SOCIAL INCENTIVES IN THE WORKPLACE*

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Abstract

We combine 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. In this setting there are no externalities across workers due to the production technology or compensation schemes in place, so that if a worker's behavior is influenced by the presence of her friends this is indicative of there being social concerns of some kind. We find evidence of such social incentives, namely the presence of friends affects worker's performance. Friends conform to a common productivity norm that lies between the typical performances of the most and least able friends. 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 forgo 10% of their earnings on average to conform to the norm; (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 meet the norm. The distribution of worker ability is such that the net effect of social incentives on the firm's aggregate performance is positive. The results shed light on whether and how firms can use alternatives to monetary incentives to motivate workers.

Keywords: conformism, social incentives, social networks.

JEL Classification: L2, M5.

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1 Introduction

Individuals are embedded in a network of social relationships that shape their incentives and constraints, and ultimately affect their behavior and outcomes. In the labor 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]

This paper presents evidence on whether and how workers' social ties in the workplace effect their individual performance and the performance of the firm as a whole. To do so 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 on 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 behavior 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' behavior places no externalities onto their co-workers. This allows us to assess whether workers' behavior 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

[1] In relation to the first literature, Granovetter's [1974] seminal study finds 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 labor 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 behavior and sociology have 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].

[2] The interplay between social relations and worker behavior has long been studied [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, in settings mostly related to education [Angrist and Lavy 1999, Hoxby 2000, Krueger 1999, Sacerdote 2001].

effect of social incentives is *a priori* theoretically ambiguous.[4]

On the one hand, the presence of friends might generate contagious enthusiasm, provide positive role models, or generate incentives to compete to be the best in the group. All these mechanisms would cause a worker being more productive in the presence of friends relative to when she only works alongside 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 presence of friends might have different effects on different workers, for instance if groups of friends conform to a common norm that is in between the natural productivity level of the most and least productive friends in the network.

Our analysis yields four findings. First, the effect of social incentives differs 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 analyze 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.

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 on average to conform to the norm; (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 meet the norm. 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 test whether workers respond to variations in the cost of conformism. To do so we analyze whether workers' behavioral response to social incentives depends on the net marginal benefit of effort. We find that on 'good' field-days, when fruit is plentiful so that the opportunity cost of slowing down in terms of lost earnings is higher and the benefit of speeding up is greater, the level of the norm is higher compared to 'bad' field-days when the quantity of fruit is low. Namely, on good field-days fast workers slow down less, and slow workers work harder, to conform with their friends.

[4]Our analysis therefore complements three strands of the literature. The first examines the interplay between workers' behavior in the presence of production technologies that cause there to be externalities of worker effort on co-worker's behavior [Ichino and Maggi 2000, Mas and Moretti 2006]. The second explores the interplay between workers' behavior within firms when the compensation schemes in place cause there to be an externality of worker's effort on the pay of their co-workers, such as relative performance evaluation [Ehrenberg and Bognanno 1990, Bandiera *et al* 2005] or team pay [Jones and Kato 1995, Knez and Simester 2001, Hamilton *et al* 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 2006, Falk and Ichino 2006].

The balance of evidence thus suggests – (i) workers' response to social incentives depend on their ability relative to their friends so that groups of friends conform to a common norm; (ii) the level of the norm is increasing in the marginal benefit of effort.

Third, the form social incentives take in this setting implies high ability workers lose earnings when working alongside their low ability friends, and low ability workers exert more effort in the presence of high ability friends. Hence the costs of conforming are greater for pairs of friends that have a higher ability differential, all else equal. We therefore assess whether workers minimize such costs of conformism by befriending others who are of similar ability. We find other factors dominate – friendships are formed on the basis of similarity between workers on dimensions such as gender and nationality. Although the cost of conformism is lower for friends of similar ability, we find the ability differential between workers is not a predictor of them forming a friendship.[5]

Finally, 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 are 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 simple framework from which to understand how social incentives within the workplace might affect individual behavior. Section 3 describes our empirical context and data. Section 4 presents evidence in support of our identifying assumptions. Section 5 identifies the effect of social incentives on workers' productivity. Section 6 presents evidence on how workers' behavior responds to variations in the cost of conformism. Section 7 measures the impact of social incentives on the firm's overall performance. Section 8 concludes. Further robustness checks are in the Appendix.

[5] The principle that similarity between individuals on their socioeconomic and behavioral 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 *et al* 2001].

2 Conceptual Framework

We present a framework, tailored to our setting, that provides a basis from which to understand how social incentives can influence individual behavior. Suppose any given worker i exerts $e_i \geq 0$ units of effort which, without loss of generality, equals her productivity. Worker's are assumed heterogenous in their effort costs, $\frac{\theta_i e_i^2}{2}$, where θ_i is inversely related to i's ability. In our setting, the production technology is such that each worker's effort places no externalities on co-workers. Workers are paid a piece rate β per kilogram of fruit picked so there are also no externalities of worker's effort on co-workers arising from the compensation scheme. Hence the benefit derived from pay, denoted $\phi(\beta e_i)$, is solely a function of own effort and the piece rate. In the absence of social incentives worker i's optimal effort choice is,

$$e_i^* = \arg\max \left(\phi(\beta e_i) - \frac{\theta_i e_i^2}{2} \right). \tag{1}$$

