4.3 Monitoring

This section tests prediction 4. First, we identified agricultural tasks for which effort is more difficult to observe. As noted, employers are more likely to hire workers for preharvest activities: land preparation, sowing/planting and weeding. Our priors indicated that sowing/planting is the activity for which it is most difficult to observe agents' effort. The difficulty lies in the fact that employers can only determine whether the task has been carried out correctly when the plant starts to grow.[15] Sowing/planting is also a task for which stakes are higher. If this task is not performed correctly, the harvest will be poor. In contrast, weeding is performed on multiple occasions during the season, and it is possible to compensate for a suboptimal effort at a later period. The division of tasks into three categories, namely, those in which the observation of effort is easy (harvest tasks), those in which the observation of effort is difficult (preharvest tasks) and those in which the observation of effort is very difficult (sowing/planting), is in line with the analysis presented in Bharadwaj (2015).

Table 8 presents the hiring preferences of employers by type of task. The questionnaire asked participants whether they preferred to hire individuals or groups to perform each agricultural task. Overall, employers prefer to hire individuals, partly as a result of liquidity constraints. However, groups are considered relatively more attractive for sow-

[15] In addition, qualitative interviews revealed that employers are occasionally concerned with the possibility that some seeds may be stolen by workers.

ing/planting activities. This observation is consistent with the claim that worker effort is more difficult to observe in the context of this task; thus, in this case, employers prefer to hire teams.

Table 8: Hiring preferences by agricultural task (% by task)

Task	Individuals	Groups	Indifferent
Land Preparation	59	33	8
Sowing/Planting	53	41	6
Weeding	59	38	3
Other	81	19	0
Harvesting	77	19	4
Total	64	32	4

Sample: All employers. Sample size: 100. Total number of observations: 397 employer-activities in which there is a hiring. The table shows the hiring preference for each task (row percentage).
The survey asked the respondents: *"Please tell me, for [TASK], if you prefer to hire external workers (individuals or groups), or if you prefer to do that activity with household members"*. Respondents were asked about 7 activities.

We could also use the supervision time reported by employers to confirm this hypothesis. In the baseline questionnaire, we asked how long these individuals supervised their workers over a full day of work depending on the agricultural task at hand.[16] We did not ask separate questions depending on how many workers were active in the field; therefore, the supervision time cannot be computed per each active worker in the plot. As more workers are presumably present in the field when a group is hired, this table overestimates the supervision time per worker in the Groups column in comparison with the Individuals column.

Table 9 indicates that, on average, supervision time is lower for groups, thus confirming the self-monitoring advantage of teamwork. More interestingly, the discrepancy between supervision time for individuals and supervision time for groups is largest for sowing/planting activities. These results provide initial confirmation of prediction 4: monitoring effort in the context of sowing/planting is costly, so employers are more likely to use groups to perform this task. Furthermore, in this case, employers provide less

[16] We asked only about their preferred hiring mode, which led to a fairly low number of observations.

Table 9: Average supervision time (hours) by agricultural task and type of hiring.

Task	Individuals	Groups	Ratio
Land Preparation	0.97	0.85	1.14
No. of obs.	*58*	*33*	
Sowing/Planting	1.11	0.83	1.33
No. of obs.	*46*	*36*	
Weeding	1.06	0.96	1.10
No. of obs.	*53*	*34*	
Harvesting	1.37	1.67	0.82
No. of obs.	*40*	*10*	
Total	1.11	0.95	1.16
No. of obs.	*197*	*113*	

Sample: Employers who declare to prefer either individuals or groups for each agricultural task.
Ratio corresponds to the average supervision time of individuals divided by the average supervision time of groups.
The survey asked the respondents: *"For a standard day of work on [TASK], how much time do you spend on the plot checking what your hired workers are doing?"*.

supervision. For other preharvest tasks, the supervision time is lower for groups than for individuals; however, this difference is less notable. Finally, this result is reversed for harvesting tasks, in line with our expectations. The higher supervision costs faced by groups can likely be explained by the fact that more workers perform work simultaneously. However, given that employers rarely hire for this task, we focus mostly on preharvest tasks in the following.

We then use detailed information regarding the farm activities performed by women to determine whether teams have a comparative advantage in sowing/planting. Using all farm activities performed during the survey, we first consider women's own farm production (in the first two columns of Table 10). The first column pertains to team members (WLT), whereas the second column pertains to the remaining women (WNLT) and displays the frequency of each task. The two distributions appear to be quite similar, but the tests reveal that they differ from each other (as indicated by the p-value for the

chi-square test and the Fisher test, as shown at the bottom of Panel A). Panel B provides the same information, which is expressed as a percentage of all tasks performed within a category. More than half of the time is spent on weeding, approximately 30% of the time on sowing/planting and approximately 15% of the time on land preparation. Harvesting accounts for a very small proportion of time because the survey was conducted at the beginning of the agricultural season. Weeding receives two percent more of women's own farm time if they work as part of a labor team; some other proportions appear to be statistically different from each other, but the difference is even lower.

The final three columns present the same statistics for paid agricultural work. Panel A indicates that the frequency of weeding/planting for women in labor teams is double that of women who were not in labor teams. The equality of the two distributions is thus strongly rejected. In this context, a much larger share of activities is devoted to sowing/planting by women in labor teams (+12% of their time).[17] This table reveals that the comparative advantage of women in teams indeed pertains to activities for which effort is more difficult to observe. Interestingly, the bottom section of Panel A reveals that the distributions of tasks pertaining to women's own farm production and paid work are not statistically distinguishable from each other for women who do not work as part of labor teams, whereas women in labor teams are characterized by a notable difference between their production and paid work.

Table B5 estimates the effect of being in a labor team on the likelihood to perform each agricultural task when hired, while controlling for observables. The results confirm the previous findings: women in labor teams are more likely to be hired to perform tasks for which monitoring costs are higher (i.e., sowing and planting).

