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Social Incentives in the Workplace

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We present evidence on social incentives in the workplace, namely on whether workers' behaviour is affected by the presence of those they are socially tied to, even in settings where there are no externalities among workers due to either the production technology or the compensation scheme in place. To do so, we combine data on individual worker productivity from a firm's personnel records with information on each worker's social network of friends in the firm. We find that compared to when she has no social ties with her co-workers, a given worker's productivity is significantly higher when she works alongside friends who are more able than her, and significantly lower when she works with friends who are less able than her. As workers are paid piece rates based on individual productivity, social incentives can be quantified in monetary terms and are such that (i) workers who are more able than their friends are willing to exert less effort and forgo 10% of their earnings; (ii) workers who have at least one friend who is more able than themselves are willing to increase their effort and hence productivity by 10%. The distribution of worker ability is such that the net effect of social incentives on the firm's aggregate performance is positive. The results suggest that firms can exploit social incentives as an alternative to monetary incentives to motivate workers.

1. INTRODUCTION

Individuals are embedded in a network of social relationships that shape their incentives and constraints, and ultimately affect their behaviour and outcomes. In the labour market, social networks have been shown to play a key role in matching workers to firms, and in determining outcomes for workers once they are within the firm.[1]

1. In relation to the first literature, Granovetter's (1974) seminal study finds that the majority of surveyed residents of a Massachusetts town had obtained their jobs through social contacts. There is also evidence on the importance of social networks on the demand side of labour markets such that firms use the social contacts of their workers to fill vacancies (Fernandez and Weinberg, 1997). In relation to the second literature, research in organizational behaviour and sociology has stressed the role of social relations within firms (Rotemberg, 2006). Examples of such work includes that on how social networks within the firm influence within firm promotions (Podolny and Baron, 1997), and on the effect of manager–subordinate similarity on subjective outcomes such as performance evaluations, role ambiguity, and job satisfaction (Wesolowski and Mossholder, 1997).

This paper presents evidence on whether and how workers' social ties in the workplace affect their individual performance and the performance of the firm as a whole. The paper focuses on a prominent form of social ties–friendship. To this purpose, we combine a firm's personnel records on individual worker productivity with a survey we administered to workers to elicit information on the identity of their friends within the firm. The firm we study is a leading UK farm producer of soft fruit. Each year, the firm hires foreign workers on seasonal contracts. The main task of workers is to pick fruit from fields on the farm. Worker productivity, defined as the kilograms of fruit picked per hour, is observable, comparable within a worker over time, and comparable across workers at the same moment in time. Two features of this setting make it ideal to study social incentives in firms.[2]

The first is that for any given worker, the identity of co-workers that are physically located in close proximity to her changes on a daily basis for reasons that are shown to be orthogonal to her productivity. We therefore observe the *same* worker on days in which she works with her friends and on days in which she works with people outside of her social network. Moreover, for any given worker, we also observe variation in the precise identity of her friends that are present in the field, conditional on at least one friend being present. These sources of variation together allow us to make some headway in empirically identifying a causal effect of the behaviour of individuals within the same social network on each other (Manski, 1993; Moffitt, 2001).[3]

The second feature is that the workers' compensation scheme and production technology are such that workers' behaviour places no externalities onto their co-workers. This allows us to assess whether workers' behaviour is shaped by social incentives *per se*, rather than because social ties facilitate cooperative agreements in the presence of such externalities. The question is of interest because the effect of social incentives is *a priori* theoretically ambiguous.[4]

On the one hand, the presence of friends might make work more enjoyable, generate contagious enthusiasm, or generate incentives to compete to be the best in the group. All these mechanisms cause a worker to be more productive in the presence of friends relative to when she works alongside only non-friends. Alternatively, the presence of friends may generate contagious malaise, or the establishment of low effort norms, that cause workers to be less productive in the presence of friends. Finally, the productivity effect of the presence of friends might depend on the worker's characteristics relative to her friends'. For instance, if workers' preferences are such that, in equilibrium, groups of friends conform to a common productivity norm that is in between the productivity level of the most and least able friend in the network,

2. The interplay between social relations and worker behaviour has long been studied in the organizational behaviour and sociology literatures (Mayo, 1933; Barnard, 1938; Roethlisberger and Dickson, 1939; Roy, 1952). Such concerns have been incorporated into economic analysis (Akerlof, 1980; Kandel and Lazear, 1992; Rotemberg, 1994; Bewley, 1999; Rob and Zemsky, 2002).

3. A number of papers have recently exploited natural experiments that lead to the random assignment of peers to address similar econometric concerns. This has been done in settings mostly related to education (Angrist and Lavy, 1999; Krueger, 1999; Hoxby, 2000; Sacerdote, 2001).

4. Our analysis therefore complements three strands of the literature. The first examines the interplay between workers' behaviour in the presence of production technologies that cause there to be externalities of worker effort on co-workers' behaviour (Ichino and Maggi, 2000; Mas and Moretti, 2009). The second explores the interplay between workers' behaviour within firms when the compensation schemes in place cause there to be an externality of workers' effort on the pay of their co-workers, such as relative performance evaluation (Ehrenberg and Bognanno, 1990; Bandiera, Barankay and Rasul, 2005) or team pay (Jones and Kato, 1995; Knez and Simester, 2001; Hamilton, Nickerson and Owan, 2003). The third is a literature based on experimental evidence to identify social concerns or peer pressure in workplace environments (Fehr and Falk, 2002; Charness and Kuhn, 2007; Falk and Ichino, 2006). Such concerns have been found to play an important role in shaping behaviour in the field in contexts such as informal insurance agreements in rural economies (Dercon and Krishnan, 2000) or transfers within extended family networks (Cox and Fafchamps, 2008).

then the presence of friends will reduce the productivity of higher ability workers and increase the productivity of lower ability workers.

Our analysis yields three main findings. First, on average, the effect of social incentives is zero. Namely, the average worker's productivity is the same regardless of whether she has social ties with her co-workers or not. This, however, masks a considerable degree of heterogeneity, as the effect of social incentives is found to differ in sign and magnitude across workers. Using data on workers' productivity when they work without their friends, we build a measure of individual ability that is unaffected by the presence of friends and we analyse how the effect of social incentives varies as a function of the worker's ability *relative* to her friends'. We show that, relative to when they work only with non-friends, workers are on average significantly less productive when they work with friends who are less able than them and are significantly more productive when they work with friends who are more able than them. The evidence thus rules out the class of models that predict unambiguously positive or negative effects of social incentives, in favour of models that predict conformity.

As workers are paid piece rates based on individual productivity, social incentives can be quantified in monetary terms and are such that, other things equal, (i) workers who are more able than their friends are willing to forgo 10% of their earnings; and (ii) workers who have at least one friend who is more able than themselves are willing to increase their effort and hence productivity by 10%. To provide some context for these magnitudes, we note that others have previously estimated the incentive effect on individual productivity of moving from low-powered incentives, such as fixed wages, to high-powered incentives in the form of piece rates, to be in the order of 20% (Lazear, 2000; Shearer, 2004).

Second, we explore the empirical relevance of two mechanisms that might drive the observed conformism–the desire to socialize and inequality aversion (Fehr and Schmidt, 1999; Charness and Rabin, 2002). To do so, we exploit a feature of the technology that yields different predictions on workers' behaviour, depending on whether they adjust their productivity levels to be in close physical proximity–as implied by the socialization hypothesis–or whether they adjust their productivity levels to minimize the difference among them–as implied by the inequality aversion model. Under some assumptions, we are then able to provide suggestive evidence that workers' behaviour is consistent with a desire to socialize with their friends rather than them being averse to inequality within their groups of friends.

Third, we use our estimates of the effect of social incentives on each worker to conduct a simple accounting exercise to measure whether the firm benefits from the existence of social incentives. The findings indicate that, although social incentives reduce the productivity of some workers, the distribution of worker ability is such that the net effect is positive. Namely, the positive effect on workers who would be less productive without friends dominates the negative effect on workers who would be more productive without their friend. However, the firm could have increased productivity by only 2.6% had they kept friends together at all times, relative to the allocation actually observed. Whether this would have increased profits ultimately depends on the cost of always assigning friends to work together in terms of reduced flexibility to adjust the workforce within the same day.

While the form that social incentives take might be specific to this setting, the essence of the results is of general interest. The fact that some workers are willing to sacrifice earnings and others are willing to exert more effort in the presence of friends within the firm, indicates social incentives can, more generally, reinforce or countervail monetary incentive schemes in solving agency problems. This has important implications for how workers respond to a given set of monetary incentives, and sheds light on the design of optimal compensation schemes.

The paper is organized as follows. Section 2 describes a framework from which to understand how social incentives within the workplace affect individual behaviour. Section

3 describes our empirical context and data. Section 4 tests the class of models that predict unambiguously negative or positive effects of social incentives. Section 5 tests the class of models that predict the effect of social incentives depends on the characteristics as well as the presence of friends among co-workers. Section 6 measures the impact of social incentives on the firm's overall performance. Section 7 concludes. Further results and evidence in support of the identifying assumptions are in the Appendix.

2. CONCEPTUAL FRAMEWORK

We present a framework, tailored to our setting, that makes precise how social incentives can influence individual behaviour. Worker i chooses the amount of effort $e_i \geq 0$ to devote to production. In our setting, the production technology is such that each worker's effort places no externalities on co-workers, hence the productivity of a given worker depends on her effort alone. In addition, there are no externalities of a worker's effort on co-workers arising from the compensation scheme either–workers are paid a piece rate per kilogram of fruit picked, and hence the pay of a given worker depends on their own effort. We assume that workers derive utility from pay, which depends on productivity and ultimately on effort. This is captured by the benefit function $B(e_i)$, which, as standard, we assume to be increasing and concave in e_i.

Workers are assumed to be of heterogeneous ability. Denoting worker i's ability by θ_i, we assume effort entails disutility $C(e_i, \theta_i)$, with $C_{e_i} > 0$, $C_{e_i e_i} > 0$, and $C_{e_i \theta_i} < 0$. Namely, disutility is increasing and convex in effort, and that, other things equal, more able workers face a lower marginal cost of effort. In the absence of social incentives, worker i's maximization problem is

$$\max_{e_i} \; B(e_i) - C(e_i, \theta_i). \tag{1}$$

The goal of this section is to explore whether and how worker behaviour is affected by social incentives, namely by the social relationships with her co-workers in a setting where a worker's effort does not impose an externality on her co-workers.[5]

In general, several types of social relationships can be thought to affect individual behaviour. To fit the model to our empirical context, we focus on friendship ties because our data allow us to partition the set of co-workers between those who are reported to be friends by worker i and those who are not. The majority of these non-friends, as described in detail in Section 3, will be unknown to worker i. Hence we will compare worker i's behaviour in two settings: (i) when she works alongside her reported friends as well as other workers with whom she has no social ties; (ii) when she only works alongside workers with whom she has no social ties.

To model social incentives, we assume the composition of the group of co-workers enters in the cost of effort function $C(.)$. The simplest case is the one in which the mere presence of friends affects the cost of effort. Worker i's maximization problem in this case is

$$\max_{e_i} \; B(e_i) - C(e_i, \theta_i, f_i), \tag{2}$$

5. This case is therefore complementary to the framework of Kandel and Lazear (1992) who model peer pressure in environments where individual i's effort imposes an externality on her peers. In Kandel and Lazear (1992), the externality creates incentives to exert pressure on co-workers, and leads to the peer pressure that is exerted to be a function of the efforts and actions of peers. Rotemberg (2006) reviews the theoretical literature and field evidence from the organizational behaviour literature on the effects within firms of individuals having two specific types of social concern–altruism and reciprocity. On the empirical side, Fehr and Falk (2002) review the experimental evidence on the importance of such concerns in laboratory labour market settings, and Levy-Garboua *et al.* (2006) review the literature in biology and psychology that delves deeper into understanding the formation of such social concerns in the first place.

where f_i is a measure of the physical presence of friends, such as, for instance, the share of co-workers that are friends. Differentiating the first-order condition for effort with respect to f_i illustrates that whether social incentives lead to higher or lower effort intuitively depends on whether the presence of friends decreases or increases the marginal cost of effort for worker i, namely whether $C_{e_i f_i} < 0$ or $C_{e_i f_i} > 0$.[6] The presence of friends would decrease the marginal cost of effort if, for example, working alongside friends generates contagious enthusiasm, or generates incentives to compete to be the best in the network of friends. In contrast, the presence of friends would increase the marginal cost of effort if, for example, working alongside friends creates contagious malaise.

The framework thus captures in reduced form all models that predict positive or negative effects of social incentives for all workers, regardless of their characteristics or the characteristics of their friends. In other words, while the magnitude of the difference in efforts of any given worker with and without her friends may differ, the key prediction of this class of social incentive model is that the sign of the difference is the *same* for all workers.

A second class of models suggests that the effect of social incentives might depend on the characteristics as well as the presence of friends among co-workers. For instance, a given worker might take a high-ability friend as role model and work harder in her presence, or take a negative example from low-ability friends and slow down in their presence. Other causes of such heterogeneous effects are preferences for status (Bernheim, 1994) or aversion to inequality (Fehr and Schmidt, 1999; Charness and Rabin, 2002) that can generate conformism to a common norm. In all these models, the effect of social incentives in reduced form depends on the ability of worker i relative to her friends'. Worker i's maximization problem thus becomes

$$\max_{e_i} \; B(e_i) - C(e_i, \theta_i, f_i, \overline{\theta}_f), \tag{3}$$

where $\overline{\theta}_f$ is a measure of the ability of the friends present. In this setting, the sign of $C_{e_i f_i}$ can depend on the sign of $\theta_i - \overline{\theta}_f$. For instance, conformism to a common norm would imply that $\text{sign}(C_{e_i f_i}) = \text{sign}(\theta_i - \overline{\theta}_f)$, so that worker i exerts more (less) effort in the presence of friends that are more (less) able than her. If such mechanisms are at play, then the effects of social incentives on behaviour are heterogeneous across workers. More precisely, the sign of the marginal effect on worker effort from having friends present depends on worker i's ability *relative* to her friends'. In the empirical analysis, we will explore such mechanisms in detail.