We explore whether and how worker behavior is affected by social incentives, namely concerns she has over those in her network of friends. To shed light on this we follow Kandel and Lazear [1992] and introduce a peer pressure function for worker i that depends on co-workers' efforts. In the later empirical analysis we analyze worker i's behavior in two settings – (i) when her friends are physically present, as well as other workers that are not reported to be friends of i being present; (ii) when only non-friends of worker i are present. To therefore tie this framework closely to the empirical analysis we model the peer pressure function as depending on worker i's effort, the effort of the set of friends that are physically present, $e_{n(i)}$, and the effort of other co-workers that are physically present but are not friends of i, $e_{-n(i)}$. The pressure function is then denoted $P(e_i, e_{n(i)}, e_{-n(i)})$.[6]

With social incentives there are two effort choices of worker i that are of interest – (i) in the presence of her friends as well as non-friends, e_i^n; (ii) in the absence of her friends and presence only of non-friends, e_i^{-n}. These are given by the following two expressions respectively,

$$\begin{aligned} e_i^{n*} = &\quad \arg\max \left(\phi(\beta e_i) + P(e_i, e_{n(i)}, e_{-n(i)}) - \tfrac{\theta_i e_i^2}{2} \right), \\ e_i^{-n*} = &\quad \arg\max \left(\phi(\beta e_i) + P(e_i, e_{-n(i)}) - \tfrac{\theta_i e_i^2}{2} \right). \end{aligned} \tag{2}$$

The empirical strategy we set out later is designed to identify the difference in worker i's behavior in the presence of her friends, and in the presence only of non-friends, which relates to the difference between e_i^{n*} and e_i^{-n*}. In the absence of social incentives, workers i's optimal effort choice, e_i^*, is independent of whether friends of i are physically present or not. This follows from there being no

[6] Levy-Garboua *et al* [2006] review the literatures in biology and psychology that delves deeper into understanding the formation of such social concerns. Fehr and Falk [2002] review the experimental evidence on the importance of such concerns in laboratory labor market settings. Rotemberg [2006] reviews the theoretical literature and field evidence from the organizational behavior literature on the effects within firms of individuals having two specific types of social concern – altruism and reciprocity.

externalities across worker efforts through either the production technology or compensation scheme. However, with social incentives, worker effort generally differs in the presence of friends relative to when only non-friends are present, so $e_i^{n*} \neq e_i^{-n*}$, but the precise way in which workers' behavior is affected depends on the properties of the peer pressure function. There are three cases to consider.

First, working alongside friends might make work more enjoyable, generate contagious enthusiasm among friends, provide positive role models, or generate incentives to compete to be the best in the network of friends. All such mechanisms, that effectively increase the net benefits of effort, imply workers exert more effort in the presence of their friends relative to themselves when they work in the absence of their friends. Hence $e_i^{n*} \geq e_i^{-n*}$ for all workers irrespective of their underlying ability. While the *magnitude* of the difference in efforts of any given worker with and without her friends may differ with her underlying ability, the key prediction of this class of social incentive model is that the *sign* of the difference is the same for all workers.

Alternatively, working with friends might create contagious malaise, or lead to low effort norms within friends. All such mechanisms, that effectively decrease the net benefits of effort, imply workers exert less effort in the presence of their friends. Hence $e_i^{n*} \leq e_i^{-n*}$ for all workers and again, while the *magnitude* of this difference might differ with worker ability, the *sign* is the same for all workers.

Finally, the presence of friends might have heterogeneous effects across workers in that some exert more effort in the presence of their friends relative to when they work solely with non-friends, and others exert less effort. For example, friends may conform to a common norm [Bernheim 1994], or workers might be averse to pay inequality within their network [Fehr and Schmidt 1999, Charness and Rabin 2002]. In either case, relative to when they work only with non-friends – (i) low ability workers exert more effort in the presence of their friends, and; (ii) high ability workers exert less effort in the presence of their friends.

If such mechanisms are at play, then the effects of social incentives on behavior 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 be able to explore such mechanisms in detail. To do so we exploit the fact that the precise subset of friends of worker i that are present varies over time.

In particular suppose i has one subset of friends, $n'(i)$, that are of lower ability than her, and another subset of friends, $n''(i)$, that are of higher ability. Social incentives can then imply there are heterogenous effects on behavior within the *same* worker as her ability relative to the subset of friends present varies. Relative to when she works only with non-friends – (i) her productivity is significantly higher when working with the subset of friends $n''(i)$; (ii) the productivity of the same worker is significantly lower when working with another subset of friends $n'(i)$.

This framework provides a set of predictions that open up the possibility of empirically identifying the existence of social incentives, and to rule out classes of models that are not empirically supported.

3 Context and Data

3.1 Workplace Operations

We analyze the behavior 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 three and six 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 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 worker's 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 labor and hence the number of workers varies across fields at any given moment in time, and within a field over time. In addition, there are shocks to the demand for picking labor within a day as orders from supermarkets for fruit 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.

[7] To be recruited, individuals must be full-time university students and have at least one year remaining before graduation. Workers are not typically hired from the local labor 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 workers productivity would increase in the presence of their friends, and that this effect is unlikely to be long lasting. As documented later, we do not find any evidence in support of such spillovers which is intuitive given the nature of the task workers undertake in this setting.

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 twenty workers. In particular they 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]

There is considerable variation in the quantity of fruit across rows within a field for two reasons. First, there is natural variation in the quantity of fruit on different plants. Second, some rows are closer to pillars that support the plastic covering over the field. These pillars are placed between every fifth row. On rows close to pillars, air circulation is worse and hence heat tends to accumulate. These rows therefore have lower quantities of fruit in them, and in addition, they are harder to pick due to the presence of the supporting pillars. These factors reduce the marginal productivity of worker's effort in these rows, other things equal. The fact that pillars are placed every five rows also implies that good rows – those with higher quantities of fruit – are interspersed with bad rows.