5 Validity Tests

One threat to the validity of our empirical analysis lies in the endogeneity of participation in labor-sharing. Indeed, many omitted variables may explain both participation in this

[17]Panel B appears to indicate that other tasks were performed by WNLT; however, Panel A clarifies that the change in tasks is actually the result of an increase in sowing/planting for WLT that occurs when they are paid.

Table 10: Tasks on own farm versus paid work, by WLT

Panel A: Frequencies					
	Own farm production			Paid work	
	(1)	(2)		(4)	(5)
Task	WLT	WNLT		WLT	WNLT
Land preparation	698	796		56	50
Sowing/planting	1346	1533		142	73
Weeding	2625	2682		177	162
Harvesting	52	38		3	3
Total	4724	5049		378	288
p-value chi-square WLT = WNLT	0.016			0.004	
p-value Fisher WLT = WNLT	0.016			0.003	
p-value chi-square own farm = paid work				0.144	0.002
p-value Fisher own farm = paid work				0.155	0.002

Panel B: Share of all tasks (in percent)						
	Own farm production			Paid work		
	(1)	(2)	(3)	(4)	(5)	(6)
Task	WLT	WNLT	p-value	WLT	WNLT	p-value
Land preparation	14.79	15.77	0.216	14.81	17.54	0.346
Sowing/planting	28.51	30.36	0.039	37.57	25.61	0.001
Weeding	55.6	53.12	0.013	46.83	56.84	0.010
Harvesting	1.1	0.75	0.035	0.79	0	0.128
Total	100	100		100	100	

Sample: All farming activities described by women during the eight follow-up rounds. Activities are recorded in half-days of work.
The survey asked the respondents: *"What was your main activity last [DAY D] in the [MORNING/AFTERNOON]? "* Excluded tasks (few observations) include: Ridging and Fertilizing, Irrigation, and other non-harvesting activities.
Panel A: Frequencies for each task. The reported statistics test whether the distribution of tasks is the same between women in labor teams and women not in labor teams (first two lines), whether in employment or not. The last two lines test whether the distribution of tasks is the same between own farm work and paid work, separately for women in a labor team or for women not in a labor team.
Panel B: Share of task within columns. The column "p-value" reports the p-value of a two-sample test of proportions between WLT and WNLT for each task, separately for own farm work and paid work.

informal arrangement and the number of paid jobs that the woman in question can obtain. For instance, if a woman has only a limited amount of time (because she has limited autonomy or because she must perform many household chores), then she is less likely to allocate time to a team or to work for someone else. Another potential problem pertains to the possibility that the woman may exhibit a low level of productivity and

therefore not be accepted by a team or hired by a landowner. In this section, we provide a series of robustness tests that aim to verify the validity of our estimation. First, we include additional covariates to limit potential bias. Second, we follow Cinelli & Hazlett (2019) and assess the risk that our estimate is so biased that it is actually zero.[18] Finally, we implement a matching strategy.

5.1 Controlling for Observables

To address the risk of omitted variable bias, we include additional covariates that reflect women's willingness to provide work outside their own farm. Results are presented in Table B6. We use the proportion of half-days spent on housework during the survey (Column 1). We also use an index of women empowerment that is based on several variables (Column 2). These variables reflect women's ability to make a number of decisions in the household. We then include women's willingness to take on a paid job the following day (Column 3), as well as the "reservation wage" for taking that job (Column 4). We also include an estimate of the (log of) household income (Column 5). A potential threat in this context is that women exhibit a level of productivity that can be observed by third parties but not by us. In the main specification, respondents' health is a covariate that is included systematically. Here we introduce a measure of grip strength, which is an objective additional measure of the person's strength and proxy for productivity (Column 6). The final column includes all the observables simultaneously. The estimates are strikingly similar whether or not these additional covariates are included.

5.2 Sensitivity Analysis

We then follow the suggestions of Cinelli & Hazlett (2019).[19] The method involves assessing the extent to which an omitted variable would have to be correlated with both the outcome and the WLT variable to explain the WLT coefficient in full. First, we assess the sensitivity of the extensive margin analysis (Table B7, Panel A). An extreme

[18] This method is similar in spirit to that suggested by Oster (2019) but does not arbitrarily set the maximum amount of variance that can be explained in the model.

[19] We use the sensemakr Stata package that these authors provided; see Cinelli et al. (2024).

confounder (orthogonal to the covariates) that could explain 100 percent of the residual outcome variance would need to explain at least 23.66 percent of the residual variance in the treatment to fully account for the observed WLT effect. Since this context presents an extreme scenario, we also perform the reverse exercise and compute the robustness value. In its notation, $RV_{q0.05} = 33.5\%$. Unobserved confounders (orthogonal to the covariates) that explain more than 33.55 percent of the residual variance of both WLT and the probability of obtaining paid group work are sufficiently strong to bring the WLT estimate into a range in which it is no longer significantly different from 0 at the 5% level. This event is extremely unlikely, especially in this case, since no other variable explains the fact that a woman has obtained group work.

The sensitivity analysis conducted when we study the intensive margin is quite similar (Panel B). For this estimation, the housing score variable is significant at the 10% level (coefficient 0.35), and we can use it as a benchmark with respect to the size of the omitted variable that could alter the results. If the omitted variable exhibited up to three times the observed explanatory power of the housing variable, our estimate would still remain within the [0.68; 1.65] 95% confidence interval. In summary, we cannot claim that our estimate is fully causal, but we can show that the causal effect is indeed positive.

5.3 Propensity Score Matching

To account for the fact that women who participate in a labor-sharing arrangement differ from those who do not, we investigate whether the implementation of a matching strategy between the two groups yields a similar result. Table B8 estimates the effect of WLT on labor market outcomes via propensity score matching. The results are similar in magnitude and statistical significance after matching on observables. Tables B9 and B10 indicate that the balancing of the observable characteristics is satisfactory, and Graph B2 shows the common support.