3. CONTEXT AND DATA

3.1. *Workplace operations*

We analyse the behaviour of workers in the fruit picking division of a leading UK farm producer of soft fruit during the 2004 season. Workers are hired from eight countries in Eastern Europe on seasonal contracts that last between 3 and 6 months. The workers' primary task is to pick fruit from fields on the farm site. They typically pick on two different fields each day, and there are between 40 and 50 workers in each field. Within a field, workers are assigned their own row of fruit to pick. Workers are present on the field for the number of hours it takes to pick all the available fruit. The only choice variable of workers is how much effort to exert into picking. As each worker picks on her own row, her productivity is independent of the

6. Indeed, $\frac{de_i}{df_i} = C_{e_i f_i}/(B_{e_i e_i} - C_{e_i e_i})$, and the denominator is negative due to the twin assumptions that $B(.)$ is concave and $C(.)$ is convex.

efforts of other workers on the same field-day, so there are no externalities arising from the production technology.[7]

Workers are paid a piece rate per kilogram of fruit picked. Each worker's pay is thus related to her own productivity, which is an increasing function of her effort, the quantity of fruit available on the rows of fruit within the field to which she is assigned, and the general conditions in the field in which she works. As pay is based on individual performance only, there are no externalities of workers' effort arising from the compensation scheme either.[8]

3.2. *The assignment of workers to fields*

Workers are assigned to fields on a daily basis by a permanent employee of the farm, whom we refer to as the Chief Operating Officer (COO). Workers do not themselves decide which field they work on, nor do they decide whom to work with.

The quantity of fruit varies across fields on any given day because fields vary in their size and, within a field, over time because plants reach maturity at different times. The fruit is planted some years in advance so the total quantity of fruit to be picked is given and the sequence in which fields are picked over time is pre-determined and is not decided by the COO. This natural variation implies that the demand for picking labour and hence the number of workers vary across fields at any given moment in time, and within a field over time. In addition, there are shocks to the demand for picking labour within a day as fruit orders from supermarkets are received. These orders specify a quantity of specific fruit types that need to be picked and delivered by some date. These orders further cause some workers to be reassigned across fields within the same day.

Importantly for our study, these sources of variation cause the group of co-workers to change each field-day and so allow us to observe an individual working alongside her friends on some field-days, and to observe the *same* individual working in the absence of her friends on other field-days. Moreover, these sources of variation also lead to the subset of worker i's friends that are actually present on the field with her to vary across the field-days on which i picks.

3.3. *The assignment of workers to rows within a field*

Within each field-day, workers are organized and supervised by managers. The COO allocates workers and managers to fields, and managers are hired from the same pool of individuals as workers, and like workers, they are hired on seasonal contracts. Each manager is responsible for the field logistics of around 20 workers. As the fruit plants are organized in rows, managers are responsible for allocating workers to rows at the start of the field-day, and for reallocating workers to new rows once they have finished picking the row they were originally assigned to. On any given field-day, managers focus on their assigned group of workers and work independently of each other.[9]

A key feature of the technology is that there is considerable variation in the quantity of fruit across rows within a field. Fields are covered by plastic sheets supported by pillars placed every fifth row. On rows close to pillars, air circulation is worse and hence heat tends to

7. To be recruited, individuals must be full-time university students and have at least 1 year remaining before graduation. Workers are not typically hired from the local labour market, and few are hired for consecutive seasons.

8. There is also the possibility that workers learn from their friends. Such knowledge spillovers would imply that workers' productivity would increase in the presence of their friends, and that such spillovers die out over time. As documented later, we do not find any evidence of such a pattern of spillovers.

9. A separate group of individuals, called field runners, are responsible for physically moving fruit from the field to the packaging plant. They neither pick fruit nor manage workers.

accumulate, so the quantity of fruit is lower. In addition, these rows are harder to pick because of the presence of the supporting pillars. Both factors reduce workers' productivity, other things equal. Indeed, since the quantity of fruit per plant is lower, workers need to pick more plants–and hence spend more time moving from one plant to the next–to pick a given quantity. Similarly, since the pillars restrict some movements, workers have less discretion on how to approach a plant. In summary, for every five rows between pillars, the marginal productivity of workers' effort is highest in the central row and lowest in the two lateral rows next to the pillars. Due to the complementarity between workers' ability and row quality, managers are required to assign the fastest workers to the most abundant rows.

It is important to stress that this feature of the technology might bias the estimates of social incentives. In particular, if friends are assigned to contiguous rows, these will necessarily have different quantities of fruit in them, hence making the friends' productivity diverge, other things equal. We are thus less likely to find support for models that predict that social incentives make friends conform to a common productivity norm, other things equal. This feature also weakens any common productivity shocks among friends that work on contiguous rows on the field. If, on the other hand, friends are assigned to similarly plentiful rows, they will necessarily be physically distant in most cases. All else equal, this would mitigate against finding evidence of some forms of social concern driving behaviour, such as the benefits of socializing with friends on the field, which are more relevant when friends are in close physical proximity to each other.

3.4. *Data sources*

We use two sources of data for our analysis. This first is the firm's personnel records which contain information on each worker's productivity on every field-day they pick fruit. Productivity is defined as the kilograms of fruit picked per hour and is electronically recorded with little measurement error. In this setting, productivity is therefore observable, comparable across workers at any given moment in time, and comparable within the same worker over time. Personnel records also allow us to identify all the co-workers and managers present each field-day. We focus on fruit picking operations during the peak picking season from 1 May until 30 September 2004.

The second data source is a survey we administered to workers. This provides information on each worker's socioeconomic background, characteristics, and self-reported social network of friends on the farm. Workers are surveyed once, generally around 2 weeks after their arrival, thus allowing time for new social ties to form and be reported. Individuals are asked to name up to seven of their friends on the farm. Hence, the peer group of friends of each worker is self-reported and specific to the worker. For each named friend, workers report whether the social tie existed prior to the individual's arriving to the workplace–which would be the case if, for example, the individuals are friends from their home country–or whether the friendship newly formed within the workplace.[10]

3.5. *Sample selection*

The worker survey is administered on three different dates over the peak picking season. It is administered in the evening after workers have returned from the fields. We aimed to interview

10. The survey is translated into a number of Eastern European languages, and administered by enumerators from Eastern Europe. Note, finally, that the personnel records identify *all* co-workers and managers present on each field-day, and record all workers' productivity, including those not interviewed in our survey.

all workers present on the survey date, and obtained a 95% response rate. Workers who were not present on the living site on the survey date–around half the total workforce–are not in our sample. This may occur if they are engaged in other non-work-related activities away from the farm site at the time of the survey. Table A1 presents descriptive evidence on the characteristics of workers who were interviewed and those who were on the farm's payroll but were not present on survey day. Information available on both sets of workers mostly relates to that contained in personnel records.

Three points are of note. First, those surveyed have similar productivity to those not surveyed. This is true both for worker productivity on average, and also the entire distribution of worker productivity. Second, the gender and nationality composition of the two groups is quite similar. Third, surveyed workers are more than four times more likely to name another surveyed worker as their friend as they are to name an individual who was not surveyed. This is consistent with non-surveyed workers not being present at the time of the survey due to social engagements away from the workplace, and indicates that the social networks of non-surveyed workers do not overlap with those of surveyed workers on which our analysis is based.

3.6. *Reported friendships*

Table 1 shows the pattern of self-reported friendship ties within the workplace. The table shows that 70% of surveyed workers report having at least one friend in the workplace, and that 30% of workers report having no friends in the workplace. We refer to these as "isolated" workers to distinguish them from those that report at least one friendship tie, whom we refer to as "connected" workers. The median worker reports three co-workers as friends, and this rises to four, conditional on reporting at least one friend. The last column shows that workers who report having more co-workers as friends are themselves more likely to be named to be a friend of other workers that are surveyed. For example, among connected workers, they are on average themselves named as a friend by 2.16 other surveyed workers. In contrast, isolated workers are on average themselves named as a friend by only 1.49 other workers. Moreover, of the 87 workers that report no friends within the firm, 37% of them are not reported to be a friend of any other surveyed worker.[11,12]

Taken together, the results highlight that the extent to which workers are socially tied to their co-workers varies considerably. This is despite workers being hired from the same pool, having similar observables, and working frequently with each other within the same tier of the firm hierarchy.

To provide further evidence that workers reliably report the identity of their friends, Table A2 reports survey evidence on the type and frequency of interactions among connected workers and their friends. We collected information along four dimensions of social interaction–going to the supermarket together, eating together, lending/borrowing money, and talking about problems. Although workers were not asked to rank their friends, the table shows that workers report first the friend with whom they interact most frequently along all dimensions, followed by the second reported friend, and so on. The first named friend i is also more likely to be a pre-existing friend and to report i as a friend of theirs. The high frequency of interaction between

11. The terms "connected" and "isolated" are used only to ease the expositional, and we do not mean to imply that workers who name no friends are literally isolated in the workplace in that they have no social interaction with co-workers.

12. The majority of friendships are newly formed in the workplace, and pre-existing friendships are more likely to be reciprocal. For any given number of friendship ties, the ratio of newly formed ties to pre-existing ties varies considerably across workers. On average this ratio is 1.33, although it varies from 0 to 6 across surveyed workers.

TABLE 1
Reported friendships

Number of self-reported friends	Number of surveyed workers (percentage)	Number of times mentioned as a friend by another surveyed worker (standard deviation)
0	87	1.49
	(30.1)	(1.59)
1	33	1.45
	(11.4)	(1.73)
2	24	1.58
	(8.30)	(1.18)
3	29	1.79
	(10.0)	(1.24)
4	48	2.38
	(16.6)	(1.38)
5	19	2.68
	(6.57)	(1.63)
6	16	2.94
	(5.54)	(1.29)
7	33	2.64
	(11.4)	(2.22)
Median	3	2
Mean	2.71	1.96
Standard deviation	(2.44)	(1.65)
Conditional on at least one reported friendship		
Median	4	2
Mean	3.87	2.16
Standard deviation	(1.99)	(1.64)

Notes: All the information is derived from the worker survey. There were 289 individuals interviewed. Each individual was asked to list up to seven of their friends on the farm.

friends outside of the work environment implies friendship networks may be qualitatively more important drivers of behaviour than other networks, say based on similarity in gender or nationality. Moreover, although workers may have more than seven friends in the firm, the strength of the social ties between workers–measured by either forms of social interaction or the probability that the relationship is reciprocal–is highest for the friends who are mentioned first. This implies that we may well capture the strongest friendship bonds in the workplace, and it is these bonds, if any, that are likely to provide social incentives.

4. SOCIAL INCENTIVES AND WORKERS' PRODUCTIVITY: HOMOGENEOUS EFFECTS

4.1. *Identification*

In this section we present evidence on whether workers' performance is affected by the presence of their friends among co-workers. We begin by scrutinizing the class of models that predict the effect of social incentives to have the same sign on all workers: namely, we test whether workers are *always* more or less productive in the presence of their friends compared to when friends are absent. To identify the effect of the presence of friends, we exploit the fact that the same worker is observed on some field-days in the presence of his friends, and on other field-days she is observed working in the absence of her friends. We therefore estimate the following panel data specification for the productivity of connected workers:

$$y_{ift} = \alpha_i + \lambda_f + \beta F_{ift} + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift}, \tag{4}$$

where y_{ift} is worker i's productivity, measured in kilograms per hour, on field-day ft, α_i and λ_f are worker and field fixed effects that capture time-invariant determinants of productivity at the worker and field level, respectively, X_{ift} is the worker's cumulative picking experience to capture the fact that there are positive returns to experience in fruit picking, and Z_{ft} is the field life cycle that captures within field time trends in productivity as plants ripen and field conditions alter, and finally we include a linear time trend to capture learning by farm management and aggregate trends in productivity.[13]

Our variable of interest is F_{ift}, which measures the presence of worker i's friends on field-day ft. The analysis exploits several alternative measures such as an indicator variable for the presence of friends, measures that exploit the different strength of various friendship ties, and measures that exploit the difference in the size of the friends' group on different field-days. All continuous variables are in logarithms, and the error term, u_{ift}, is clustered by worker because the variable of interest–the presence of friends–is correlated within a given worker through time.

The coefficient of interest is β, which captures the difference between workers' productivity on days when they work with their friends and on days when they do not. The interpretation of β depends on the composition of the co-workers' group when friends are not present. We can partition this set into two: (i) individuals with whom worker i has no social ties, namely "strangers"; (ii) individuals with whom worker i has ties other than friendship, such as acquaintances or even enemies. Given that a given worker has 40–50 colleagues on the same field, and these are selected from a pool of 300 individuals from eight different countries, the majority of co-workers on any field-days will be strangers to worker i. The coefficient of interest β should therefore be interpreted as the difference between workers' productivity on days when they work with their friends and on days when they work with individuals they are not socially connected to.

Given that we only collected information on friendship ties, we are unable to compare the estimated effects against those of other types of social tie. For example, it is plausible that enemies may also influence each other's behaviour. If so, then our parameter of interest of the difference between workers' productivity on days when they work with their friends and on days when they work with individuals they are not socially connected to, in part also captures any influence enemies might have.

The identification strategy relies on the validity of two assumptions: (i) the assignment of worker is orthogonal to unobserved determinants of productivity so $\text{cov}(F_{ift}, u_{ift}) = 0$; (ii) there are no intertemporal productivity effects that spillover from field-days when friends are present to field-days when only non-friends are present, and vice versa.[14]

13. As fields are operated on at different parts of the season, and not all workers pick each day, the effects of the field life cycle and workers' picking experience can be separately identified from the effect of the time trend.