If managers assign groups of friends to contiguous rows, it is therefore unlikely they are all assigned to rows that are either abundant with, or lacking in, fruit. If on the other hand, managers assign groups of friends to similarly plentiful rows, then necessarily friends will be physically separated within the field. All else equal, this would mitigate against finding evidence of some forms of social concern driving behavior, 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.

[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.

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 May 1st until September 30th 2004.

The second data source is a survey we administered to workers. This provides information on each workers' socioeconomic background, characteristics, and self-reported social network of friends on the farm. Workers are generally surveyed around two weeks after their arrival, thus allowing time for new social ties to form and be reported. Each worker is surveyed once. To be precise, individuals were asked to name up to seven of their friends on the farm. For each named friend, workers report whether the social tie existed prior to the individuals 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. Hence the peer group of friends of each worker is self reported and specific to the worker.[10]

3.5 Sample Selection

The worker survey is administered on three different dates over the peak picking season. The survey is administered in the evening after workers have returned from the fields. We aimed to interview all workers present on the survey date, and obtained a 95% response rate. Workers who were not present on the living site – 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 that are interviewed and those that were present on survey day but were not interviewed. 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. Hence it is not the case that surveyed workers are oversampled from either tail of the productivity distribution. 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.

[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 worker's productivity, including those not interviewed in our survey.

3.6 Reported Friendships

Table 1 shows the pattern of self-reported friendship ties within the workplace. We see 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. The first reported friend is whom the worker interacts with most frequently along all dimensions, followed by the second reported friend, and so on. The first named friend of i is also most likely to be a pre-existing friend and themselves report i as a friend of theirs. The high frequency of interaction between friends outside of the work environment implies friendship networks may be qualitatively more important drivers of behavior 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 either by forms of social interaction or the probability the relationship is reciprocal – decreases as they are reported later in the survey.[13]

[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 zero to six across surveyed workers.

[13] Those that report seven friends, and those that report less than seven, are of similar nationalities, genders, ages, and spend a similar number of days on the farm in total. The later empirical results are also robust to dropping workers that name exactly seven friends.

4 Identification

The workplace we study has two key features that make it well suited to identify whether social incentives exist among workers. First, the production technology and the pay schemes are such that worker's effort places no externalities onto their co-workers. Hence there should be no behavioral response among workers to the presence or specific identities of their co-workers, other than because of social concerns of some kind. Second, we observe each worker both on field-days in which they work alongside their friends as well as non-friends, and on field-days in which they work without any of their friends and only with non-friends.

This variation allows us to identify the causal effect of the presence of friends on workers' performance under the identifying assumption that the assumption that the assignment of workers to their friends across field-days is orthogonal to unobserved determinants of workers' performance. Two types of factors might invalidate this empirical strategy.

The first are factors that affect the performance of *all* workers on the same field-day. For instance if the COO assigns individuals to work alongside their friends on field-days in which productivity is naturally lower, this generates a spurious negative correlation between the presence of friends and workers' productivity. In Sections 4.1 and 4.2 we present evidence against there being field-day specific factors that drive both the assignment of workers to their friends and worker productivity.

The second are factors that *differentially* affect workers on the same field-day. For instance, if the COO assigns individuals to work with their friends on field-days in which they feel particularly motivated or less tired, this generates a spurious positive relationship between worker performance and the presence of friends even in the absence of any social incentives. In Section 4.3 we present supportive evidence against there being worker-field-day specific factors that drive both the assignment of workers to their friends and worker productivity.

An additional assumption required to identify social incentives in this setting is that there are no intertemporal spillovers on worker behavior 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 behavior in one scenario is affected by exposure to the other. Section 4.4 presents evidence in support of this identifying assumption.[14]

[14] These identifying assumptions are analogous to those in the program evaluation literature [Heckman *et al* 1999]. In this context, the treatment individuals are subject to is 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 behavior on field-days in the absence of all friends.

4.1 Descriptive Evidence on the Assignment of Workers

To present evidence in support of the identifying assumption that there are no field-day specific factors that determine both the assignment of workers to their friends and worker productivity, we exploit the fact that on every field-day we observe both connected and isolated workers – namely those that report at least one friend, and those that report having no friends in the firm. 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 their friends. We then test whether the productivity of isolated workers is affected by the share of connected workers who have friends on the field. The intuition is that if connected workers are assigned to friends on field-days with characteristics that make productivity exogenously higher or lower, these characteristics should affect the productivity of the isolated workers that are also present on the field-day.

Table 2 examines whether the 87 workers that report no friends are similar on observables to the 202 workers that report at least one friendship tie. 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.

Panel C shows the two groups are of similar genders, ages, are equally likely to have previously had paid employment in the past, study similar subjects in their home countries, and are equally likely to 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 slight difference in these observables is that isolated workers are less likely to be Polish, the main nationality among workers.

Table 3 presents descriptive evidence on whether field-days when connected workers work alongside their friends differ from those when their friends are absent. We report field-day characteristics when connected workers are observed with and without their friends in Columns 1 and 2 respectively, and we present the same evidence for isolated workers in Column 3. The first row shows that of the 202 connected workers, 167 (195) of them are observed picking on field-days when none (at least one) of their friends is present in the same field-day. The second row provides the number of worker-field-day observations over the peak picking season that fall into each of the three groups. The next row shows that on average, connected workers pick for around 16 field-days on which their friends are absent, and an additional 24 field-days in the presence of friends. In comparison, isolated workers are observed picking for 44 field-days in the sample.