5.4 Poststratification

Our sample is not a representative sample of farming women in the villages under investigation, as it has been stratified on the basis of whether they are part of a labor exchange team. We thus poststratify our sample to assess the robustness of our results. The poststratification consists of reweighting observations to obtain a sample that matches the specific shares of women who do or do not participate in a labor team. Appendix A3 explains how we use national censuses collected in 2012 and 2022 to achieve such a reweighting, and Table B13 provides the results which are remarkably similar.

5.5 Effects on Other Variables Pertaining to Working Time

Finally, we investigate whether we observe other associations between working in a labor exchange team and working activities. Working in a team and working in a group could displace other activities, thus leading us to incorrectly attribute economic returns to the practice of labor exchange. Table 11 reveals that working as part of a labor team is positively associated with the likelihood of obtaining paid nonfarm work (Column 1, significant at the 10% level). However, we do not observe such a positive association with the number of times that women obtain such paid nonfarm work in Column 2 (neither in the OLS specification nor in the negative binomial regression specification). Subsequently, we determine whether working as part of a labor exchange team affects how much work is provided on one's own farm. Given that all the women included in the sample worked on their own farms, we do not consider the extensive margin and focus instead on the intensive margin (Column 3). We accomplish this goal in the following way: we compute the number of person-half-days of work provided on the woman's own farm. This computation includes the woman's own labor as well as, if applicable, the work of the other team members. We do not observe a decrease in the intensity of farming one's own plots. Finally, we consider household chores in Column 4 (once again on the intensive margin), and we do not observe that working in labor teams displaces household domestic activities.

Table 11: Non-farm paid work, own farm production, and domestic activities

	Non-farm paid work		Own farm prod.	Chores
	Performed	No. of instances	No. of instances	No. of instances
	(1)	(2)	(3)	(4)
Panel A				
Woman in Labor Team	0.12*			
	(0.07)			
Panel B				
Woman in Labor Team		0.55	6.81	2.89
		(0.96)	(8.73)	(2.54)
Panel C				
Woman in Labor Team		0.33*	0.06	0.06
		(0.20)	(0.13)	(0.04)
Panel D				
Woman in Labor Team		1.69	3.15	3.14
		(1.09)	(6.84)	(2.51)
Observations	200	200	200	200
Sample mean of Y	0.37	4.91	52.91	56.66

Sample: All women. Data were aggregated across the eight rounds. Panel A: OLS regression. Panel B: OLS regression. Panel C: Negative binomial regression. Panel D: Average marginal effects. All estimations include the controls used in Table 4. Robust standard errors are reported in parentheses. Significance levels: * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

6 Additional Mechanisms

Liquidity Constraints A natural question is why groups are not hired more often if they are beneficial. We now present results that suggest that the liquidity constraints faced by employers prevent them from using this efficient system more often. We construct a variable that indicates whether an employer faced liquidity constraints in a given week and then average this information across all employers in a village. We use information regarding whether the employer ultimately cancelled a planned activity; if so, and if this cancellation was due to a lack of liquidity, then we code that the employer faced liquidity constraints during that particular week. We reveal that the share of group hiring decreases when local employers faced liquidity constraints during the previous week (Table B11), which does not hold for individual hiring. Interestingly, in Table B12, we also test whether the benefits in terms of additional paid jobs depend on the liquidity constraints faced by

employers in the village.[20] The results reveal that, for the average level of constraints, participation in the labor-sharing arrangement is beneficial in the sense that it increases the probability of being hired to perform group work by 40%. However, for the observed maximum value of liquidity constraints, this effect decreases to 21%.

Information Asymmetries: Monitoring versus Signaling An alternative explanation for the increased hiring associated with labor-sharing arrangements could be that labor-sharing arrangements are used by women as a signaling device with respect to employers. If this characterization were accurate, however, we would expect to observe positive effects also on the *individual* hiring of group members because women would be perceived by employers as more productive even if they worked alone. The fact that we only observe an effect for group hiring is thus better explained by the team self-monitoring mechanism.

Transaction Costs Teams can also benefit employers by reducing transaction costs. If the employer must hire several people, he could simply contact the leader of a team and secure and instruct 5-10 workers with only one phone call. The instructions that must be delivered to the group can then be passed on by the leader, thereby saving the employer's time. While this added benefit of teams may be considered by the employer, it certainly cannot explain all of our findings. In particular, it cannot explain why women are more likely to be hired for tasks for which effort is more difficult to observe.

Networking Effects and Disutility from Work Additional benefits may be obtained through the establishment of labor exchange teams: women strengthen their ties, and they may experience a lower level of disutility from working together than from working alone, as reported in Bandiera et al. (2010). This possibility could drive some of our results. For instance, women in a labor team may be more prone to share paid jobs with their fellow workers. However, we think that this mechanism is unlikely to explain the results for several reasons. First, we observed that labor demand is binding.

[20] In this specification, liquidity constraints are averaged over the 8 weeks of the survey.

Therefore, employers hire a group only if doing so is beneficial to them, and it is not clear why women would have sufficient leverage to ensure that their teammates received employment. Instead, we observed that liquidity constraints on the employers' side play a decisive role in the hiring of groups. Second, if women in a labor team could negotiate to convert opportunities for individual work into opportunities for group work, we would expect to observe a decrease in their likelihood of obtaining individual paid work alongside an increase in the opportunities for group work. While the OLS estimate for individual paid work is negative, it is far from significant. In other specifications, this coefficient is positive (although not significant), thus providing further support for the claim that this negotiation mechanism does not drive the results of this research.