14. These identifying assumptions are analogous to the standard identifying assumptions in the program evaluation literature (Heckman, Lalonde, and Smith, 1999). In this context, the treatment individuals are subject to being assigned to work with their friends on a field-day, and the control group is the *same* individual on field-days in the absence of her friends. We therefore require the treatment to be orthogonal to other determinants of worker productivity, and for there to be no spillover effects from field-days in which friends are present onto behaviour on field-days in the absence of all friends.

Two types of factors might generate $\text{cov}(F_{ift}, u_{ift}) \neq 0$, thus invalidating our identification strategy. The first are factors at the field-day level. For instance, if the COO were to assign individuals to work alongside their friends on field-days in which productivity is naturally lower, there would be a spurious negative correlation between the presence of friends and workers' productivity. The second are factors at the worker–field-day level. For instance, if the COO were to assign individuals to work with their friends on field-days in which the individuals feel particularly motivated, there would again be a spurious positive correlation between the presence of friends and workers' productivity.

To test whether the presence of friends is correlated to field-day unobservables that affect productivity, we exploit the fact that on every field-day we observe both connected and isolated workers. By definition, isolated workers are always observed working alongside co-workers they are not socially connected to; hence their productivity cannot be affected by social incentives.

We first establish that connected and isolated workers are similar on observables, so that the performance of isolated workers on the field-day can serve as a counterfactual for what would have been the performance of connected workers on the *same* field-day in the absence of social incentives. We then test whether the productivity of isolated workers is affected by the share of connected workers who have friends in the field. The intuition is that if the presence of friends is correlated to unobservable field-day determinants of productivity, it should also affect the productivity of isolated workers. In other words, if the coefficient β in specification (4) were to capture a spurious correlation between the presence of friends and productivity rather than the effect of social incentives, the same spurious correlation should affect the productivity of isolated workers. In the Appendix we present formal tests of whether the share of connected workers on a field-day is correlated to the productivity of isolated workers, allowing the effect to be nonlinear and to vary across the conditional distribution of productivity. Reassuringly, all tests indicate that the correlation is not significantly different from zero, in support of one of the identifying assumptions.

To test whether the presence of friends is correlated to worker–field-day unobservables that affect productivity, we test whether the assignment of workers to friends can be predicted by a host of worker characteristics that vary across field-days and by the workers' past performance. The tests, reported in the Appendix, indicate that we cannot reject the null hypothesis of zero correlation, thus casting doubt on the possibility that β captures the effect of worker–field-day-specific unobservables.

The second identifying assumption is that there are no inter-temporal spillovers on worker behaviour from field-days in which friends are absent onto field-days on which at least one of them is present, and vice versa. If, for example, working with friends leads to contagious enthusiasm, productivity in the absence of friends may be lower on field-days that immediately succeed those on which they have worked with their friends, because they are more tired after their earlier exertions. A comparison of field-days with and without friends would then lead to an overestimate of the pure social incentive provided by the presence of friends, as behaviour in one scenario is affected by exposure to the other. To shed light on this issue, we test whether the productivity of worker i on a given field-day ft is affected by his exposure to friends in previous days. The tests, reported in the Appendix, indicate that productivity is not affected by long run exposure to friends or by spillovers from one field-day to the next.

Taken together, the evidence suggests workers are not allocated to fields on the basis of factors at the field-day level that drive worker productivity, nor on the basis of their own past performance. Perhaps as is intuitive, this suggests the COO does not actually observe the friendship ties between workers, and even if he does so, he does not find it beneficial to devote time and effort to allocate hundreds of workers to fields on the basis of these friendship ties each day. In addition, the evidence casts doubt on the relevance of inter-temporal spillovers. Hence a comparison of workers' behaviour in the presence of friends relative to when all friends are absent, can be informative of the existence and nature of social incentives in this setting.

Finally, the COO also sets the piece rate each field-day. This is the same for all workers on a given field-day and is set as a function of field-day characteristics to minimize the firm's wage bill each field-day subject to a minimum wage constraint.[15] If the piece rate were correlated to the presence of friends on the field-day, this would confound the identification of social incentives, as the presence of friends would be correlated to the strength of monetary incentives. In the Appendix we show that, reassuringly, the level of the piece rate is uncorrelated with the level of social ties among co-workers on the field-day. In what follows, we therefore provide evidence on the existence and form of social incentives, holding monetary incentives constant.

4.2. *Results*

Table 2 presents descriptive statistics on different measures of the presence of friends F_{ift} to illustrate the within-worker variation used to identify β in specification (4). Our first measure is an indicator variable which is equal to 1 when at least one of the friends of worker i is present on the field-day and zero otherwise. On average, workers work alongside friends on 62% of all field-days. There is, however, considerable variation in the likelihood that at least one friend is present both across workers on the same field-day, and within the same worker over field-days.

The next three rows describe friendship measures that capture social ties of different strength. We divide friends into "old" friends to capture pre-existing ties and "new" friends to capture ties formed on the farm. For each worker we also identify their "best" friend, namely the co-worker who is mentioned first in the self-reported list of friends. As described above, the first reported friend is the one with whom the worker interacts most frequently along all measured dimensions. In line with this, Table 2 shows that, conditional on at least one friend being present, the best friend is present on over two-thirds of field-days, and so is at least one new friend, while the probability of working alongside an old friend is 45%. Most importantly for our purposes, all measures exhibit considerable variation both across workers and within the same worker over field-day.

The final three rows present descriptive statistics on the variation of the size of the friends group across field-days. The table shows that on average, a worker works alongside one friend. Conditional on at least one friend being present, 1.76 or 50% of friends mentioned are present on the same field-day. Finally, friends account for a small share of co-workers on the field-day–on average a given worker has friendship ties with only 3% of co-workers. As expected, the size of the friends group varies across workers on the same field-day, and within the same worker over field-days.

15. More precisely, at the start of the day the COO inspects each field to be picked. He then forms an expectation of worker productivity that field-day and sets the piece rate so that a worker with average productivity expects to obtain an hourly equivalent of $\underline{w}$, where $\underline{w}$ is above the legally prescribed minimum wage, which is chosen by the owner of the firm at the beginning of the season and does not change over the season. This piece rate is announced to workers before they start picking on the field-day, and cannot be revised *ex post*. If a worker's productivity is so low that they earn an hourly equivalent less than the legally prescribed minimum wage, they are paid a one-off supplement to ensure they reach the minimum wage. When they first arrive on the farm, workers are informed that they will not be hired for picking if they consistently need to be paid this supplement. We observe less than 1% of worker–field-day observations where workers are paid the supplement.

TABLE 2
The presence of friends: descriptive statistics

	All field-days	Conditional on at least one friend being present
At least one friend on field-day (= 1 if yes)	0.621	
	(0.228)	
	[0.428]	
At least one old friend on field-day (= 1 if yes)	0.283	0.456
	(0.305)	(0.440)
	[0.332]	[0.233]
At least one new friend on field-day (= 1 if yes)	0.420	0.676
	(0.337)	(0.431)
	[0.361]	[0.183]
Best friend on field-day (= 1 if yes)	0.420	0.664
	(0.272)	(0.344)
	[0.412]	[0.324]
Number of friends on field-day	1.10	1.76
	(0.754)	(0.792)
	[0.942]	[0.735]
Number of friends on field-day/total reported friends	0.312	0.502
	(0.184)	(0.230)
	[0.273]	[0.160]
Number of friends on field-day/number of co-workers on field-day	0.027	0.044
	(0.020)	(0.020)
	[0.030]	[0.031]

Notes: Values are expressed as means, between standard deviations in parentheses and within standard deviations in square brackets. An "old friend" refers to a friendship tie that formed before the individuals arrived on the farm. A "new friend" refers to a friendship tie that formed on the farm. The "best friend" is the friend who is mentioned first on the list of seven reported friends. The number of co-workers on the field-day refers to the total number of other pickers on the field-day. The standard deviations within and between workers takes account of the panel being unbalanced.

To see whether the presence of friends affects individual productivity on average, Columns 1–7 of Table 3 report the estimates of specification (4) for different measures of the presence of friends. Throughout, $\hat{\beta}$ is small, precisely estimated, and not significantly different from zero. This suggests that the presence of friends has no significant effect on the productivity of the average worker conditional on other determinants of productivity. This is true regardless of the strength of ties, of the number of friends on the field-day, and of the percentage of co-workers who are friends.

4.3. *Robustness checks*

As discussed in Section 4.1, our identification strategy relies on the assumption that the presence of friends is orthogonal to determinants of productivity at the field-day level. In the Appendix we show that, in line with this assumption, the productivity of isolated workers is uncorrelated with the share of connected workers who have friends on the field-day. To provide further evidence on this, we first analyse whether the estimated effect of the presence of friends is sensitive to the inclusion of manager fixed effects. This is of particular relevance in our context because the presence of friends could be correlated with the presence of managers who are also socially connected to worker i. Column 1 in Table A3 shows the result to be robust to

TABLE 3
Social incentives: homogeneous effects

	(1) Friend	(2) New friend	(3) Old friend	(4) Best friend	(5) Number of friends	(6) Share of friends	(7) Share of co-workers who are friends
At least one friend on field-day (= 1 if yes)	0.007						
	(0.020)						
At least one new friend on field-day (= 1 if yes)		0.016					
		(0.025)					
At least one old friend on field-day (= 1 if yes)			−0.003				
			(0.035)				
Best friend on field-day (= 1 if yes)				0.019			
				(0.026)			
Log (number of friends on field-day +1)					0.030		
					(0.022)		
Log (number of friends on field-day/total reported friends +1)						0.073	
						(0.050)	
Log (number of friends on field-day/number of co-workers on field-day +1)							0.209
							(0.298)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4792	4792	4792	4792	4792	4792	4792
Adjusted R^2	0.300	0.300	0.300	0.301	0.301	0.301	0.300

Notes: Dependent variable: log of worker's productivity (kg/hour) on the field-day. Standard errors in parentheses are clustered by worker. ***Denotes significance at 1%, **at 5% and *at 10%. Standard errors are clustered by worker. Throughout we use observations only from workers who report having at least one friend and who work at least five field-days with and without friends. In all specifications, controls include the log of worker's picking experience, the log of the field life cycle plus one, a time trend, and field fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked on. An "old friend" refers to a friendship tie that formed before the individuals arrived on the farm. A "new friend" refers to a friendship tie that formed on the farm. The "best friend" is the friend who is mentioned first on the list of seven reported friends. The number of co-workers on the field-day refers to the total number of other pickers on the field-day.

TABLE 4

The presence of friends by relative ability: descriptive statistics

		All field-days	Conditional on at least one friend being present
Measure 1	At least one friend more able than worker i on field-day (= 1 if yes)	0.289	0.521
		(0.338)	(0.449)
		[0.302]	[0.220]
	No friend more able than worker i on field-day (= 1 if yes)	0.266	0.479
		(0.294)	(0.448)
		[0.330]	[0.220]
Measure 2	Ability differential when worker i's ability is lower than the average of her friends on the field-day	0.076	0.136
		(0.154)	(0.215)
		[0.091]	[0.057]
	Ability differential when worker i's ability is higher than the average of her friends on the field-day	0.090	0.162
		(0.129)	(0.221)
		[0.146]	[0.089]
Measure 3	Share of friends on field-day who are more able than worker i	0.206	0.371
		(0.263)	(0.375)
		[0.240]	[0.161]
	Share of friends on field-day who are less able than worker i	0.258	0.464
		(0.264)	(0.383)
		[0.283]	[0.165]

Notes: Values are expressed as means, between standard deviations in parentheses and within standard deviations in square brackets. The ability differential equals the absolute difference between worker i's ability and the mean ability of her friends on the field-day. The share of friends who are more (less) able than worker i is equal to the ratio of the number of friends who are more (less) able than i on the field-day and the total number of friends on the field-day. The standard deviations within and between workers take account of the panel being unbalanced.

controlling for manager-fixed effects. This suggests the presence of friends is orthogonal to the identity of managers of the field-day.

We next exploit the fact that the presence of friends varies across workers within the same field-day to control for field-day heterogeneity directly by including field-day-fixed effects in (4). In line with the findings in Section 4.1, Column 2 in Table A3 shows that the estimated effect of the presence of friends is unaffected by the inclusion of field-day-fixed effects, suggesting that the presence of friends is uncorrelated to field-day unobservable determinants of productivity, such as field conditions, the level of the piece rate, or the identities of the managers present.

A final concern is that since friendship links are measured only at one point during the 3-month season and friendships might change throughout the season, the estimated effect of the presence of friends might be biased towards zero because of measurement error. To address this, Column 3 in Table A3 exploits the fact that the measure of friendship is most precise on days that are close to the survey date and restricts the sample to a 2-week interval either side of the survey date. In the same spirit, Column 4 in Table A3 interacts the friendship measure with the time lag to/from the survey date. The estimated magnitude of the effect of friends is still very close to zero in the restricted sample and does not appear to be sensitive to the lag

TABLE 5
Social incentives: heterogeneous effects

	(1) Rank	(2) Ability differential	(3) Share of friends
Friends on field-day × at least one friend more able than worker i	0.104***		
	(0.033)		
Friends on field-day × no friend more able than worker i	− 0.099***		
	(0.030)		
Friends on field-day × worker i less able than the mean × log (ability differential)		0.439*	
		(0.227)	
Friends on field-day × worker i more able than the mean × log (ability differential)		− 0.362***	
		(0.092)	
Friends on field-day × log (share of friends on field-day who are more able than i)			0.221***
			(0.071)
Friends on field-day × log (share of friends on field-day who are less able than i)			− 0.115**
			(0.048)
Controls	Yes	Yes	Yes
Worker fixed effects	Yes	Yes	Yes
Observations	4081	4081	4081
Adjusted R^2	0.303	0.303	0.301

Notes: Dependent variable: log of worker's productivity (kg/hour) on the field-day. Standard errors in parentheses are clustered by worker. ***Denotes significance at 1%, **at 5% and *at 10%. Throughout we use observations only from workers who report having at least one friend and who work at least five field-days with and without friends. The ability differential equals the absolute difference between worker i's ability and the mean ability of her friends on the field-day. In all specifications, controls include the log of worker's picking experience, the log of the field life cycle plus one, a time trend and field fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked.

to/from the survey date, thus casting doubt on the hypothesis that the findings in Table 3 were driven by friendship being measured with error. Further analysis, not shown, shows that for each of the measures of the presence of friends in Table 3, the robustness checks presented in Table A3 suggest the average effect of social incentives is not significantly different from zero.