Overall, connected workers pick fruit in the presence of their friends for around two thirds of all

field-days on which they work. There is however considerable variation both in the likelihood that at least one friend is present both across connected workers on the same field-day, and within the same connected worker over field-days.

Column 2 shows that conditional on friends being present, 2.09 friends are present on the same field-day. As 3.87 friends are named on average (Table 1), this corresponds to 54% of all friends being present on field-days when at least one friend is present. As expected, there is considerable variation in this statistic across connected workers on the same field-day, and within the same worker over field-days. The next row shows that connected workers are more likely to work with their friends when they have less picking experience. Hence it is important to directly control for picking experience to avoid confounding the effect of work experience from any effects of the presence of friends.

The remaining rows of Table 3 compare field-day characteristics when the friends of connected workers are present or not. As is intuitive, friends are more likely to be present on larger fields because they are picked by more workers. Reassuringly, the number of workers in the fields is no different between when connected workers pick in the absence of their friends and those fields picked on by isolated workers. The final row reports on the field life cycle for each group. This is defined as the nth day the field is picked divided by the total number of days the field is picked over the season. This captures the natural within-field trend in productivity as fields deplete over time. We see that for connected workers, the fields on which they pick are at the same stage of their life cycle when their friends are present or are absent. Moreover, the field life cycle on these field-days is not significantly different than for the field-days on which isolated workers pick.[15]

4.2 The Assignment of Workers and Field-day Factors

To provide direct evidence in support of the assumption that the allocation of connected workers to friends is uncorrelated field-specific determinants of productivity, we first 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, at a first stage we run the following panel data regression for isolated worker i on field f on day t,

$$y_{ift} = \alpha_i + \lambda_f + \delta X_{ift} + \lambda Z_{ft} + \tau t + u_{ift}, \tag{3}$$

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, Z_{ft} is the field life cycle that

[15] This addresses the concern that if connected workers predominantly pick with their friends later in the season, then because later in a field's life cycle there is naturally less variation in the quantity of fruit available across different rows, this induces their performances to be more similar even if workers have no social concerns over those in their friendship network. The evidence does not support such a timing of the assignment of workers to their friends.

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. All continuous variables are in logarithms and the error term, u_{ift}, is clustered by field-day because workers on the same field-day face similar field conditions and hence are subject to common productivity shocks.[16]

At a second stage we take each isolated worker's residual productivity from (3), 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 1A, 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 does 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 1A rules out that friends are more likely for 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 $\theta \in [0, 1]$,

$$Quant_{\theta}(y_{ift}|.) = \phi_{\theta f}\lambda_f + \delta_{\theta}X_{ift} + \lambda_{\theta}Z_{ft} + \tau_{\theta}t + \mu_{\theta}S_{ft}, \tag{4}$$

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 1B graphs estimates of μ_{θ} and the associated 95% confidence interval at each quantile.[17]

[16] 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.

[17] The quantile regression method imposes no distributional assumptions on the error term, which in our context

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 does 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, the COO also sets the piece rate each field-day. One concern is that the piece rate is manipulated as a function of the presence of connected workers and their friends on the field-day. If so, this confounds identification of social incentives as the presence of friends would also imply variation in the monetary incentives workers face. In the Appendix we present evidence that this is not the case – the piece rate is unrelated to the social ties of workers on the field-day.

4.3 The Assignment of Workers and Worker-field-day Factors

We now provide evidence against there being factors at the worker-field-day level that drive both the allocation of workers to their friends and determine worker productivity. 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,

$$D_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + \lambda y_{ift-1} + u_{ift}. \tag{5}$$

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) labor demand shocks that lead to changes in the number of workers on the field-day; (ii) field-day conditions that cause workers to lobby managers or 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 A3.

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 non-linear. 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

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.

her subsequent assignment to friends. It is not therefore the case that worker's 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.[18]

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.

4.4 Intertemporal Spillovers

The second assumption required for the identification of social incentives in this setting is that there are no within worker intertemporal spillovers on behavior from field-days in which friends are absent onto field-days on which at least 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 ($D_{ift} = 1$),

$$y_{ift} = \alpha_i^0 + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift} \text{ if } D_{ift} = 0, \tag{6}$$

$$y_{ift} = \alpha_i^1 + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift} \text{ if } D_{ift} = 1. \tag{7}$$

X_{ift} now additionally controls for worker i's exposure to her friends. The results, reported in Table A4, 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 (7) to check for within worker productivity spillovers from field-days where friends are absent onto field-days in which at least one friend is present.

Reassuringly, the data does 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 worker's behavior 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. The remainder of the paper provides such evidence.

[18] 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 -.002 (.001) and on the second lag is -.002 (.002), and neither lag is different from zero at the 10% level.

5 Social Incentives: Individual Productivity Effects

5.1 Descriptive Evidence

As discussed in Section 2, social incentives can have heterogenous effects across workers with some workers increasing their productivity in the presence of friends and others decreasing their productivity. Crucially, these heterogeneous responses might depend on the ability of worker i relative to her friends present on the field-day. Hence in order to map the empirical analysis back to theory, an important element of the analysis is to build a measure of each worker's ability.