7 Conclusion

Informal institutions that reduce imperfections in credit and insurance markets have been widely studied in the field of development economics. In contrast, we know little about how informal arrangements among farmers can help overcome labor market imperfections. In this paper, we have shown that nonmarket labor-sharing arrangements can help reduce information asymmetries in the labor market in the context of rural Tanzania. We developed a model that analyzes the interactions between agents who form a labor sharing team in the form of a relational contract and a principal who can hire these agents to perform paid work. We showed that the principal has a higher payoff when a labor-sharing team is hired because he can outsource monitoring to team members, who themselves have stronger incentives to cooperate as a result of their informal labor-sharing arrangement.

We tested the predictions of this model using novel data that were collected weekly in ten villages in Bukoba Rural District, northwestern Tanzania, during the long rainy season in 2023. Our results confirm the main predictions of the model: (i) women from wealthier households are less likely to engage in team labor and paid work because their marginal utility from cooperation is low; (ii) team members are 12 percentage points

more likely to receive paid work than were women who did not participate in such labor-sharing teams; and (iii) teams in which labor exchange was more frequent were offered more paid work over the eight weeks of the survey. We also reveal that employers benefit more from hiring teams to perform activities that are associated with high monitoring costs, such as sowing and planting. The employers reported the lowest supervision time when they hired groups of workers to perform the work of sowing and planting, and they reported the highest average supervision time when individuals were hired. We observed that women who were involved in labor-sharing arrangements were more likely to be hired for the tasks, for which supervision is important. This final result is difficult to explain by mechanisms other than team self-monitoring, thus allowing us to rule out pure effects pertaining to information regarding the quality of the worker or pure effects pertaining to a reduction in transaction costs.

We also provided evidence indicating that the effects identified in this research are not (entirely) driven by unobservables that affect both the likelihood of participating in a labor-sharing arrangement and the likelihood of receiving paid work. Our results are robust to the inclusion of a wide range of additional covariates and to the use of propensity score matching; furthermore, we conducted a sensitivity analysis of our main results.

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A1 Proofs

Proof of Proposition 1:

First, we conduct comparative statics for $\bar{\alpha}$, which are

$$\frac{d\bar{\alpha}}{d\delta} = (1-\delta)\,\frac{(1-p_T)u(W+\gamma\theta) - (1-p_I)u(W+\theta) + \left(p_T u_T^E - p_I u_I^E\right)}{(1-\delta p_T)^2}$$
$$\frac{d\bar{\alpha}}{dW} = \delta\frac{[(1-p_T)u'(W+\gamma\theta) - (1-p_I)u'(W+\theta)] + \left(p_T\frac{du_T^E}{dW} - p_I\frac{du_I^E}{dW}\right)}{1-\delta p_T}.$$

$d\bar{\alpha}/d\delta > 0$ follows from $\bar{\alpha} > 0$. For $d\bar{\alpha}/dW$, note that $u'(W+\gamma\theta) - u'(W+\theta) < 0$; therefore, a sufficient condition for the term in squared brackets to be negative is $p_T \geq p_I$. Finally, a sufficient condition for the whole expression to be negative is that p_T is sufficiently small.

The comparative statics for Δ are

$$\frac{d\Delta}{d\delta} = \frac{(1-p_T)\left(u(W+\gamma\theta) - \alpha\right) - (1-p_I)u(W+\theta) + p_T u_T^E - p_I u_I^E}{(1-\delta)^2} \quad (1)$$
$$\frac{d\Delta}{dW} = \frac{(1-p_T)u'(W+\gamma\theta) - (1-p_I)u'(W+\theta) + \left(p_T\frac{du_T^E}{dW} - p_I\frac{du_I^E}{dW}\right)}{1-\delta}. \quad (2)$$

$d\bar{\alpha}/d\Delta > 0$ follows from $\Delta > 0$. The conditions for $d\Delta/dW < 0$ are equivalent to the conditions for $d\bar{\alpha}/dW < 0$.

■

A2 Definition and Construction of Variables

Woman in Labor Team (WLT) Indicator of whether the respondent belongs to a labor exchange team.

Age Age of the respondent in years.

Household size Number of people who have meals and sleep in the respondent's dwelling.

Married (Marital status) Indicator of whether the respondent's marital status is "married, monogamous"; "married, polygamous"; or "living together".

No. of children below age 2 Respondent's number of children who are 2 years old or younger.

Literate Indicator of whether the respondent is able to read and write (in Kiswahili, in English, or in another language).

HH total land (ha) Respondent's self-estimate of the number of hectares (ha) that the household cultivated during the long rainy (masika) season of 2023.

Health PCA score (std) Standardized principal component analysis (PCA) score that is used to measure women's physical functioning and role limitations resulting from physical health problems by reference to questions 3 to 12 from the RAND's 36-Item Short Form Health Survey (SF-36). See Hays et al. (1993).

Housing PCA score (std) Standardized principal component analysis (PCA) score that is used to measure the housing characteristics of the respondent's dwelling on the basis of the following criteria: (i) number of habitable rooms occupied by the household; (ii) major source of lighting; (iii) main fuel used in cooking; (iv) main source of drinking water during the rainy season; (v) main source of drinking water during the dry season; (vi) predominant material(s) used in the walls; (vii) predominant material(s) used in the roof; (viii) predominant material(s) used in the floor; and (ix) main toilet facilities typically used by the household.

Durable goods - PCA score (std) Standardized principal component analysis (PCA) score of asset ownership, which is drawn from a list of 20 nondurable goods: beds, bicycles, chairs, complete music system, computer, dish antenna/decoder, electric/gas stove, fan/air conditioner, lanterns, mosquito net, motor vehicles, motorcycles, radio and radio cassette, refrigerator or freezer, sewing machine, sofas, tables, telephone (mobile), television, and watches.

Productive assets - PCA score (std) Standardized principal component analysis (PCA) score of productive asset ownership, which is drawn from a list of 6 types of animals (i.e., bulls, cows, heifers, goats, pigs, and poultry) and different cash crops

(including coffee, vanilla, cotton, and cocoa, among others).