Our findings therefore rule out that social incentives increase or decrease the net benefit of effort for *all* workers, as embodied in the maximization problem in (2). If that had been the case, then the presence of friends should have had a significant effect on the productivity of the average worker. The findings thus lend no support to the hypotheses that the presence of friends generates contagious enthusiasm or generates incentives to compete to be the best in the group. All these mechanisms would lead to workers being more productive in the presence of friends. The results also rule out social incentives of the form of contagious malaise or low effort norms, which lead all workers to be less productive in the presence of friends. We next investigate whether, in contrast, social incentives have different effects on different workers, so that the estimated β in specification (4) is effectively an average of positive and negative effects on different workers.

5. SOCIAL INCENTIVES AND WORKERS' PRODUCTIVITY: HETEROGENEOUS EFFECTS

5.1. *A measure of ability*

As discussed in Section 2, a class of models predicts the effect of social incentives to be heterogeneous across workers, and, in particular, a function of the ability of worker i relative to the ability of her friends present on the field-day, as embodied in the maximization problem in (3). This would, for example, be the case if individuals have preferences that lead them to have similar productivity levels. In our settings such conformism can arise because workers derive utility from socializing with their friends on the field-day, and socialization is facilitated by going at a similar pace in order to remain physically close in the field. They can also arise if friends are averse to within-group inequality (Fehr and Schmidt, 1999; Charness and Rabin, 2002). In this section we first present evidence that sheds light on the common predictions of this class of models, and then present a test that allows us to discriminate between different models in the class.

Tests of conformity require a measure of the ability of worker i and all her friends. To this purpose, we exploit our earlier finding that the assignment of workers to friends is orthogonal to the characteristics of the field-day that drive worker productivity, and we measure ability using the estimated worker fixed effect, $\widehat{\alpha}_i^0$, from the following specification:

$$y_{ift} = \alpha_i + \lambda_f + \delta X_{ift} + \lambda Z_{ft} + \tau t + u_{ift}, \tag{5}$$

where we restrict the sample to field-days when the friends of worker i are not present and all variables are as previously defined. The worker's fixed effect thus measures worker i's "permanent productivity" or "ability" in the absence of her friends, conditional on other observable determinants of productivity. To focus attention on those individuals for whom the fixed effect can be estimated precisely, we restrict the sample to workers that are observed for at least 5 field-days in the absence of friends, so $\widehat{\alpha}_i^0$ is estimated on average from 22 observations per worker.[16] The units in which (the exponent of) ability is measured is kilograms of fruit picked per hour and so this metric is directly comparable to productivity. In the absence of friends, average ability is estimated to be 0.812 kg/h with a standard deviation of 0.176. Relative to the average productivity on field-days on which these workers pick in the absence of their friends, around 9.8% of the average worker's performance can be attributed to their ability.[17]

5.2. *Identification*

To assess whether the effect of social incentives depends on worker i's ability relative to her friends, we exploit the fact that the precise *identity* of friends present on the field-day varies across field-days. We then investigate whether and how the productivity of worker i is affected by the presence of friends of differential ability, by estimating the following panel

16. An alternative procedure by which to build the ability measure for worker i is to estimate (A5) for all workers except i and then impute the fixed effect for i. This procedure leads to similar results to those presented.

17. The ability measure $\widehat{\alpha}_i^0$ can be used to assess whether management sorts workers into fields by ability over time. Depending on the true nature of social incentives, such sorting of workers may either bias against finding evidence of social concerns, or may lead to us over-estimate the true influence such incentives have on worker behaviour. To check for this, we first calculate the standard deviation in ability of workers at the field-day level, and then regress this on a series of dummies for each month of the season. We find there to be no significant changes in the standard deviation of a worker's ability in fields across months of the season.

data specification:

$$y_{ift} = \alpha_i + \lambda_f + \gamma_1 A_{ift} D_{ift} + \gamma_2 (1 - A_{ift}) D_{ift} + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift}, \quad (6)$$

where $D_{ift} = 1$ when at least one of the friends of worker i is present on the field-day and 0 otherwise, and A_{ift} is a measure of relative ability. We first define $A_{ift} = 1$ if worker i is the ablest among her friends on the field-day, and $A_{ift} = 0$ otherwise. Later in the empirical analysis, we explore alternative measures such as the size of the ability differential between worker i and her friends.

The parameters of interest are: (i) γ_1, which measures the difference in productivity between field-days when i is the most able among her friends on the field-day and field-days when no friends are present; (ii) γ_2, which measures the difference in productivity between field-days when i is *not* the ablest among her friends on the field-day and field-days when no friends are present.

The validity of the identification strategy rests on the assumption that the COO's assignment of workers to friends of higher or lower ability is orthogonal to unobservables at the worker-field-day that determine worker productivity. It is important to stress that for this assumption to be violated, the COO would need to have information both on the friendship ties between workers and the relative ability of her friends *and* he would need to find it beneficial to devote time and effort to allocate hundreds of workers to fields on the basis of friendship ties and relative ability each day. To test whether the presence *and* identity *percentage* of friends is correlated to worker–field-day unobservables that affect productivity, we check whether the assignment of workers to friends of lower ability can be predicted by a host of worker characteristics that vary across field-days and by the workers' past performance. In the Appendix we show the probability that the COO assigns a worker to a friend of higher or lower ability is uncorrelated to worker-field-day-specific variables such as the worker's picking experience and lagged performance.

A separate issue arises because the identification of γ_1 and γ_2 in (6) relies on workers having friends of different ability so the relative ability measure varies within worker. Since friendship formation is endogenous, however, we might expect workers to form friends with others who are of similar ability to them.[18] This would reduce the variation used to identify γ_1 and γ_2 and reduce the precision of the estimates. In addition, since γ_1 and γ_2 would be identified from small differences in relative ability, they would not be informative about the effect of social incentives in settings where friends' ability levels vary more substantially. To assess the practical relevance of this issue, the Appendix provides direct evidence on whether friends have similar ability levels by analysing the process of network formation. Reassuringly, the findings indicate that while friends are similar on a number of dimensions such as nationality, time of arrival to the farm, and where they live on the farm, there is no evidence that ability differentials play any role in the determination of friendships.

5.3. *Results*

Table 4 reports the means and standard deviations of three alternative measures of relative ability used to estimate (6). Measure 1 shows that, on average, a given worker works with at least one friend who is abler than her on 29% of field-days, while she is the ablest among her

18. The principle that similarity between individuals on their socioeconomic and behavioural characteristics leads them to be more likely to form social ties with each other–the homophyly principle–has been well documented to be a major driving force in the formation of social ties in a wide range of contexts including friendship, marriage, work advice, information transfer, exchange, and co-membership of organizations (McPherson, Smith-Lovin and Cook, 2001).

friends on 27% of field-days. Conditional on at least one friend being present, the right-hand column shows that the shares rise to 52 and 48%, respectively. Measure 2 captures both the ranking and the difference in ability among friends on the field-day. Conditional on at least one friend being present, when worker i's ability is lower than the average among her friends on the field-day, the difference between her ability and the mean is 0.14, which is half a standard deviation of ability among sample workers. When worker i is abler than the average of her friends on the field, the difference between her ability and the mean is 0.16. Measure 3 captures both the ranking and the ability distribution among friends on the field-day. Conditional on at least one friend being present, on average, 37% of the friends present are abler than worker i and 42% are less able than her.

Importantly for our purposes, Table 4 shows that all three measures of relative ability vary substantially within worker across field-days. We exploit this variation to estimate γ_1 and γ_2 in specification (6). The result in Column 1 of Table 5 shows that (i) the average worker is 10.4% more productive if at least one of her abler friends is on the field-day, relative to herself when no friends are present ($\widehat{\gamma}_1$); (ii) the average worker is 9.9% less productive if she is the ablest among her friends on the field-day, relative to herself when no friends are present ($\widehat{\gamma}_2$). Given that the average worker works half of the times with friends who are abler than her and half of the times with friends who are less able, this finding is consistent with the fact that the effect of social incentives is zero, on average, as reported in Table 3. The size of the coefficients implies that social incentives are a powerful motivator. As workers are paid piece rates, the estimates implies that the average worker is willing to forgo 10% of her earnings when she works with friends who are slower than her and to exert more effort to work 10% faster when she works with friends who are able.

Column 2 shows that the magnitude of the effect varies with the distance between the ability of worker i and that of her friends. The estimates imply that, for instance, social incentives increase the productivity of worker i by 16% when she works with friends who are abler than her and the ability differential between her and her friends is 0.36 (the 75th percentile of the distribution of ability differentials), and by 6% when she works with friends who are abler than her and the ability differential between her and her friends is 0.13 (the 25th percentile of the distribution of ability differentials). Similarly, Column 3 shows that the magnitude of the effect varies with the composition of the friends group. For instance, social incentives increase worker i productivity by 14% when two-thirds of her friends on the field are abler than her, and by 7% when one-third of them are.[19]

It is natural to ask whether, if the ability differential between friends is sufficiently large, then these types of social incentives are no longer relevant. In our setting, this is hard to pin down but is worth exploring in other contexts where there are large differences in ability between socially connected co-workers.

As a benchmark with which to compare the magnitude of these social incentives, we note that others have estimated the pure incentive effect on individual productivity of moving from low-powered incentives, such as fixed wages, to high-powered incentives such as piece rates, to be around 20% (Lazear, 2000; Shearer, 2004). The provision of social incentives is therefore a quantitatively important alternative to providing monetary incentives, as a means to increase worker performance. While such alternatives to monetary incentives in labour markets have been documented to exist in laboratory settings (Fehr and Falk 2002), this paper, along with

19. Alternative measures of relative ability, such as the distance from the ablest and the least able friend on the field-day, and the number of the abler and less able friends on the field-day produce similar results and are not reported for reasons of space.

that of Mas and Moretti (2009), is among the first to provide field evidence from firms on the existence and magnitude of such effects.

5.4. *Robustness checks*

Table A4 reports a battery of robustness checks. For clarity, we restrict the analysis to our baseline measure of relative ability, as the findings for the other two measures are qualitatively similar. First, as in Section 4.2 above, we test whether the findings capture a spurious correlation between the assignment to friends of different ability and the assignment to particular managers. Column 1 in Table A4 casts doubts on this interpretation, as the estimated social effects are not sensitive to controlling for managers' identity. Namely, the presence of more/less able friends does not appear to be correlated to the presence of specific managers on the field.

Next, we exploit the fact that the presence and the relative ability of friends vary across workers on the same field-day to control for field-day heterogeneity directly by including field-day fixed effects in (6). The results, reported in Column 2, show the estimated coefficients to be qualitatively unchanged. Unsurprisingly, they are less precisely estimated given that common productivity shocks are controlled for, but the confidence intervals on each parameter overlap with those in Column 1 of Table 5 and both remain significantly different from zero at conventional levels of significance.

Column 3 restricts the sample to field-days when worker i works with at least one friend ($D_{ift} = 1$). In this specification, we identify $(\gamma_2 - \gamma_1)$ from variation in the precise identity of friends present so that on some field-days worker i has higher ability friends present and on other field-days her lower ability friends are present. In line with the findings in Column 1 of Table 5, the average worker is 24.6% more productive when she works with at least one friend who is abler than her when she is the ablest in her network of friends present on the field-day.[20]

Overall, we find robust evidence that the behavioural response of workers to the presence of their friends depends on their ability relative to their friends. A final concern is that this result can be spuriously generated if a given worker is matched with abler friends on field-days when she has a positive productivity shock, *and* her abler friends have a negative productivity shock and the same worker is matched with less able friends on field-days when she has a negative shock and her less able friends have a positive shock. This could occur, for example, if (i) workers can influence their assignment to their friends; and (ii) groups of friends choose to work together only on field-days when they expect their productivities to be similar for exogenous reasons.[21]

20. A second concern relates to the standard errors in (6). In particular, the key regressors are based on estimated ability, and so contain some error. This leads to attenuation bias, and so the productivity effects of social incentives are underestimated. More importantly, the standard errors are likely to be underestimated. The seriousness of the problem is partly mitigated by the relatively large sample sizes used. However, as an additional check, we bootstrap the standard errors in (6) based on 1000 replications and accounting for clustering by worker. The results show these standard errors to be only incrementally larger than the clustered ordinary least squares (OLS) standard errors reported throughout. A related issue is that the standard errors are clustered by worker throughout. However, on any given field-day, many workers are subject to the same treatment of being assigned to work alongside their friends. To take account of these correlated treatments across connected workers, we also clustered standard errors by the two groups of workers in the same field-day that have, and do not have, at least one friend present. The results are robust to this alternative clustering.

21. This is in contrast to the evidence presented in Section 4 on the assignment of workers to fields being orthogonal to other determinants of productivity, which was predicated on the concern that the COO has knowledge of, and acts upon, the friendship ties of workers and their relative abilities. Here the empirical concern stems from workers themselves being able to influence their assignment.