To do so, we use the estimated worker fixed effect, $\widehat{\alpha}_i^0$, from (6) to measure 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 with some precision, we restrict the sample to workers that are observed for at least five field-days in the absence of friends. Hence, $\widehat{\alpha}_i^0$ is estimated on average from 22 observations per worker.[19]

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 .812 kg/hr with a standard deviation of .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, with the remainder being attributable to the other factors conditioned on in specification (6).[20]

To provide preliminary evidence of whether social incentives exist in this setting and the form they take, we compare the estimates of each worker's permanent productivity in the absence of her friends, $\widehat{\alpha}_i^0$, to the worker fixed effects estimates, $\widehat{\alpha}_i^1$, from specification (7) when i has at least one friend present on the field-day. Again we only use workers that are observed at least five field-days with their friends so that $\widehat{\alpha}_i^1$ is estimated on average from 31 observations per worker.

To be precise, the $\widehat{\alpha}_i^0$ estimates capture worker behavior in the presence only of non-friends. The $\widehat{\alpha}_i^1$ estimates capture worker behavior in the presence of friends and non-friends, so the difference in these estimates is informative of whether social incentives exist in this setting, and the way in which they affect behavior. Figure 2 then shows a cross plot of the exponents of $\widehat{\alpha}_i^0$ against $\widehat{\alpha}_i^1$. To

[19] As the earlier evidence suggested the assignment of workers to friends is orthogonal to the characteristics of the field-day that drive worker productivity, this ability measure does not reflect factors relating to the assignment of workers and their friends to fields. An alternative procedure by which to build the ability measure for worker i is to estimate (6) for all workers except i and then impute the fixed effect for i. This procedure leads to similar results to those presented.

[20] 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 behavior. 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 a dummies for each month of the season. We find there to be no significant changes in the standard deviation of worker's ability in fields across months of the season.

emphasize that the results are not driven by outliers, we circle each observation where the diameter of the circle is proportional to the number of field-days the worker is observed in total, with larger circles therefore identifying workers that are observed more frequently.

The cross plot shows the presence of friends has heterogeneous effects across workers. The presence of friends has a positive effect on the performance of around two third of workers, and a negative effect on the remaining one third. Figure 2A also shows the line of best fit and the slope of this line highlights two issues. First, the slope coefficient is significantly less than one. If social incentives did not exist, behavior would be independent of the presence of friends and the slope coefficient would be equal to one. Second, the slope coefficient is significantly greater than zero, so that workers performance in the presence of friends is not independent of their performance in the absence of their friends. This hints at the possibility that behavior in the presence of friends is in part determined by the worker's underlying ability.[21]

Table 4 sheds further light on whether the presence of friends has heterogenous effects across workers. The first row shows that on average, although productivity is .457kg/hr lower in the presence of friends, this is not significantly different from zero at conventional levels. In line with the earlier evidence, this suggests the COO does not assign workers to work with their friends on the basis of unobserved field-day determinants of productivity.

In the remaining rows of Table 4 we use our estimate of worker ability in the absence of friends, $\widehat{\alpha}_i^0$, to divide individuals into quartiles of the ability distribution. We then report mean unconditional productivity with and without friends for workers at different quartiles of the ability distribution. We see that – (i) the productivity of connected workers in the *bottom* quartile of ability is significantly *higher* on field-days when they worker with their friends relative to field-days on which they work in the absence of the friends; (ii) the productivity of connected workers in the *top* quartile of ability is significantly *lower* when their friend are present; (iii) the productivity of connected workers in the second and third quartiles are not significantly different with and without their friends.

The first column in Table 4 highlights that in the absence of friends, there is a wide dispersion in the performance of workers across the ability distribution – those in the top quartile have double the productivity of those in bottom quartile. In contrast, the second column shows that in the presence of their friends, the performance of low ability workers increases and the performance of high ability workers decreases to such an extent that, on average, the difference in productivity between high and low ability workers is not significantly different from zero. Moreover, the difference-in-difference between worker productivity across quartiles, with and without friends, is significantly less than zero.

[21] The slope of the line of best fit is adjusted to take into account that both $\widehat{\alpha}_i^0$ and $\widehat{\alpha}_i^1$ are regression estimates and may therefore be subject to measurement error. Formally, the line of best fit is from a linear regression of $\widehat{\alpha}_i^1$ on $\widehat{\alpha}_i^0$ in which we correct for attenuation bias using Cronbach's Alpha. If the regression line is not adjusted for measurement error, the slope coefficient is .397 with a standard error of .088, which is significantly different from one and zero. If only measurement error in $\widehat{\alpha}_i^0$ is corrected for, the slope coefficient is .618 with standard error .126.

5.2 Productivity Effects by Worker Ability

To present precise evidence on whether social incentives exist, 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,

$$y_{ift} = \alpha_i + \lambda_f + \beta D_{ift} + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift}, \tag{8}$$

where $D_{ift} = 1$ if at least one friend of worker i is present of field-day ft, $D_{ift} = 0$ otherwise, and all other variables are as previously defined. The parameter of interest, β, measures the average productivity effect on workers of the presence of friends relative to when only non-friends are present.[22]

Column 1 of Table 5 shows that $\hat{\beta} = .007$, and is not significantly different from zero. In line with the descriptive evidence in Table 4, this shows the presence of friends has no significant effect on the productivity of the average worker conditional on other determinants of productivity. The result rules out that social incentives increase or decrease the net benefit of effort for *all* workers. If that had been the case then *all* workers should either increase or decrease their productivity in the presence of friends. For example, this rules out that the presence of friends generates contagious enthusiasm, provides positive role models, 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 rules out social incentives of the form of contagious malaise or low effort norms, that lead all workers to be less productive in the presence of friends.