Median wage in the village (log) Log of the median wage paid to women who provide paid farm work, as measured at the village level.

High team interactions Indicator of whether the number of interactions within the woman's labor exchange team (who meet and exchange work on each member's plots for free on a rotational basis) was above the median number of such interactions among all labor exchange teams during the eight weeks included in the follow-up survey. The median value corresponds to 4 interactions, with a mean of 6.08.

Liq. constr. in village round (%) Percentage of cases in which landlords ultimately cancelled activities for which they had planned to hire workers because the landlord did not have sufficient money to pay for these workers. This constraint was measured at the village level during each week of the follow-up survey.

Indiv. wage work Indicator of whether the focal woman was hired by an employer to provide paid farm work on an individual basis, rather than as part of a group of workers.

A3 Poststratification

The sample can be reweighted to account for stratification on the basis of women's participation in a labor exchange group. In each village v, we use the listing of women who participate in labor exchange groups to determine the total number of women who belong to this category, which we label as fem. pop. 18-55 in $\text{LG}_{v,2024}$. However, we do not have information regarding the female population in each village and instead infer this formation from relevant censuses. In this context, we have access to information regarding the village population in 2012 but not in 2022, for which we have access only to information concerning the population at the ward level (which consists of several villages). Let $\text{pop}_{v,2012}$ indicate the village population in the 2012 census, $\text{share}_{v,w,2012} = \frac{\text{pop}_{v,2012}}{\text{pop}_{w,2012}}$ the share of the village population in the corresponding ward w in 2012, and $\text{pop}_{w,2022}$ the ward population in 2022; on this basis, we first infer the total village population in 2022 as follows:

$$\text{pop}_{v,2022} = \text{share}_{v,w,2012} \cdot \text{pop}_{w,2022}$$

Then, using the sex ratio at the ward level and the age pyramids for the Bukoba district provided by National Bureau of Statistics Tanzania (2022), we estimate the female population between the ages of 18 and 55 years in these villages.

$$\text{fem. pop. 18-55}_{v,2022} = \text{share}_{d,18-55,2022} \cdot \text{pop}_{v,2022}$$

where $\text{share}_{d,18-55,2022}$ is the share of female individuals between the ages of 18 and 55 years in the total population in the Bukoba district.

We then reweight observations in each village as follows:

- a woman in a labor group is reweighted fem. pop. 18-55 in $\text{LG}_{v,2024}/10$
- a woman not in a labor group is reweighted

$$(\text{fem. pop. 18-55}_{v,2022} - \text{fem. pop. 18-55 in LG}_{v,2024})/10$$

As originally described, ten women are sampled in each village and each category. This strategy does not fully account for the sampling design, as an additional criterion for inclusion in the sample was that women farmed land. As a result, the target sample (female population between the ages of 18 and 55 years) is larger than it should be. The reweighting thus tended to underestimate the proportion of women in a labor group and to overestimate the other category. Table B13 provides the main results on the basis of this reweighting, revealing that the results are similar.

B1 Additional Tables and Figures

Figure B1: Bukoba rural district

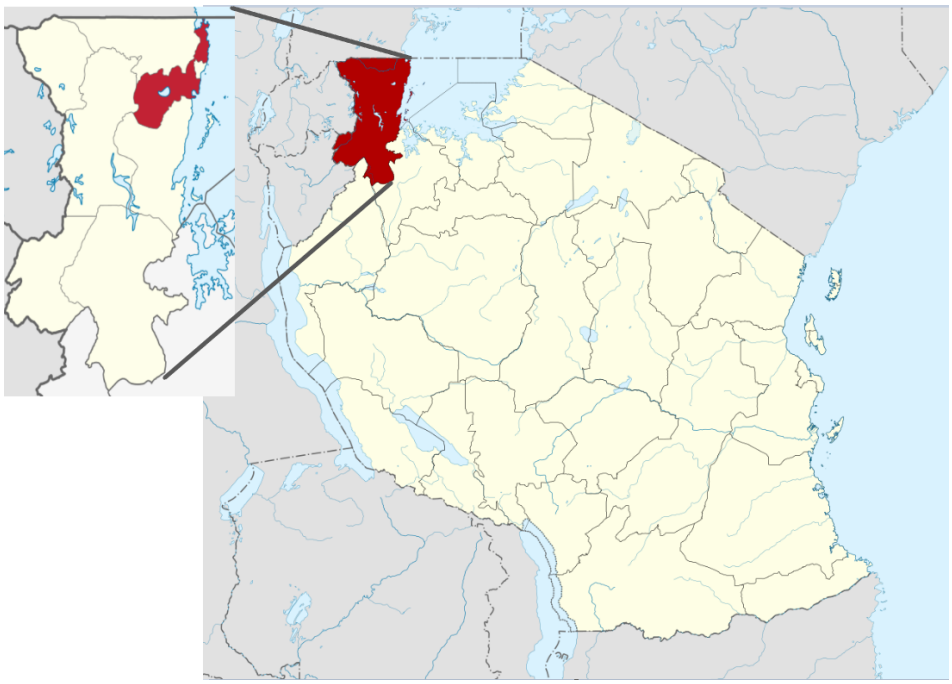

Table B1: Share of employers who hire for each task

Agricultural Task	(%)
Land Preparation	73
Sowing/Planting	40
Watering	3
Weeding	52
Ridge/Fertilizing	25
Other Non Harvest	8
Harvesting	26

Sample: All 100 employers included in the survey.
The survey asked the respondents the following question: *"Please indicate all the tasks for which you sometimes hire external workers"*

Table B2: Descriptive statistics - Surveyed women

	Mean	Sdt. Dev.	Min.	Max.
Age	39.16	9.89	18.00	55.00
Household size	4.94	1.96	1.00	11.00
Married	0.69	0.46	0.00	1.00
No. of children below age 2	0.21	0.42	0.00	2.00
Literate	0.80	0.40	0.00	1.00
HH total land (ha)	0.68	0.51	0.10	3.24
Health PCA score (std)	-0.00	1.00	-3.65	0.54
Housing PCA score (std)	-0.21	0.86	-1.65	6.33
Durable goods PCA score (std)	-0.34	0.73	-1.17	4.41
Prod. assets PCA score (std)	-0.11	0.53	-0.29	3.62
N	200			

Note: This table presents descriptive statistics for both women who participated in labor teams and women who did not participate in such teams. Table B10 presents disaggregated statistics by type.