If this were the case, each worker should work less frequently with friends whose ability differs more from her own. This is because the set of circumstances under which friends of different ability expect to have similar productivity due to exogenous reasons is small. To check for this, we first define a dummy variable $D_{ijft} = 1$ if worker i and her friend j are assigned to field-day ft, and $D_{ijft} = 0$ otherwise. We then estimate whether the probability that i and j work alongside each other varies with the ability differential between the two using the following linear probability model:

$$D_{ijft} = \beta \left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right| + \lambda_f + \delta X_{ift} + \lambda y_{ift-1} + \tau t + u_{ijft}, \tag{7}$$

where $\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|$ is the absolute ability differential between worker i and her friend j, and all other controls are as previously defined. Columns 4 and 5 of Table A4 show that the ability differential between friends does not affect the likelihood they work together. The results do not therefore appear to be driven by friends working together when they expect their productivity to be similar.[22]

5.5. *Interpretation*

The evidence points to social incentives affecting workers' behaviour, despite there being no externalities arising from either the production technology or compensation schemes in place. Social incentives are found to depend on the ability of a worker relative to that of her friends present on the same field-day. More precisely, relative to working only with non-friends, the average worker is 10% more productive if at least one of her abler friends is present, and is 10% less productive if she is the ablest among her friends.

This result can be explained in any framework in which utility decreases in the difference between an individual's performance or ability in the workplace and that of her friends, as in the maximization problem in (3). Such conformism might be driven by inequality aversion or by the desire to socialize with friends. The next subsection proposes and implements a test to assess the relevance of these alternative models. To do so, we must first distinguish between two versions of the inequality aversion hypothesis−aversion to pay inequality and aversion to productivity inequality. While pay does depend on productivity, equalizing productivity is a rather inefficient way to equalize pay in this setting because the total earnings of the group of friends are lower if fast pickers slow down. All friends would be better off if each worked at their own optimal speed and then redistributed earnings *ex post*. In light of this, we believe that aversion to pay inequality is not a likely explanation for our findings. However, our findings are consistent with the hypothesis that workers are averse to inequality in productivity with their friends. This might be relevant if, for instance, fast workers do not want to embarrass their slower friends by leaving them behind, or if slow workers are ashamed of their low productivity.

An alternative hypothesis to explain our findings is that workers benefit from socializing on the field. As plants grow on parallel rows, the workers' productivity determines the speed at which they physically move along the row and the distance to the worker in the next row. Hence slowing down in the presence of less able friends and working faster in the presence of more able friends allows a worker to remain physically close to her friends, and therefore socialize more easily with them.

22. Taken together, the results also suggest there is no learning from friends. Such knowledge spillovers would not imply the heterogeneous pattern of productivity effects we find, nor would they suggest that such effects are long lasting.

5.6. *Socializing or inequality aversion?*

To explore these two hypotheses, we exploit the fact that worker productivity varies widely across field-days due to exogenous variations in the availability of fruit, and that slow pickers are more sensitive to field conditions than fast pickers. Hence on bad field-days–when productivity is low due to exogenous reasons–the productivity differential between fast and slow pickers is greater than on good field-days. The test is then based on the intuition that the behaviour of workers in the presence of their friends varies across good and bad field-days differently depending on whether aversion to inequality or the desire to socialize is driving the social incentives.

More precisely, if workers strive to minimize the inequality in productivity with their friends, then the effect of the presence of friends on productivity will be larger on bad field-days compared to good field-days. This is because, given that on a bad field-day the productivity gap between fast and slow pickers is exogenously wider, to close it fast pickers should decrease their productivity to a greater extent and/or slow pickers should increase their productivity to a greater extent, all else equal.

This, however, is not necessarily the case if social incentives are driven by workers' desire to socialize with their friends. Indeed, given that contiguous rows have different quantities of fruit, and workers are required to pick all ripe fruit on their row–a requirement strictly monitored and enforced by field managers–the worker on the more abundant row needs to pick more fruit per unit of time than the worker on the least abundant row for them to remain physically close and thus able to socialize. How field conditions and social incentives interact then depends on whether the difference in fruit availability between rows is greater or smaller on bad field-days compared to good field-days. If it is greater, as might be plausible, the socialization hypothesis has the opposite prediction to the inequality aversion hypothesis. Namely, on bad field-days socialization requires fast pickers to decrease their productivity to a smaller extent and/or slow pickers to increase their productivity to a smaller extent. This is because when there is very little fruit on bad rows, the worker on the bad row can proceed quickly while picking little fruit so that workers on good and bad rows can have different productivity levels and yet they remain physically close.

To implement this test we proceed in three steps. First, we use the sample of isolated workers to identify good and bad field-days. To do so, we estimate the following specification for isolated workers:

$$y_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + u_{ift}, \tag{8}$$

where all variables are as previously defined. We then use the estimated field-day-fixed effects to classify field-days as good or bad. More precisely, field-day ft is defined to be good, $G_{ft} = 1$, if $\widehat{\lambda}_{ft}$ is above the median of all field-day-fixed effects, and field-day ft is defined to be bad, $B_{ft} = 1 - G_{ft}$, otherwise.

The second step is to present evidence that the difference in productivity between a good and a bad field-day is greatest at the lowest quantiles of the conditional distribution of worker productivity. In other words, slow workers are more sensitive to changes in field conditions than fast workers. To do so, we estimate the following conditional distribution of the logarithm of residual productivity of isolated worker i on field f on day t, r_{ift}, at each quantile θ,

$$\text{Quant}_\theta(r_{ift}|.) = \delta_\theta G_{ift}, \tag{9}$$

where r_{ift} is worker i's residual productivity on field-day ft after controlling for standard worker–field-day and field-day factors as in specification (5). The $\widehat{\delta_\theta}$ coefficients, plotted in

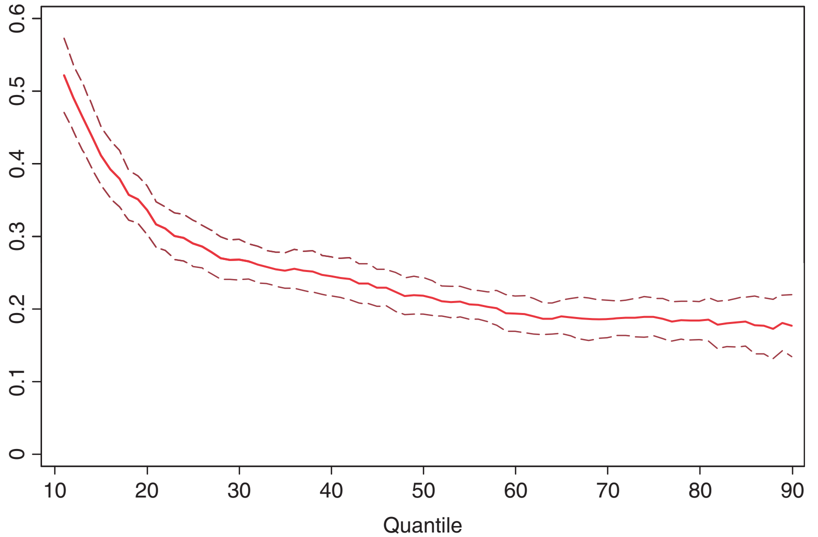

FIGURE 1

Heterogeneous effects of good and bad field-days

Notes: Each point on the solid line measures the effect of a "good" field-day at the respective quantile of workers' productivity, conditional on the worker's picking experience, the field life cycle and field fixed effects where all continuous variables are in logarithms. The dotted lines represent the 95% confidence interval. The sample is restricted to isolated workers. To classify field-days we retrieve the estimated field-day fixed effects from a regression of worker productivity on worker experience, worker fixed effects and field-day fixed effects. A field-day is classified as "good" if its estimated fixed effect is above the median.

Figure 1, are higher at lower quantiles than for higher quantiles, indicating, as discussed above, that differences in field-day conditions affect slow workers to a significantly greater extent, all else equal.[23]

The final step is to then use this classification of good and bad field-days to explore how the effect of the various relative ability measures varies between good and bad field-days. For our baseline measure of relative ability, we estimate the following panel data specification:

$$\begin{aligned} y_{ift} = \; & \alpha_i + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t \\ & + \varphi_1 A_{ift} D_{ift} G_{ft} + \varphi_2 A_{ift} D_{ift} B_{ft} + \varphi_3 (1 - A_{ift}) D_{ift} G_{ft} \\ & + \varphi_4 (1 - A_{ift}) D_{ift} B_{ft} + \vartheta G_{ft} + + u_{ift}, \end{aligned} \quad (10)$$

where all other controls are as previously defined, and the error terms are clustered by worker. The inequality aversion hypothesis implies that either fast workers decrease their productivity to a larger extent on bad field-days compared to themselves on good field days ($|\varphi_1| \leq |\varphi_2|$), and/or slow workers increase their productivity by a larger extent on bad field-days compared to themselves on good field-days ($\varphi_3 \leq \varphi_4$). This is because, on bad field-days the change in worker behaviour has to be larger to compensate for the fact that the variance of productivity across workers of different ability is naturally higher, as shown in Figure 1.

23. To focus on where the quantile estimates are precisely measured, Figure 1 shows $\widehat{\delta}_\theta$ from the 10th to the 90th quantiles. At the extremes of the distribution, still $\widehat{\delta}_\theta$ is monotonically decreasing–from 1.81 to 0.63 in the first 9 quantiles and from 0.19 to 0.15 in the last 9.

TABLE 6
Social incentives: socialization vs. inequality aversion

	(1) Rank	(2) Ability differential	(3) Share of friends
Friends on field-day × at least one friend more able than worker i × good field-day	0.152***		
	(0.031)		
Friends on field-day × at least one friend more able than worker i × bad field-day	0.060		
	(0.047)		
Friends on field-day × no friend more able than worker i × good field-day	−0.078**		
	(0.035)		
Friends on field-day × no friend more able than worker i × bad field-day	−0.109***		
	(0.041)		
Friends on field-day × worker i less able than the mean × log (ability differential) × good field-day		0.643***	
		(0.166)	
Friends on field-day × worker i less able than the mean × log (ability differential) × bad field-day		0.348	
		(0.267)	
Friends on field-day × worker i more able than the mean × log (ability differential) × good field-day		−0.365**	
		(0.154)	
Friends on field-day × worker i more able than the mean × log (ability differential) × bad field-day		−0.281**	
		(0.111)	
Friends on field-day × log (share of friends on field-day who are more able than i)× good field-day			0.272***
			(0.059)
Friends on field-day × log (share of friends on field-day who are more able than i)× bad field-day			0.133
			(0.091)
Friends on field-day × log (share of friends on field-day who are less able than i)× good field-day			−0.118**
			(0.055)
Friends on field-day × log (share of friends on field-day who are less able than i)× bad field-day			−0.128*
			(0.066)
Controls	Yes	Yes	Yes
Worker fixed effects	Yes	Yes	Yes
Observations	4081	4081	4081
Adjusted R^2	0.378	0.378	0.376

Notes: Dependent variable: log of worker's productivity (kg/hour) on the field-day. Standard errors in parentheses are clustered by worker. ***Denotes significance at 1%, **at 5% and *at 10%. Throughout we use observations only from workers who report having at least one friend and who work at least five field-days with and without friends. In all specifications, controls include the log of worker's picking experience, the log of the field life cycle plus one, a time trend and field-fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked on. Standard errors are clustered by worker throughout. To classify field-days we retrieve the estimated field-day fixed effects from a regression of log worker productivity on worker experience, worker fixed effects and field-day fixed effects. A field-day is classified as "good" if its estimated fixed effect is above the median.

In contrast the socialization hypothesis requires workers to keep the same pace rather than the same level of productivity, and is thus consistent with either ($|\varphi_1| \leq |\varphi_2|$) and ($\varphi_3 \leq \varphi_4$) if on bad field-days the difference in fruit availability across rows is smaller or with ($|\varphi_1| \geq |\varphi_2|$) and ($\varphi_3 \geq \varphi_4$) if on bad field-days the difference in fruit availability across rows is larger.

The evidence in Table 6 suggests that, in the presence of friends, pickers who are faster than their friends reduce their productivity at the same rate on good and bad field-days, that is $|\varphi_1| = |\varphi_2|$. In contrast, pickers who are slower than their friends increase productivity significantly more on good field-days $\varphi_3 \geq \varphi_4$. The results are qualitatively similar for all three measures of relative ability across Columns 1 to 3.

Taken together, these findings are in line with the joint hypothesis that friends want to minimize the physical distance between themselves and so be able to socialize, and that the difference between the availability of fruit across rows is larger on bad field-days. The evidence does not strongly support the hypothesis that friends want to minimize the inequality in their productivities. However, this test should be interpreted with care given that it is based on a joint hypothesis and the assumption that the difference between the availability of fruit across rows is larger on bad field-days cannot be tested directly.

6. SOCIAL INCENTIVES AND THE FIRM'S AGGREGATE PRODUCTIVITY

We now address the question of whether and how the existence of social incentives in this workplace affects aggregate firm performance. In this context the answer is not straightforward, precisely because the presence of friends increases the productivity of some workers and decreases the productivity of others. The net effect depends both on the number of workers for whom productivity decreases and increases and on the relative magnitude of the productivity changes.

To calibrate the impact of social incentives on aggregate productivity, we use the previously estimated average residual productivity of each worker in the absence of his friends, $\widehat{\alpha}_i^0$, and in the presence of his friends, $\widehat{\alpha}_i^1$. As the assignment of workers to friends is orthogonal to underlying determinants of productivity, aggregate productivity then depends on the workers' productivity with and without their friends, $(\widehat{\alpha}_i^1, \widehat{\alpha}_i^0)$, and on the share of days worked with and without friends. Denoting the share of field-days worker i has at least one friend present as s_i^1, and the share of field-days in which his friends are absent as s_i^0, aggregate productivity is therefore equal to

$$\sum_i (s_i^1 \widehat{\alpha}_i^1 + s_i^1 \widehat{\alpha}_i^0). \tag{11}$$

We can then use the estimates $\widehat{\alpha}_i^1$ and $\widehat{\alpha}_i^0$ to conduct thought experiments as to what would have been the aggregate productivity under different scenarios in which management varies the allocation of workers to their friends, namely varies s_i^1 and s_i^0 subject to $s_i^1 + s_i^0 = 1$ for each worker i. In each thought experiment, the benchmark comparison we make is what aggregate productivity would have been if workers were *never* assigned to work with their friends, namely if $s_i^1 = 0$ and $s_i^0 = 1$ for all i. The thought experiments rely on the twin identifying assumptions that have been emphasized throughout: (i) that the COO's assignment of workers to fields is not based on their friendship ties; (ii) that worker's productivity with and without friends is independent of the share of days spent working with friends.