To focus on whether social incentives are heterogenous across workers, Columns 2 to 4 repeat the analysis separately for workers in different quartiles of the ability distribution. The results indicate the presence of friends – (i) reduces the productivity of high ability workers by 9% relative to themselves in the absence of any friends; (ii) has no effect on the productivity of middle ability workers; (iii) increases the productivity of low ability workers by 29%.

Two interpretations are consistent with this. First, social incentives might affect different workers in different ways – in particular high ability workers experience contagious malaise in the presence of friends, while the opposite is true for low ability workers. Alternatively, it might be that the peer pressure function takes the same form for all workers, but is such that the effort effects of social incentives are decreasing in the *difference* between the worker's own productivity and that of her friends. This would for example be the case if individuals have a preference for conformity or are averse to pay inequality among the friendship network [Bernheim 1994, Fehr and Schmidt 1999, Charness and Rabin 2002]. If so, given high ability workers are more likely to have friends who are

[22] This specification embodies the twin identifying assumption that the assignment of worker is orthogonal to unobserved determinants of productivity so $cov(D_{ift}, u_{ift}) = 0$, and that 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*.

of lower ability than themselves and *vice versa*, such a peer pressure function can explain why, on average, the presence of friends reduces (increases) the productivity of high (low) ability workers, relative to themselves when they work only with non-friends. The next subsection explore this second hypothesis more closely.[23]

5.3 Productivity Effects by Worker's Ability Relative to Friends

The workplace has the feature that conditional on at least one friend of worker i being present, the precise identities of these friends varies over time. In conjunction with the fact we have constructed a measure of ability for each worker, $\widehat{\alpha}_i^0$, we can then estimate how the productivity of i changes as her ability *relative* to that of her friends present varies. To identify the causal effect on productivity of higher ability friends relative to lower ability friends, we require the COO's assignment of workers to friends of higher or lower ability to be orthogonal to unobservables at the worker-field-day that determine worker productivity.[24]

To check for such evidence, Columns 5 to 7 of Table A3 estimate regressions analogous to those in (5) for connected workers on the subset of field-days when friends are present. The dependent variable is equal to one if worker i has no friend more able than herself present, and $D_{ift} = 0$ if she has at least one friend of higher ability present. The results 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.

We therefore progress to estimate how the productivity of worker i is affected by the presence of friends of differential ability, by estimating the following panel data specification,

$$y_{ift} = \alpha_i + \lambda_f + \theta_h HD_{ift} + \theta_m MD_{ift} + \theta_l LD_{ift} + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift}, \tag{9}$$

where $HD_{ift} = 1$ if the most able friend of i present of field-day ft is in the top quartile of the ability distribution, and zero otherwise; $MD_{ift} = 1$ if the most able friend of i present of field-day ft is in the middle two quartiles of the ability distribution, and zero otherwise; $LD_{ift} = 1$ if the most able friend of i present of field-day ft is in the bottom quartile of the ability distribution, and zero otherwise. All other variables are as previously defined. The parameters of interest (θ_h, θ_m, θ_l) measure the individual productivity effects of having friends of differential ability present on the field-day relative to when only non-friends are present.

Column 5 of Table 5 first estimates (9) for all workers – the sample falls slightly from that in Column 1 because the ability measure, $\widehat{\alpha}_i^0$, is estimated for most but not all workers and their friends.

[23] This pattern of coefficients directly rules out the existence of other mechanisms unrelated to social incentives – such as knowledge spillovers – explaining worker behavior in the presence of friends of different ability.

[24] As before, this concern over the assignment of workers is predicated on the fact that the COO can observe both the friendship ties between workers and the relative ability of friends.

The point estimates of the parameters of interest suggest the effect of social incentives is an increasing function of the ability of the friends of i, holding worker i's own ability constant. However, these parameters are not precisely estimated. To shed more light on this Columns 6 to 8 repeat the analysis for workers in different quartiles of the ability distribution.

We see that – (i) high ability workers in the fourth quartile of the ability distribution, have significantly lower productivity in the presence of lower ability friends, $\theta_l < \theta_m < \theta_h = 0$; (ii) middle ability workers have significantly *lower* productivity in the presence of low ability friends, and significantly *higher* productivity in the presence of high ability friends, $\theta_l < \theta_m = 0 < \theta_h$; (iii) low ability workers have significantly higher productivity in the presence of higher ability friends, $0 < \theta_l = \theta_m < \theta_h$.[25]

Throughout we find there are no significant productivity effects of having friends of *similar* ability present on the field-day. Rather, the evidence highlights that it is the presence of friends of *differential* ability – either more or less able – that causes a significant behavioral responses among workers. In short, the productivity effects of social incentives depend on the ability of worker i *relative to* her friends. This is picked up most clearly in Column 7 for workers in the middle of the ability distribution. The estimates show that such workers respond in a significantly different way to the presence of their friends depending on their friends' ability relative to themselves. To more clearly benchmark the magnitude of these effects, we next estimate the following more parsimonious specification,

$$y_{ift} = \alpha_i + \lambda_f + \gamma_1 A_{ift} D_{ift} + \gamma_2 (1 - A_{ift}) D_{ift} + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift}, \tag{10}$$

where $A_{ift} = 1$ if worker i is the most able among her friends on the field-day, and $A_{ift} = 0$ otherwise. The parameters of interest are – (i) γ_1, the productivity effect of the presence of at least one friend that is less able relative to when no friends are present; (ii) γ_2, the productivity effect of the presence of at least one friend that is more able, relative to when no friends are present.