Table B3: Paid farm work - Extensive margin, full table

	Performed paid farm work		
	(1)	(2)	(3)
	Individual	Group	Total
Woman in Labor Team	-0.02	0.40***	0.12*
	(0.07)	(0.05)	(0.07)
Age	-0.00	0.02	0.01
	(0.03)	(0.02)	(0.03)
Age sq.	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
Household size	0.03	-0.00	0.03
	(0.02)	(0.01)	(0.02)
Married	-0.00	0.05	-0.02
	(0.09)	(0.06)	(0.08)
No. of children below age 2	-0.30***	-0.01	-0.35***
	(0.10)	(0.07)	(0.10)
Literate	-0.02	0.07	0.04
	(0.09)	(0.06)	(0.08)
HH total land (ha)	-0.13**	-0.01	-0.13**
	(0.06)	(0.05)	(0.06)
Health PCA score (std)	-0.01	0.04	0.03
	(0.04)	(0.03)	(0.03)
Housing PCA score (std)	0.03	0.02	0.02
	(0.05)	(0.04)	(0.05)
Durable goods PCA score (std)	-0.19***	-0.03	-0.20***
	(0.07)	(0.05)	(0.06)
Prod. assets PCA score (std)	-0.06	-0.05	-0.08
	(0.06)	(0.03)	(0.06)
Median wage in the village (log)	-0.23**	0.11	-0.16
	(0.10)	(0.07)	(0.10)
Observations	200	200	200
Sample mean of Y	.45	.2	.52
R^2	.142	.284	.192

Sample: All women. Data were aggregated across the eight rounds.
OLS estimation. All estimations include the controls featured in Table 4. Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.
Note. Column (3) = Column (1) + Column (2)

Table B4: Pay rate for individual vs. group work

	Wage ratio
	(1)
Indiv. wage work	-0.06
	(0.05)
Household size	-0.05***
	(0.01)
No. of children below age 2	0.14**
	(0.06)
Literate	0.10**
	(0.05)
HH total land (ha)	0.10*
	(0.06)
Health PCA score (std)	-0.01
	(0.03)
Housing PCA score (std)	-0.01
	(0.04)
Durable goods PCA score (std)	0.01
	(0.04)
Prod. assets PCA score (std)	-0.02
	(0.02)
Constant	1.35***
	(0.34)
Observations	657
Sample mean of Y	1.156
R^2	.049

OLS regression. The level of observation is the transaction (which is measured at the woman-day level). This outcome measures the ratio between the woman's reported wage and the median wage in her village. "Individual hiring" is an indicator of whether the woman provided paid work as an individual (rather than as part of a group). The regression also includes age, age squared, and marital status as controls (the coefficients are not shown). Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B5: Hiring by agricultural task

	Was hired for:					
	Land Prep.		Sowing/Planting		Weeding	
	(1)	(2)	(3)	(4)	(5)	(6)
Woman in Labor Team	-0.04	-0.03	0.09**	0.09***	-0.09**	-0.11***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)
Household size	-0.00	0.00	-0.03**	-0.01	0.04**	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
No. of children below age 2	0.14***	0.13***	0.04	0.03	-0.22***	-0.20***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)
Literate	-0.00	-0.00	-0.05	-0.07	0.03	0.06
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
HH total land (ha)	-0.00	0.02	0.04	0.06	-0.05	-0.09**
	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.04)
Health PCA score (std)	0.02	0.01	0.00	-0.01	0.00	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Housing PCA score (std)	-0.01	-0.00	0.08***	0.08***	-0.04	-0.04*
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Durable goods PCA score (std)	0.03	0.00	0.02	-0.03	-0.05	0.02
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)
Prod. assets PCA score (std)	0.08**	0.07**	-0.03	-0.03	-0.05	-0.04*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Observations	686	686	686	686	686	686
Obs. in task	106	106	215	215	339	339
Sample mean of Y	.17	.17	.26	.26	.57	.57
R^2	.057	.144	.04	.29	.055	.448
Round FE	No	Yes	No	Yes	No	Yes

Each observation is a hiring event (which is measured as a half-day of work). The outcome is a variable that takes a value of one if the woman was hired for land preparation (Columns 1-2) and a value of zero otherwise (e.g., sowing or planting in Columns 3-4, and weeding in Columns 5-6).

OLS estimation. Regressions also include age, age squared, and marital status as controls (the coefficients are not shown). Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B6: Controlling for additional covariates

Panel A: Performed paid group work							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
WLT	0.402***	0.387***	0.395***	0.388***	0.398***	0.397***	0.385***
	(0.052)	(0.052)	(0.052)	(0.051)	(0.052)	(0.052)	(0.052)
Observations	200	200	200	199	199	200	198
R^2	.291	.288	.286	.295	.288	.286	.314
Panel B: No. of instances of paid group work							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
WLT	1.262***	1.174***	1.206***	1.206***	1.245***	1.229***	1.222***
	(0.270)	(0.236)	(0.246)	(0.257)	(0.259)	(0.257)	(0.259)
Observations	200	200	200	199	199	200	198
R^2	.183	.168	.173	.171	.192	.172	.232
Covariate	Chores	Empowerment score	Accept job for next day	Reservation Wage	Household income (log)	Grip strength	All

Sample: All women. Data were aggregated across the eight rounds.
Each column corresponds to a regression in which the outcome is the provision of paid work as a group (i.e., being hired as part of a group in Panel A; number of instances of paid work performed as part of a group in Panel B). Panel A and Panel B: OLS estimation. Regressions include all the controls used in the main estimation plus the additional control indicated at the bottom. Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B7: Sensitivity analysis

	Coef.	S.E.	$t(H0)$	R2yd.x	RV_q	$RV_{q0.05}$
Panel A: Performed paid group work						
WLT	0.40	0.05	7.59	0.24	0.42	0.33
Panel B: Number of instances of paid group work						
WLT	1.22	0.25	4.85	0.11	0.30	0.19

Sample: All women. Results of a sensitivity analysis following Cinelli & Hazlett (2019) with the assistance of the Stata command *sensemakr*.