In the first thought experiment, worker assignment is such that they *always* work alongside their friends, so $s_i^1 = 1$ and $s_i^0 = 0$ for all i. In this case, the distribution of worker ability is such that aggregate productivity would be 10% higher relative to the baseline scenario in which workers never work alongside their friends.

In the second thought experiment, worker assignment is such that workers who are more productive in the presence of friends always work with them and workers who are less productive in the presence of friends never work with them. Namely, we set $s_i^1 = 1$ if $\widehat{\alpha}_i^1 \geq \widehat{\alpha}_i^0$ and $s_i^0 = 0$ if $\widehat{\alpha}_i^1 < \widehat{\alpha}_i^0$. This is clearly a hypothetical scenario designed to capture what would happen if it were possible to mute the negative effects of social incentives. In this case, aggregate productivity would be 15.6% higher relative to the baseline scenario in which workers never work alongside their friends.

The final thought experiment is based on the observed allocation of workers to friends, namely the sample shares $\left(s_i^1, s_i^0\right)$ for each worker. This allocation generates a level of aggregate productivity which is 6.8% higher relative to the baseline scenario in which workers never work alongside their friends. However, the firm could have increased productivity by only 2.6% had they kept friends together at all times, relative to the allocation actually observed. Whether this would have increased profits, however, depends on the cost of assigning friends to the same fields in terms of reduced flexibility to adjust the workforce across fields within the same day.

Finally, the result that the net effect of social incentives on aggregate firm productivity is positive allows us to rule out another explanation, namely that behaviour is driven by friends wanting to insure each other against income shocks due to variation in the quantity of fruit on rows to which they are assigned. Under this hypothesis, the presence of friends does not affect workers' effort but rather abler workers simply transfer fruit to their less able friends as an insurance mechanism. If this were the case, however, aggregate productivity would be unchanged in the presence of friends, which is contrary to the evidence.[24]

7. CONCLUSION

This paper combines data from a firm's personnel records on individual worker productivity with a survey of each worker's social network of friends in the firm, to identify the causal effect of social ties on worker and firm performance. We find that the presence of friends affects worker's performance–these social incentives take the form of friends conforming to a common productivity norm that lies between the typical performances of the ablest and least able friends. The distribution of worker ability is such that the net effect of social incentives on the firm's aggregate performance is positive.

Our analysis has focused on identifying the effect of social incentives, holding monetary incentives constant. Importantly, in our setting, there are no externalities across worker effort that arise from either the production technology or compensation scheme in place. More generally, the form social incentives take, and how they interact with monetary incentives to solve agency problems, can be expected to vary in the presence of such externalities.

In terms of the interplay between social incentives and externalities arising from the production technology, Mas and Moretti (2009) present evidence on how supermarket cashiers are affected by co-workers' productivity. In that setting, the production technology is such that worker's effort imposes a positive externality on co-workers. Workers are, however, paid fixed hourly wages so there are no externalities arising from the monetary incentives in place. Using scanner-level data, they show that there exist positive productivity spillovers from the introduction of more productive workers into a shift, and that this effect is driven by low-productivity workers increasing their productivity in the presence of abler workers. They

24. Moreover, while workers might want to insure one another in this environment, this can be achieved more efficiently outside the field, using monetary or in-kind transfers, as documented in Table A2.

document that the underlying mechanism for the presence of social incentives in their setting is that workers are motivated by social pressure and mutual monitoring. As a consequence, social incentives help ease concerns over free-riding, which would normally arise in the presence of positive production externalities across workers.

The interplay between social and monetary incentives is likely to be important under compensation schemes that introduce positive externalities across worker's effort–such as team pay, or negative externalities–such as relative performance pay. While there exists evidence from laboratory settings consistent with such interactions being of first order, this remains a rich area in which to provide field evidence on in the future (Fehr and Falk, 2002; Fehr and List, 2004; Charness and Kuhn, 2007; Falk and Ichino, 2006).[25]

Finally, on the external validity of our results, there are specific aspects of the workplace we study that drive the formation of friendship ties and the nature of social incentives. In particular, the work and social environments are closely linked as individuals work and live on the farm. The process driving the formation of friendships might differ in settings with a higher degree of separation between the two. Assortative matching by ability might be more prevalent in other workplaces, which then limits the scope of there being heterogeneous social incentives of the form we document, as socially related workers would perform similarly in any case.

While the strength and type of social incentives are likely to depend on firm-specific features, the essence of the findings have general implications for the study of behaviour within firms. Other things equal, we document that some workers are willing to sacrifice earnings and others are willing to exert extra effort when working with colleagues they are socially connected to. Social incentives can thus reinforce or countervail classic incentive mechanisms, such as pay for performance, in solving agency problems. This has important implications not just for how workers will respond to a given set of monetary incentives, but also provides insights on the optimal compensation scheme that should be in place. This research agenda ties in with the growing literature on the relationship between intrinsic and extrinsic motivation (Frey and Oberholzer-Gee, 1997; Benabou and Tirole, 2003).

Finally, we have focused on the importance of social incentives–that arise from interpersonal comparisons–in understanding behaviour and how they interact with the production technology and monetary incentives in place. However, the relative importance of intrapersonal comparisons–such as those highlighted by theories of self-perception (Bem, 1967) and cognitive evaluation (Deci and Ryan, 1985)–––as drivers of individual behaviour within firms remains an open question.

APPENDIX A. IDENTIFICATION TESTS

Identifying the effect of the presence of friends on productivity relies on two assumptions: (i) the assignment of worker is orthogonal to unobserved determinants of productivity so $\text{cov}(F_{ift}, u_{ift}) = 0$, and (ii) there are no intertemporal productivity effects that spillover from field-days when friends are present to field-days when only non-friends are present, and *vice versa*.

25. The *level* of monetary incentives also matters even if such incentives introduce no externalities across worker efforts. For example, in a setting with low-powered incentives, reducing effort has negligible impacts on worker pay, so the level of any conformist norm is more likely to be set by the least able workers. In contrast, with sufficiently high-powered monetary incentives, social incentives can be harnessed to ensure that productivity norms are set by the most able workers.

A.1. *Friends' presence and field-day factors*

Two types of factors might generate $\text{cov}(F_{ift}, u_{ift}) \neq 0$: those that vary at the field-day, and those that vary at the worker–field-day level. To test for the relevance of field-day factors that invalidate our identification strategy, we exploit the fact that on every field-day we observe both connected and isolated workers–namely workers who report at least one friend, and workers who report having no friends in the firm. By definition, isolated workers are always observed working alongside co-workers they are not socially connected to, hence their productivity cannot be affected by social incentives. We first establish that connected and isolated workers are similar on observables, so the performance of isolated workers on the field-day can serve as a counterfactual for what would have been the performance of connected workers on the *same* field-day in the absence social incentives.

Table A5 examines whether isolated workers that report no friends are similar on observables to connected workers. Panel A shows that the mean and standard deviation of productivity, as well as the entire distribution of productivity, are not significantly different between connected and isolated workers. Isolated workers are not oversampled from either tail of the entire distribution of worker productivity. They do have more picking experience, although the difference is not statistically different from zero. Panel B repeats the findings from Table 1 that connected (isolated) workers are on average themselves named as a friend by 2.16 (1.49) other surveyed workers, and shows this difference to be significantly different from zero. This is as expected, given that, by definition, isolated workers report no friends and hence are less likely to have social ties with their colleagues.

Panel C shows that the two groups are of similar genders and ages, and are equally likely to have previously had paid employment in the past, study similar subjects in their home countries, and reside on the main living site on the farm. Hence those that report no friends do not do so because they are more physically isolated on the farm. The only difference in these observables is that isolated workers are less likely to be Polish, the main nationality among workers.

To provide direct evidence in support of the identifying assumption $\text{Cov}(F_{ift}, u_{ift}) = 0$, we test whether the share of friends present is correlated with field-day unobservables that have a similar effect on *all* workers on the field. To do so, we first run the following panel data regression for isolated worker i on field f on day t:

$$y_{ift} = \alpha_i + \lambda_f + \delta X_{ift} + \lambda Z_{ft} + \tau t + u_{ift}, \tag{A1}$$

where all variables are as defined in the main text. We then take each isolated worker's residual productivity from (A1), and estimate a locally weighted regression of each isolated worker i's residual productivity on field-day ft, on the share of connected workers on the field-day that have at least one of their friends present on the same field-day, S_{ft}. The result, presented in Figure A1a, shows that (i) the average effect of the share of connected workers on the field-day whose friends are present on the residual productivity of isolated workers is close to zero; (ii) the effect remains close to zero as the share of connected workers present with friends on the field-day varies over its entire support. Hence the data do not support the assertion that the allocation of connected workers to friends is correlated to field-specific determinants of productivity, because the productivity effects of such non-random assignment are not reflected in the performance of isolated workers that are also present on the same field-day.

While Figure A1a rules out that friends are more likely to work together when productivity is exogenously higher or lower *on average*, it may be that the COO non-randomly assigns connected workers to their friends on fields based on higher moments of the distribution of productivity. For instance, the presence of friends might be correlated to unobservables that reduce the variance of the distribution of productivity so that low-ability workers have higher productivity and high-ability workers have lower productivity compared to field-days with no friends. To check for this, we use quantile regression to estimate the effect of the share of connected workers with friends present on the field-day (S_{ft}) on different percentiles of the conditional distribution of the productivity of isolated workers, on the same field-day. In particular, we estimate the following conditional distribution of the logarithm of productivity of isolated worker i on field f on day t, y_{ift}, at each quantile $\theta \in [0, 1]$:

$$\text{Quant}_\theta(y_{ift}|.) = \phi_{\theta f}\lambda_f + \delta_\theta X_{ift} + \lambda_\theta Z_{ft} + \tau_\theta t + \mu_\theta S_{ft}, \tag{A2}$$

where all variables are as previously defined. The error terms are clustered by field-day because workers face similar field conditions and hence are subject to common productivity shocks. Bootstrapped standard errors based on 200 replications are calculated. The parameter of interest, μ_θ, measures the effect of the share of connected workers with friends present on the field-day at the θth conditional quantile of log worker productivity for isolated workers. Figure A1b graphs the estimates of μ_θ and the associated 95% confidence interval at each quantile.[26]

26. The quantile regression method imposes no distributional assumptions on the error term, which in our context relates to the distribution of ability and productivity shocks. This approach is particularly applicable to our context because the dependent variable, worker productivity, is electronically recorded and measured with little error.

TABLE A1
Characteristics of surveyed and non-surveyed workers

		Surveyed	Not surveyed	Difference (standard error)	Mann–Whitney test of equality of distributions
(A) Number (%) of workers		289 (51.7)	270 (48.3)		
(B) Productivity and work experience	Productivity (kg/hour)	8.75	8.82	0.070	[0.795]
		(0.152)	(0.165)	(0.225)	
	Total picking experience (field-days)	70.3	62.6	−7.65	[0.007]
		(3.36)	(3.35)	(4.74)	
(C) Friendship networks	Number of times mentioned as a friend by a surveyed worker	1.96	0.452	−1.51***	[0.000]
		(0.097)	(0.056)	(0.112)	
(D) Worker characteristics	Gender (female = 1)	0.453	0.422	−0.031	–
		(0.029)	(0.030)	(0.042)	
	Main nationality	Polish (55.4%)	Polish (56.7%)	–	[0.278]

Notes: Values are expressed in means, standard errors in parentheses and p-value on Mann–Whitney test in square brackets. ***Denotes significance at 1%, **at 5% and *at 10%. This data is obtained from the firm's recruitment survey, the firm's personnel records and the survey we administered to workers. A fruit picker is defined to be an individual that picks fruit on at least 14 field-days during the period of 1 May to 30 September 2004. Productivity refers to Type I fruit. Total picking experience is the number of field-days the worker picks Type I fruit on over the entire season. There are eight nationalities represented among the workers. The standard errors on the differences are estimated from running the corresponding least squares regression allowing for robust standard errors.

TABLE A2

The strength of ties by reported friendship number

Frequency of interaction by activity and friendship number (percentage)

			Go to supermarket together			Eat together			Lend/borrow money			Talk about problems		
Friendship number	Pre-existing friend	Reciprocal friend	Never	Sometimes/ often	Always	Never	Sometimes/ often	Always	Never	Sometimes/ often	Always	Never	Sometimes/ often	Always
1	63.8	54.3	24.8	31.1	44.0	24.1	31.6	44.3	35.9	34.4	29.7	27.1	27.5	45.4
2	42.8	43.3	24.7	44.4	30.9	32.8	35.7	31.0	44.2	34.4	20.8	27.4	43.6	29.1
3	38.9	37.7	30.5	49.4	20.1	34.7	42.3	21.8	47.0	39.6	12.7	29.5	47.0	23.5
4	33.1	24.4	25.0	55.4	19.6	32.1	42.9	24.5	50.5	39.6	8.91	27.9	49.6	22.5
5	38.0	18.3	30.0	60.0	10.0	50.0	37.5	12.5	73.2	19.6	7.14	37.1	43.6	19.4
6	40.7	16.7	21.3	55.3	23.4	43.5	45.6	10.9	62.2	24.4	11.1	28.3	45.6	26.1
7	40.5	8.11	36.4	48.5	15.2	43.8	46.9	6.25	72.4	24.1	3.45	35.3	44.1	20.6

Notes: All the information is derived from the survey we administered to workers. Each individual was asked to list up to seven of their friends on the farm. A pre-existing friend is defined to be an individual that was known before arriving on the farm, and a new friend is defined as a friendship tie that forms during the individual's stay on the farm. The friendship number reports whether the individual was listed as the first, second, etc. friend. We report for each friendship number, whether that friendship is an old or reciprocal friendship, whether the friendship is reciprocal, and for each activity type, the percentage of respondents that reported any given frequency of interaction.