The result in Column 1 of Table 6 shows that – (i) the average worker is 10.4% more productive if at least one of her more able 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 most able among her friends on the field-day, relative to herself when no friends are present ($\widehat{\gamma}_2$). These magnitudes imply social incentives are a powerful motivator. As workers are paid piece rates, the estimates imply 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 more able.

[25] A concern over the results in Columns 2 to 4 is that the constructed measure of worker ability merely captures reversion to the mean – namely workers that have higher productivity than average in the absence of their friends would naturally be expected to have lower productivity in the presence of friends, even if workers are not influenced by social incentives. The results in Columns 5 to 8 help address this concern – worker behavior is predicted by their ability *relative to* that of their friends. Even if worker i's own ability only reflects mean reversion, this does not imply that her behavior should be predicted by the ability of her friends on the field-day.

As a point of comparison, 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 both a qualitatively important driver of individual behavior, and a quantitatively important alternative to providing monetary incentives, as a means by which to increase worker performance. While such alternatives to monetary incentives in labor markets have been documented to exist in laboratory settings [Fehr and Falk 2002], this paper, along with Mas and Moretti [2006], is among the first to provide field evidence from firms on the existence and magnitude of such effects.

5.4 Robustness Checks

The evidence suggests the behavioral response of workers to the presence of their friends depends on their ability relative to their friends. This result can be spuriously generated if a given worker is matched with more able friends on field-days when she has a positive productivity shock, *and* her more able friends have a negative productivity 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.[26]

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,

$$D_{ijft} = \beta \left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right| + \lambda_f + \delta X_{ift} + \lambda y_{ift-1} + \tau t + u_{ijft}, \tag{11}$$

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. The result in Column 8 of Table A4 shows the ability differential between friends does not affect the likelihood they work together.

The remaining columns show this to be robust to – (i) controlling for worker fixed effects and other determinants of worker assignments as in (5); (ii) allowing the relationship between the assignment of i and j and their ability differential to vary with a linear time trend, as would be the case if workers learn how to effectively lobby management over time. The results do not therefore appear to be driven by friends being able to work together when they expect their productivities to be similar.

[26] 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.

Additional robustness checks are reported in the Appendix. These address – (i) remaining concerns over factors at the field-day level that determine worker productivity and worker assignment; (ii) concerns over self-reported friendships being endogenously determined by behavior in the workplace.

5.5 Interpretation

Taken together, the evidence points to social incentives existing in this setting – the mere presence of friends significantly affects worker behavior. This is despite there being no externalities arising from either the production technology or compensation schemes in place, that would otherwise directly bind together co-workers' effort choices.[27]

Social incentives are driven by 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 more able friends is present, and is 10% less productive if she is the most able among her friends. Hence social incentives take the form of friends conforming towards a similar productivity norm. Given the productivity differential documented in Table 4 across workers of different ability, we note these productivity effects are large enough to significantly narrow the productivity gap between the most and least able workers, but not so large so as to alter the relative ranking of workers productivity when working with and without their friends.

The finding that individual behavior is heterogeneous and depends on the worker's ability relative to her friends suggests behavior can be explained in any framework in which utility decreases in the difference between an individual's performance in the workplace and that of her friends, such as workers having a structural preference for conformity [Bernheim 1994], or workers being averse to pay inequality among their friendship group [Fehr and Schmidt 1999, Charness and Rabin 2002].

Conformism might also arise because workers derive utility from socializing with friends if having the same productivity facilitates socialization. In our setting, this might occur if having the same productivity allows workers to be physically close. While in the absence of row level information it is not possible to test for this mechanism directly, the characteristics of the technology make it unlikely that this hypothesis fully explains the data. Indeed, as described in Section 3.3, the quantity of fruit on adjacent rows differs and is spatially correlated so that abundant rows are typically adjacent to rows that contain less fruit. This implies that if friends were to proceed at the same pace in two adjacent rows to minimize the physical distance between them, the worker on the more abundant row would have higher productivity, so that friends productivity levels would diverge. This is inconsistent with the evidence that friends conform to a common level of productivity.

The results are inconsistent with social incentives altering, on the margin, the net benefit of effort in the *same* direction for all workers. If so, *all* workers should either increase or decrease their

[27] 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 such effects are long lasting.

productivity in the presence of friends. For example, this rules out that friends generate contagious enthusiasm, provide positive role models, generate incentives to compete to be the best in the group, or that friends generate contagious malaise or establish low effort norms.

6 Social Incentives: The Cost of Conformism

The evidence suggests that when working together, friends conform to a common productivity norm – they are less productive when working with friends of lower ability, and are more productive when working with friends of higher ability. Such conformist behavior entails a cost in either case as the worker's effort choice is different from her optimal choice when working only with non-friends, namely $e_i^{n*} \neq e_i^{-n*}$. Workers who slow down in the presence of friends forgo earnings, and workers who speed up exert more effort despite the monetary incentives they face being unchanged. We now shed light on whether workers are conscious of these choices using two alternative empirical strategies to test whether they respond rationally to variations in the costs of conformism.