Table B8: Propensity score matching estimations

	Performed paid farm work			No. of instances of paid farm work		
	(1) Individual	(2) Group	(3) Total	(4) Individual	(5) Group	(6) Total
ATT	-0.03	0.40	0.11	-0.13	1.21	1.08
Std Err	0.08	0.05	0.08	0.78	0.27	0.84
P-value	0.69	0.00	0.15	0.87	0.00	0.20
Observations	190	190	190	190	190	190

Sample: All women. Data were aggregated across the eight rounds.
The PSM estimations are done with one neighbor for observations that are part of the common support. The coefficient indicates the average treatment on the treated (ATT) effect of being part of a women labor team (WLT) on the acquisition of paid work (Columns (1) - (3)) and the number of instances of paid farm work (Columns (4) - (6)). The matching estimation includes all determinants used in the main estimation in Table 4. Reported standard errors are Abadie-Imbens heteroskedasticity-consistent analytical SE with one neighbor. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B9: PSM - Common support

Treatment	Common support		Total
	Off	On	
Untreated	8	92	100
Treated	2	98	100
Total	10	190	200

Figure B2: Propensity score matching

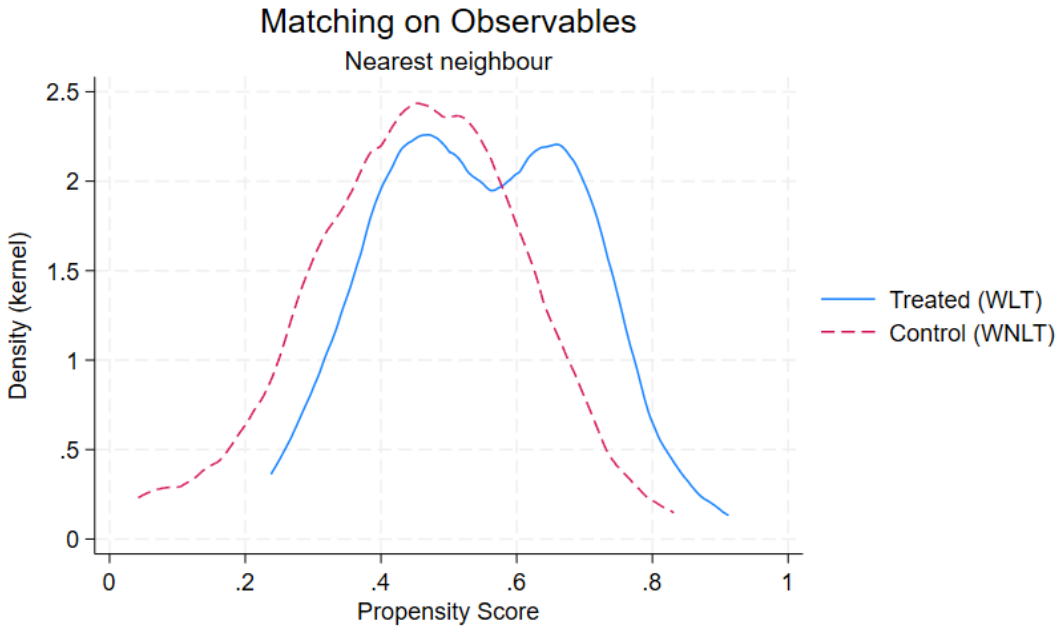

Table B10: Propensity score matching - Balancing test

Variable	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduct bias	t-test t	t-test p-value	V(T)/V(C)
Age	U	38.23	40.1	-18.9		-1.34	0.182	0.81
	M	38.276	37.837	4.4	76.5	0.32	0.748	0.96
Household size	U	5.060	4.820	12.3		0.87	0.387	0.79
	M	5.041	5.031	0.5	95.7	0.04	0.971	0.74
Married	U	0.710	0.680	6.5		0.46	0.647	.
	M	0.704	0.735	-6.6	-2	-0.47	0.635	.
No. of children below 2	U	0.210	0.210	0		0	1	1.12
	M	0.214	0.214	0	.	0	1	1.12
Literate	U	0.790	0.800	-2.5		-0.17	0.862	.
	M	0.796	0.806	-2.5	-2	-0.18	0.859	.
HH total land (ha)	U	0.635	0.719	-16.4		-1.16	0.249	0.7
	M	0.643	0.668	-4.8	70.5	-0.35	0.728	0.78
Health PCA score (std)	U	-0.099	0.099	-19.9		-1.41	0.161	1.48
	M	-0.040	-0.014	-2.6	87	-0.18	0.861	0.95
Housing PCA score	U	-0.277	-0.140	-16		-1.13	0.26	0.4
	M	-0.288	-0.142	-17	-6.2	-1.37	0.171	0.62
Durable goods PCA score	U	-0.463	-0.208	-35.6		-2.52	0.013	0.45
	M	-0.454	-0.446	-1.1	96.9	-0.11	0.915	1.48
Prod. assets PCA score	U	-0.137	-0.122	-2.9		-0.2	0.84	1.06
	M	-0.134	-0.128	-1.1	61.9	-0.08	0.935	1.51
Median wage in the village	U	7.439	7.439	0		0	1	1
	M	7.437	7.456	-5.3	.	-0.37	0.71	1.02