TABLE A3
Social incentives: homogeneous effects–robustness checks

	(1) Manager heterogeneity	(2) Field-day heterogeneity	(3) Two weeks window	(4) Survey date interaction
At least one friend on field-day (= 1 if yes)	−0.004	−0.008	0.030	0.052
	(0.020)	(0.017)	(0.037)	(0.092)
At least one friend on field-day (= 1 if yes) × days since survey date				−0.009
				(0.031)
Controls	Yes	Yes	Yes	Yes
Worker fixed effects	Yes	Yes	Yes	Yes
Manager fixed effects	Yes	No	No	No
Field-day fixed effects	No	Yes	No	No
Observations	4792	4792	2412	4360
Adjusted R^2	0.322	0.608	0.327	0.316

Notes: Dependent variable: log of worker's productivity (kg/hour) on the field-day. Standard errors in parentheses are clustered by worker in all columns except Column 2 where they are clustered by field-day. ***Denotes significance at 1%, **at 5% and *at 10%. Throughout we use only observations from workers who report having at least one friend and who work at least five field-days with and without friends. In all specifications, controls include the log of worker's picking experience, the log of the field life cycle plus one, a time trend and field fixed effects. The field life cycle is the number of days the field has been picked up to any given date, divided by the total number of days over the season the field will be picked. The sample in Column 3 is restricted to the 2 weeks before and after the worker's survey date. Days since survey date are the absolute difference between date and the worker's survey date.

The estimates suggest the conditional distribution of productivity does not become less dispersed as the share of connected workers with friends on the field-day increases–the effect is not significantly different from zero at any quantile. Hence the data do not support the assertion that, for example, the COO assigns connected workers to work with their friends on fields that are later in their life cycle and there is less dispersion in the quantity of fruit available across rows.

Finally, we note that the COO also sets the piece rate each field-day. This is the same for all workers on a given field-day and is set as a function of field-day characteristics to minimize the firm's wage bill each field-day subject to a minimum wage constraint. The identification of social incentives would therefore be confounded if the piece rate were correlated to the presence of friends on the field-day. To assess whether this is a cause for concern, we estimate whether the composition of workers on the field-day predicts the piece rate on field-day ft, β_{ft}, using the following OLS regression:

$$\beta_{ft} = \lambda_f + \rho S_{ft} + \eta Z_{ft} + \mu R_t + \varepsilon_{ft}, \tag{A3}$$

where λ_f are field-fixed effects, S_{ft} reflect the social ties among workers on the field-day, Z_{ft} are other time-varying characteristics of the workers and field that determine expected productivity and hence the piece rate, and R_t are meteorological conditions on day t. The error terms ε_{ft} are assumed to follow a field-specific AR(1) process.[27]

The results in Table A6 show that (i) the share of isolated workers on the field-day has no significant effect on the piece rate; (ii) the share of connected workers with and without friends present has no significant effect on the piece rate; (iii) other factors that are positively correlated to average productivity are negatively correlated to the piece rate. This evidence underpins the analysis in that it allows us to provide evidence on the existence and form of social incentives, holding constant the monetary incentives workers face.

27. Factors that determine the productivity of the average worker in the field-day and are therefore controlled for in Z_{ft} include the field life cycle, the average picking experience of workers, the standard deviation of workers' picking experience, and the share of workers that are women that report playing sports at least once a month and that report their primary reason for coming to the farm as being the earnings, and the number of managers and workers on the field-day. We also control for a linear time trend and the following meteorological conditions at the day level in R_t: total rainfall and the average temperature on day t.

TABLE A4

Social incentives: heterogeneous effects–robustness checks

	(1) Manager heterogeneity	(2) Field-day heterogeneity	(3) Friends present	(4) Assignment	(5) Assignment, worker fixed effects
Friends on field-day × at least one friend more able than worker i	0.091**	0.069**			
	(0.035)	(0.030)			
Friends on field-day × no friend more able than worker i	−0.093***	−0.057**	− 0.246***		
	(0.029)	(0.026)	(0.063)		
Absolute difference in ability				−0.047	−0.005
				(0.059)	(0.100)
Controls	Yes	Yes	Yes	Yes	Yes
Worker fixed effects	Yes	Yes	Yes	No	Yes
Manager fixed effects	Yes	No	No	No	No
Field-day fixed effects	No	Yes	No	No	No
Observations (worker–field-day)	4081	4081	2267		
Observations (worker–friend–field-day)				10218	10218
Adjusted R^2	0.323	0.605	0.279	0.001	0.188

Notes: Dependent variable (Columns 1–3): log of worker's productivity (kg/hour) on the field-day. Dependent variable (Columns 4 and 5): dummy equals 1 if worker i and his friend j are present on the field-day, 0 otherwise. ***Denotes significance at 1%, **at 5% and *at 10%. Throughout we use only observations from workers who report having at least one friend and who work at least five field-days with and without friends. In all specifications, controls include the log of worker's picking experience, the log of the field life cycle plus one, a time trend and field fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked on. In Columns 4 and 5 the units of observation are worker i-friend j-field f-day t level. The dependent variable is equal to one if workers i and j are assigned together on field-day ft, and is zero otherwise. The absolute difference in ability refers to that between worker i and his jth friend.

TABLE A5

Characteristics of surveyed workers, by number of reported friends

		Report no friends	Report at least one friend	Difference	Mann–Whitney test of equality of distributions
(A) Productivity and work experience	Productivity, no friends present (kg/hour)	8.76	8.74	−0.022	[0.702]
		(0.273)	(0.183)	(0.328)	
	SD of productivity, no friends present (kg/hour)	3.68	3.71	0.029	[0.894]
		(0.129)	(0.101)	(0.163)	
	Total picking experience (field days)	77.1	67.3	−9.85	[0.174]
		(6.83)	(3.78)	(7.80)	
(B) Friendship networks	Number of reported friends	–	3.87		
			(0.140)		
	Number of times mentioned as a friend by another surveyed worker	1.49	2.16	0.669***	[0.001]
		(0.171)	(0.116)	(0.206)	
(C) Worker characteristics	Gender (female = 1)	0.471	0.446	−0.026	–
		(0.054)	(0.035)	(0.064)	
	Age (years)	22.1	22.1	−0.004	[0.620]
		(0.268)	(0.352)	(0.442)	
	Have had paid employment before (yes = 1)	0.840	0.859	0.019	––
		(0.041)	(0.025)	(0.048)	
	Main nationality	Polish (42.5%)	Polish (60.9%)	––	[0.071]
	Main subject studying	Social Science (37.1%)	Agriculture (32.9%)	–	[0.751]
	Live on main site on farm (yes = 1)	0.552	0.520	−0.032	–
		(0.054)	(0.035)	(0.064)	

Notes: Values are expressed in means, standard errors in parentheses and p-value on Mann–Whitney test in square brackets. ***Denotes significance at 1%, **at 5% and *at 10%. This data are obtained from the firm's recruitment survey, the firm's personnel records, and the survey we administered to workers. Each individual was asked to list up to seven of their friends on the farm. A fruit picker is defined to be an individual present that picks fruit on at least 14 field-days during the period of 1 May to 30 September 2004. Total picking experience is the number of field-days the worker picks fruit on over the entire season. There are eight nationalities represented among the workers, university subjects are classified into one of nine categories, and there are four living sites on the farm. The standard errors on the differences are estimated from running the corresponding least squares regression allowing for robust standard errors.

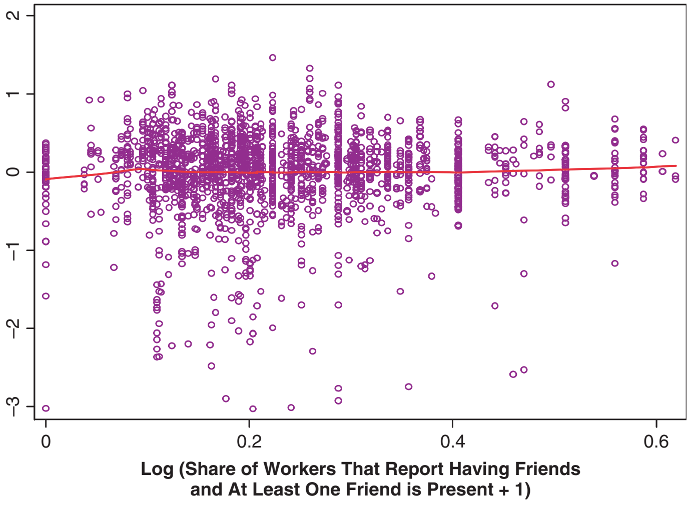

FIGURE A1a

Locally weighted regression of residual productivity on the composition of workers in the field

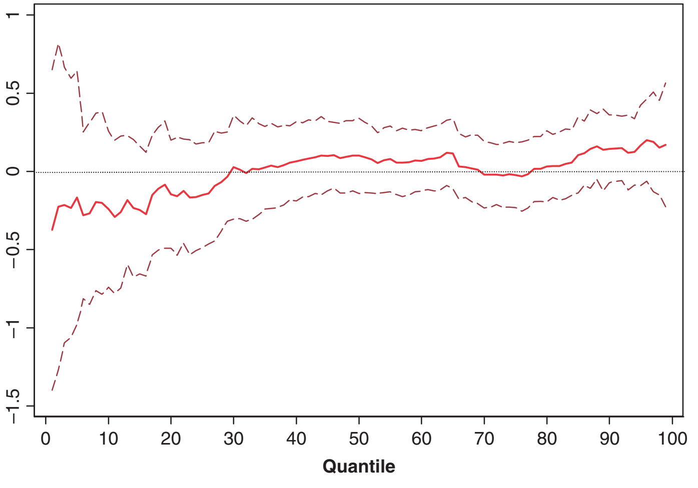

FIGURE A1b

The elasticity of worker productivity with respect to the share of workers who report having friends and at least one of their friends is present

Notes: Both figures are graphed for the subset of workers who report having no friends. Figure A1a is a locally weighted regression at the worker–field-day level, of the worker's residual productivity (in logs) on the log of one plus the share of workers on the field-day that report having at least one friend on the farm and at least one of their friends is present. The residual productivity is the residual from a regression of the worker productivity on the number of field-days of picking experience of the worker is controlled for, the field life cycle, a time trend, field fixed effects and worker fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked on. All continuous variables are in logs in this first stage. Figure A1b is derived from quantile regression estimates at the worker–field-day level, of worker productivity on the worker's picking experience, field life cycle, field fixed effects and the share of workers who report having friends and at least one of their friends is present on the field-day. All continuous variables are in logs. Figure 1b shows the associated 95% confidence interval where bootstrapped standard errors are estimated based on 200 replications and allowing them to be clustered by field-day.

TABLE A6
Monetary incentives

	(1) Isolated vs. connected	(2) Composition of connected workers
Share of workers who are isolated	0.098	
	(0.135)	
Share of workers who are connected, friends present		−0.033
		(0.140)
Share of workers who are connected, friends not present		−0.240
		(0.164)
Field life cycle	0.538***	0.518***
	(0.124)	(0.121)
Average picking experience of workers	−0.003***	−0.003***
	(0.001)	(0.001)
SD of picking experience of workers	−0.005***	−0.005
	(0.002)	(0.002)
Time trend	0.007***	0.007***
	(0.001)	(0.001)
Rainfall (mm)	0.008**	0.008**
	(0.004)	(0.004)
Minimum temperature (Celsius)	−0.003	−0.004
	(0.007)	(0.007)
Share of workers who are women	0.122	0.135
	(0.134)	(0.132)
Share of workers who play sports	−0.555***	−0.505***
	(0.170)	(0.174)
Share of workers who came for earnings	0.832***	0.783***
	(0.216)	(0.220)
Number of managers	−0.016	−0.018
	(0.018)	(0.018)
Number of workers	0.002	0.002
	(0.001)	(0.001)
Field fixed effects	Yes	Yes
R^2	0.646	0.642
Number of observations	496	496

Notes: Dependent variable = piece rate on field-day (£ per kilogram picked). Standard errors allow for field-specific AR(1). ***Denotes significance at 1%, **at 5% and *at 10%. All continuous variables are in logarithms. AR(1) regression estimates are reported. Panel corrected standard errors are calculated using a Prais-Winsten regression. This allows the error terms to be field specific heteroskedastic, and contemporaneously correlated across fields. The autocorrelation process is assumed to be specific to each field. The rainfall and minimum temperature measures correspond to a 0900–0900 time frame. The "play sports" variable is defined to be one if the worker reports playing sports at least once a month, and zero otherwise. The "came for earnings" variable is defined to be one if the worker reports one reason why they came to the farm is because the pay is good, and zero otherwise. Other options were "to travel and meet new people", "to learn English" and "it is part of my university course". These variables are then averaged across the workers on the field-day.

A.2. *Friends' presence and worker–field-day factors*

To test whether the presence of friends is correlated to worker–field-day unobservables that affect productivity, we test whether the assignment of workers to friends can be predicted by a host of worker characteristics that vary across field-days and by the workers' past performance. To do so, we focus on connected workers and define a dummy variable $D_{ift} = 1$ if worker i has at least one friend present on field-day ft, and $D_{ift} = 0$ otherwise. We then estimate the following specification to shed light on the determinants of when connected workers are assigned to work alongside their friends:

$$D_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + \lambda y_{ift-1} + u_{ift}. \quad \text{(A4)}$$

We control for worker-fixed effects α_i, to capture permanent differences in the likelihood workers are assigned to work with their friends, and we control for field-day-fixed effects λ_{ft} to capture (i) labour demand shocks that lead to changes in the number of workers on the field-day; (ii) field-day conditions that cause workers to lobby the COO to be able to work with their friends. We also control for time varying worker characteristics, X_{ift}, and the past performance of the worker, y_{ift-1}, defined as the worker's productivity on the previous field-day on which she picked. The error term u_{ift} is clustered by worker. The parameters of interest are δ and λ–these reflect how a connected worker's likelihood of working with her friends alters over time as she becomes more experienced say, and whether her previous performance influences her subsequent assignment to friends. The results are reported in Table A7.