Table B11: Impact of employers' liquidity constraints on paid work

	Performed paid farm work		
	(1)	(2)	(3)
	Individual	Group	Total
Liq. constr. in the village round (%)	-0.04	-0.05**	-0.07*
	(0.04)	(0.02)	(0.04)
Household size	0.02***	0.00	0.02***
	(0.01)	(0.00)	(0.01)
No. of children below age 2	-0.12***	-0.02**	-0.14***
	(0.03)	(0.01)	(0.03)
Literate	0.01	0.03**	0.03
	(0.03)	(0.01)	(0.03)
HH total land (ha)	-0.05***	-0.00	-0.05**
	(0.02)	(0.01)	(0.02)
Health PCA score (std)	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)
Housing PCA score (std)	-0.02	0.02	-0.01
	(0.02)	(0.01)	(0.02)
Durable goods PCA score (std)	-0.03*	-0.04***	-0.06***
	(0.02)	(0.01)	(0.02)
Prod. assets PCA score (std)	-0.01	-0.01***	-0.02
	(0.02)	(0.00)	(0.02)
Round 1 village wage (log)	-0.07***	0.03*	-0.04
	(0.02)	(0.01)	(0.03)
Observations	1400	1400	1400
Round F.E.	Yes	Yes	Yes
Sample mean of Y	.17	.05	.21
R^2	.054	.033	.061

OLS estimation. Observations are at the woman-round level. The outcome measures whether the woman in question was hired at least once (individually) to perform paid work in each week of the follow-up survey (Column 1); whether she was hired at least once (as part of a group) to perform paid work in each week of the follow-up survey (Col 2); and whether she was hired to provide paid work in each week of the follow-up survey (Column 3). 'Liq. constraint' measures the proportion of cases in which employers were unable to hire workers as a result of liquidity constraints within each village. Regression includes age, age squared, and marital status as controls (the coefficients are not shown). Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B12: Paid farm work and employers' liquidity constraints

	Performed paid farm work			No. of instances of paid farm work		
	(1)	(2)	(3)	(4)	(5)	(6)
	Individual	Group	Total	Individual	Group	Total
Woman in Labor Team	-0.07	0.68***	0.14	-2.21	2.49***	0.28
	(0.20)	(0.14)	(0.20)	(2.03)	(0.78)	(2.29)
Liq. constr. in village (%)	-0.17	-0.09	-0.23	-0.33	-0.36	-0.69
	(0.27)	(0.09)	(0.26)	(2.67)	(0.48)	(2.76)
Woman in Labor Team × Liq. constr. in village (%)	0.11	-0.61**	-0.05	3.70	-2.67**	1.03
	(0.38)	(0.28)	(0.37)	(4.20)	(1.32)	(4.56)
Observations	200	200	200	200	200	200
Sample mean of Y	.45	.2	.52	2.91	.61	3.52
Coef WLT (at liq. const. mean)	-0.02	0.40	0.12	-0.45	1.22	0.77
p-value (at liq. const. mean)	0.82	0.00	0.10	0.54	0.00	0.34
Coef WLT (at liq. const. max)	0.02	0.21	0.11	0.67	0.41	1.08
p-value (at liq. const. max)	0.90	0.03	0.41	0.67	0.23	0.51

Sample: All women. Data were aggregated across the eight rounds. Liq. constraint in village measures the proportion of cases in which landlords were unable to hire workers as a result of liquidity constraints within each village. OLS estimations. Regressions include all controls used in Table 4. Mean of liquidity constraint in the sample: 0.474. Max of liquidity constraint in the sample: 0.778.
Robust standard errors are reported in parentheses. Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.

Table B13: Estimation results with post-stratification weights

Panel A: Determinants of participation in a labor team						
	WLT					
Durable goods PCA score (std)	-0.0591**					
	(0.0247)					
Observations	200					
Sample mean of Y	.087					
R2	.031					
Panel B: Paid work						
	Performed paid farm work			No. of instances of paid farm work		
	Individual	Group	Total	Individual	Group	Total
Woman in Labor Team	0.02	0.35***	0.13*	-0.30	0.97***	0.67
	(0.08)	(0.05)	(0.08)	(0.77)	(0.21)	(0.81)
Observations	200	200	200	200	200	200
Sample mean of Y	.41	.031	.42	2.7	.084	2.8
R2	.3	.34	.32	.17	.19	.17
Panel C: Paid work depending on team interactions						
	Performed paid farm work			No. of instances of paid farm work		
	Individual	Group	Total	Individual	Group	Total
High team interactions	-0.09	0.15	0.08	-0.65	0.69*	0.04
	(0.11)	(0.11)	(0.11)	(1.16)	(0.35)	(1.26)
Observations	100	100	100	100	100	100
Sample mean of Y	.5	.35	.6	2.9	.96	3.9
R2	.14	.1	.15	.07	.15	.057
Panel D: Hiring by agricultural task						
	Land prep.		Sowing/Planting		Weeding	
Woman in Labor Team	-0.04	-0.04	0.08*	0.09**	-0.11**	-0.12***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Observations	685	685	685	685	685	685
Sample mean of Y	.15	.15	.3	.3	.53	.53
R2	.07	.2	.062	.29	.067	.5
Round FE	No	Yes	No	Yes	No	Yes

Sample: All women surveyed during the eight rounds of follow-up survey. Data were aggregated across the eight rounds, with the exception of panel D.

Weights were implemented to reproduce the total population of women between the ages of 18 and 55 years old living in the villages. All estimations are OLS regressions and include the controls used in Table 4.

Significance levels: * p<0.10 ; ** p<0.05 ; *** p<0.01.