Column 1 shows there is no relationship between a worker's picking experience and the likelihood she is assigned to work with her friends, and this remains true in Column 2 when we allow the relationship to be nonlinear. Column 3 then controls for the lagged productivity of worker i, y_{ift-1}. Reassuringly, there is no relationship between how a worker has performed in the immediate past and her subsequent assignment to friends. It is not therefore the case that workers whose productivity is above their long run average on a given field-day are rewarded by the COO by being assigned to their friends on the subsequent field-day.[28]

A.3. *Intertemporal spillovers*

The second assumption required for the identification of social incentives in this setting is that there are no within-worker inter-temporal spillovers on behaviour from field-days in which friends are absent onto field-days on which at least one of them is present, and vice versa. To check for such effects, we estimate the following panel data specifications for connected workers, restricted to field-days in which connected worker i has no friends present on the field-day ($D_{ift} = 0$), or has at least one friend present on the field-day ($D_{ift} = 1$):

$$y_{ift} = \alpha_i^0 + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift} \text{ if } D_{ift} = 0, \quad \text{(A5)}$$

$$y_{ift} = \alpha_i^1 + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift} \text{ if } D_{ift} = 1. \quad \text{(A6)}$$

X_{ift} now additionally controls for worker i's previous assignment to her friends. The results in Table A8 show that on field-days in which no friends are present, worker i's productivity is uncorrelated to (i) the log of the cumulative number of field-days she has previously worked with friends (Column 1); (ii) whether she has worked with friends on the *previous* field-day (Column 2), or two field-days ago (Column 3). Columns 4 to 6 estimate (A6) to check for within-worker productivity spillovers from field-days on which friends are absent onto field-days on which at least one friend is present.

Reassuringly, the data do not support the hypothesis that there are within-worker productivity spillovers from field-days in which friends are absent onto those in which friends are present, and vice versa. This is true in terms of the overall exposure of working with and without friends, as well as short-run spillovers from one field-day to the next. Hence a comparison of workers' behaviour in the presence of friends relative to when all friends are absent can be informative of the existence and nature of social incentives in this setting.

A.4. *Friends' relative ability and worker–field-day factors*

To shed light on whether the presence of friends of higher and lower ability than worker i is correlated to worker–field-day unobservables that affect productivity, we analyse whether this can be predicted by a host of worker characteristics that vary across field-days and by the workers' past performance. To do so, we focus on connected workers on the subset of field-days when friends are present. The dependent variable is our baseline measure of relative ability A_{ift}, which is equal to 1 if worker i is the most able among the group of friends on the field-day, and equal to 0 if at least one more able friend is present. We then estimate the following specification to shed light on the determinants of when connected workers are assigned to work alongside less vs. more able friends:

$$A_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + \lambda y_{ift-1} + u_{ift}. \quad \text{(A7)}$$

28. We also experimented with longer lags for productivity because it may take time for the COO to learn about the productivity of a given worker on a given field-day. If two lags are introduced, the coefficient (standard error) on the first lag is −0.002 (0.001) and on the second lag is −0.002 (0.002), and neither lag is different from zero at the 10% level.

TABLE A7

Predictors of friends being present on the field-day

	(A) Assignment to friends			(B) Assignment to friends of lower ability		
	(1) Experience	(2) Experience squared	(3) Lagged performance	(4) Experience	(5) Experience squared	(6) Lagged performance
Picking experience (field-days)	0.000	−0.003	−0.004	−0.002	−0.000	0.000
	(0.001)	(0.002)	(0.002)	(0.001)	(0.005)	(0.005)
Picking experience squared		0.000	0.000		0.000	−0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Lagged productivity (kg/hour)			−0.002			−0.003
			(0.001)			(0.002)
Absolute difference in ability						
Absolute difference in ability × time trend						
Time trend						
Mean of dependent variable	0.644	0.644	0.638	0.435	0.435	0.444
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Field-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.497	0.499	0.511	0.871	0.871	0.871
Observations (worker–field-day)	7404	7404	6553	3596	3596	3160

Notes: Dependent variable (Columns 1–3): dummy equals 1 if worker has at least one friend present on the field-day, 0 otherwise. Dependent variable (Columns 4–6): dummy equals 1 if worker i has no friend more able than himself present on the field-day, 0 if there is at least one friend of lower ability present. Linear probability model, standard errors in parentheses are clustered by worker i. ***Denotes significance at 1%, **at 5% and *at 10%. Throughout we use only observations from workers who report having at least one friend and who work at least five field-days with and without friends. The dependent variable in Columns 1–3 is a dummy variable equal to one if worker i has at least one friend present on the field-day, and zero otherwise. The dependent variable in Columns 4–6 is a dummy variable equal to one if worker i has no friend more able than herself present on the field-day, and equal to zero if there is at least one friend of higher ability on the field-day. For each worker, there are up to $n(i)$ observations for friends on each field day, where $n(i)$ is the number of friends reported by worker i. A linear probability model is estimated in all columns. The lagged productivity of worker i is her productivity on the last field-day on which she picked. The picking experience is the cumulative number of field-days for which the worker has picked fruit.

TABLE A8
Intertemporal productivity spillovers

	Friends not present on field-day			Friends present on field-day		
	(1)	(2)	(3)	(4)	(5)	(6)
Cumulative number of field-days have worked with friends	−0.079			−0.063		
	(0.074)			(0.080)		
Worked with friends on previous field-day (Yes = 1)		−0.051	−0.034		−0.022	−0.018
		(0.040)	(0.039)		(0.029)	(0.030)
Worked with friends two field-days ago (Yes = 1)			−0.035			0.011
			(0.036)			(0.026)
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Field fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.335	0.339	0.343	0.300	0.309	0.303
Observations (worker–field-day level)	2637	2593	2544	4767	4600	4443

Notes: Dependent variable: log of worker's productivity (kg/hour) on the field-day. Standard errors in parentheses are clustered by worker. ***Denotes significance at 1%, **at 5% and *at 10%. Only connected workers are used for the analysis throughout. The dependent variable is the log of worker productivity on the field-day, measured in kilograms of fruit picked per hour. In all specifications the following controls are included–the log of the number of field-days of picking experience of the worker, the log of the field life cycle plus one, a time trend and field fixed effects. The field life cycle is the number of days the field has been picked for up to any given date, divided by the total number of days over the season the field will be picked on. Columns 1–3 (4–6) are restricted to the subsample of field-days in which worker i has no friends present (at least one friend present) on the field-day. In Columns 1 and 4 the logarithm of the cumulative number of field-days that the worker has worked with friends is also controlled for. In Columns 2 and 5 (3 and 6) we also control for a dummy variable equal to one if the worker worked with at least one friend on the previous field-day (two field-days ago) and equal to zero otherwise.

TABLE A9
The formation of friendships

	(1) Ability measure	(2) Baseline	(3) Discrete ability measure
Absolute difference in ability	1.04	0.909	
	(0.105)	(0.111)	
Both above or below median ability			1.20
			(0.244)
Same nationality		14.7***	14.5***
		(8.60)	(8.31)
Same living site		9.71***	9.63***
		(2.74)	(2.72)
Same arrival cohort		14.3***	14.00***
		(4.10)	(4.05)
Same gender		1.80***	1.77**
		(0.413)	(0.407)
Same subject study		3.94***	3.93***
		(0.931)	(0.927)
Both have done paid work before		1.37	1.39
		(0.342)	(0.346)
Both play sports		1.01	1.00
		(0.218)	(0.216)
Observations	9591	9591	9591

Notes: Dependent variable: dummy equals 1 if worker i reports j as a friend, 0 otherwise. Logit regressions, log odds ratio reported. Standard errors in parentheses are clustered by worker i. ***Denotes that the log odds ratio is significantly different from one at 1%, **at 5% and *at 10%. Log odds ratios are reported throughout. The dependent variable is a dummy variable equal to one if worker i reports worker j as being a friend in the workplace, and zero otherwise. All controls are dummy variables except the absolute difference in the exponent of worker i and worker j's ability which is continuous. This continuous variable is divided by its standard deviation so that one unit increase can be interpreted as an increase by one standard deviation. In Column 3 we use a dummy variable to measure the ability differential between workers. This is defined to be equal to one if both workers are either above or both below the median ability of all workers, and zero otherwise. In all columns the sample is based on workers for whom an ability measure is constructed. There are 138 workers in this sample. Throughout we use only one observation for each pair of workers (i, j). When individuals arrive to the farm they are consecutively assigned a worker number. Workers are defined to be of the same arrival cohort if they are assigned worker numbers within five of each other. There are four sites on the farm in which workers can potentially reside. This is used to build to the "same living site" variable. Workers are defined to play sports if they report playing sports at least once a month.

We control for worker-fixed effects α_i to capture permanent differences in the likelihood workers are assigned to work with less able friends, such as differences due to worker i's ability. We control for field-day-fixed effects λ_{ft} to capture field-day conditions that cause workers to lobby the COO to be assigned to less able friends. We also control for time-varying worker characteristics, X_{ift}, and the past performance of the worker, y_{ift-1}, defined as the worker's productivity on the previous field-day on which she picked. The error term u_{ift} is clustered by worker. The results, reported in Columns 4–6 of Table A7, show the probability the COO assigns a worker to a friend of higher or lower ability is uncorrelated to worker–field-day-specific variables such as the worker's picking experience and lagged performance.

A.5. *Friendship formation*

We analyse the process of friendship formation to assess whether friends match by ability. We first define a dummy variable $l_{ij} = 1$ if worker i reports j as a friend, $l_{ij} = 0$ otherwise. The sample consists of one observation per pair of workers (i, j) where i and j are both surveyed and have ability measures constructed for them. There are 138 workers in this sample with 9591 potential worker friendship pairs defined. We then estimate the following logit regression:

$$Pr(l_{ij} = 1) = \Lambda(\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|, X_{ij}), \tag{A8}$$

where $Pr(l_{ij} = 1)$ is the probability that $l_{ij} = 1$, $\Lambda(.)$ is the logistic CDF, $\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|$ is the absolute difference in worker i and j's ability, measured in kilograms per hour, and X_{ij} are measures of similarity between i and j. Table A9 presents the results where the coefficients are presented as log odds ratios with the z-statistic for the test against the null hypothesis that the odds ratio is equal to 1, and standard errors are clustered by worker i. The absolute difference in ability is divided by its standard deviation so that the coefficient can be interpreted as the change in the odds of two workers forming a friendship with a one standard deviation change in their absolute ability differential.

Column 1 first estimates (A8) controlling only for the ability differential. The result shows workers are not more likely to form friendships with those of similar ability to them–the odds ratio on the absolute difference in the workers ability is 1.04 and is not significantly different from one.

Column 2 additionally controls for other factors that are likely to drive the formation of friendships. We include whether workers are of the same nationality, live on same site on the farm, and have joined the farm at the same time. Intuitively, friendships are more likely to form among individuals who share the same culture and language, who live in close proximity to each other, and who arrive in the same cohort. We also control for whether workers are of the same gender, study the same subject in their home country, have both had paid employment before, and both report playing sports at least once a month. This last control is designed to pick up whether the individuals are of similar physical fitness and so might work at similar speeds on a field.[29,30]

Column 2 shows that workers are significantly more likely to form new friendships with others that are similar to them–along nearly each dimension, the odds ratios are significantly greater than 1, so there is strong evidence of assortative matching along the lines of nationality, living site, arrival cohort, gender, and subject studied. In common with the literature on the formation of social networks, the homophyly principle holds in this setting (McPherson *et al*., 2001; Marmaros and Sacerdote, 2006). The odds ratios along other dimensions show that workers are *not* more likely to form new friendships with those who have similar employment histories, nor with those that play sports to the same extent. This hints at the possibility that workers do not purposively seek out others from whom they might learn to improve their workplace performance in this particular setting. In this specification, the odds ratio on the workers' ability differential remains close to 1, suggesting that for any given pair of workers, their similarity in ability is not strongly correlated with their similarity along other observable dimensions.

Column 3 replaces the continuous ability differential with a similarity indicator that equals 1 when both workers i and j are either below or above the median of the ability distribution of all workers. The coefficient is then directly comparable to those on the other binary outcomes, X_{ij}. The qualitative conclusions are unchanged–the ability coefficient is precisely estimated and very close to 1, indicating that the odds of i and j being friends are similar regardless of whether or not they belong to the same half of the ability distribution.[31]

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29. Workers are housed in caravans that accommodate between four and six workers. When workers first arrive, they are allocated to a particular caravan on the basis of (i) the spaces available in caravans, which varies as workers arrive and depart over the season; (ii) the number of individuals that arrive simultaneously, so that if two workers arrive on a given day they are more likely to be housed in a caravan that has two spare places in it than in another caravan, all else equal.

30. Workers arrive to the farm throughout the fruit-picking season. The median worker arrives in mid-May and the last cohort arrive in late June. Upon arrival to the farm, workers in the same arrival cohort attend an induction programme that provides a range of information to workers related to job tasks, health and safety regulations, methods of payment, and local amenities. Hence, workers that arrive in close proximity to each other are more likely to attend the same induction programme, and therefore are more likely to befriend each other, all else equal. When individuals arrive to the farm, they are consecutively assigned a worker number. Workers are defined to be of the same arrival cohort if they are assigned worker numbers within five of each other.

31. We also found no robust evidence that within each quartile of the ability distribution, workers form friendships with others of similar ability.

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