6.1 Heterogeneous Effects Across Field-days

Our first empirical strategy to test whether workers' response to social incentives depends on the net marginal benefit of effort exploits the fact that the amount of fruit available varies greatly across field-days. On 'good' field-days when fruit is plentiful, the opportunity cost of being less productive in terms of lost earnings is high relative to 'bad' field-days when the quantity of fruit is low. Similarly, on good field-days the effort cost of being more productive is low relative to bad field-days. Hence the productivity norm workers conform to, should be higher on good field-days relative to bad-field days.

To measure the quantity of fruit available on any given field-day we exploit the fact that isolated workers are also always present, and are not subject to social incentives. We then estimate the following specification for isolated workers,

$$y_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + u_{ift}, \tag{12}$$

where all variables are as previously defined. We 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. We use this classification to then estimate the following specification for connected workers,

$$\begin{aligned} y_{ift} \;=\; & \alpha_i + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t \\ & + \varphi_1 A_{ift} D_{ift} G_{ft} + \varphi_2 A_{ift} D_{ift} B_{ft} + \varphi_3 (1 - A_{ift}) D_{ift} G_{ft} + \varphi_4 (1 - A_{ift}) D_{ift} B_{ft} + \vartheta G_{ft} + + u_{ift}, \end{aligned} \tag{13}$$

where all other controls are as previously defined, and the error terms are clustered by worker.[28]

If the response to social incentives depends on the net marginal benefit of effort, then on good field-days – (i) workers who are more able than their friends should slow down to a lesser extent ($\varphi_2 < \varphi_1 < 0$); (ii) workers who are less able than their friends should speed up to a greater extent ($\varphi_3 > \varphi_4 > 0$). The result in Column 2 of Table 6 shows a pattern of coefficients that is consistent with this hypothesis. The null hypothesis of equal coefficients can be rejected at conventional levels for the comparison between $\widehat{\varphi}_3$ and $\widehat{\varphi}_4$, but however cannot be rejected for the comparison between $\widehat{\varphi}_2$ and $\widehat{\varphi}_1$.

One concern with the interpretation of this result is that workers may react differently to changes in field conditions, hence the previous estimates may confound heterogeneous responses to field conditions with heterogeneous reponses to social incentives. To address this, Column 5 allows the field-day condition to have differential effects across workers by controlling for a full set of interactions between G_{ft} and the worker fixed effects α_i. Although each parameter of interest is slightly less precisely estimated as expected, the qualitative pattern of results still holds.

The balance of evidence thus suggests – (i) workers' response to social incentives depend on their ability relative to their friends so that groups of friends conform to a common norm that lies between the typical productivity of high and low ability friends; (ii) the *level* of the norm increases on good field-days on which the marginal benefit of effort is higher.

6.2 The Formation of Friendships

A second approach by which to understand whether workers are aware of the costs of social incentives is to examine which friendships form in the first place. In particular, workers are able to minimize the costs of conformism by befriending those of similar ability – workers then avoid having to work more or less hard in the presence of friends of differential ability. To check for this we test whether the probability of worker i reporting worker j as her friend decreases as the ability differential between i and j increases.

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

[28] As the piece rate is adjusted to compensate for field conditions, the change in the net benefit of effort is equal to the change in field conditions multiplied by the change in the piece rate. If the latter were fully adjusted to compensate for differences in field conditions, the marginal benefit of effort would be the same on all field-days and our test would have no power. In practice, however, since all workers on the field-day are paid the same piece rate, the piece rate is adjusted to ensure the worker with average productivity earns a pre-determined amount and nobody earns less than the minimum wage. Hence changes in the piece rate do not fully offset the variation due to changes in fruit availability for most workers.

worker friendship pairs defined. We then estimate the following logit regression,

$$Pr(l_{ij} = 1) = \Lambda(\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|, X_{ij}), \tag{14}$$

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/hr, and X_{ij} are measures of similarity between i and j. Table 7 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 one, 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 (14) 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 one 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 workers are *not* more likely to form

[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 program, 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.

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 one 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 one when both worker 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 one, 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]

The Appendix presents a series of additional robustness checks on the baseline result in Column 2. These checks address concerns relating to – (i) the process underlying the formation of *new* friendships in the workplace differs from that for pre-existing friendships; (ii) on any given survey date, there is variation in how long individuals have been on the farm for, and therefore their opportunities to form friendships; (iii) unobserved heterogeneity across workers that drives the formation of friendships.

In summary, the main driver of friendship formation is the similarity between individuals in terms of nationality, arrival cohort, living in close proximity, and studying the same subject. These factors represent a combination of such pairs of individuals having lower costs of meeting each other and having higher benefits from socially interacting, other things equal. In contrast, individuals do not seek to befriend others on the basis of their ability in the workplace. This does not necessarily imply workers do not anticipate the form social incentives take in this workplace. Rather, this is consistent with workers having higher utility from adhering to the conformist norm in the workplace – as would be the case if workers have a structural preference for conformity or aversion to inequality among friends – rather than workers being compelled to conform on the basis of social pressure or the threat of sanctions from others should they deviate from the norm.

7 Social Incentives: Effects on Aggregate Firm 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

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

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,

$$\sum_i (s_i^1 \widehat{\alpha}_i^1 + s_i^1 \widehat{\alpha}_i^0). \tag{15}$$

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 aggregate productivity under different scenarios in which management vary the allocation of workers to their friends, namely vary 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 COOs 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 Section 4 we provided evidence in support of each assumption.

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 (s_i^1, s_i^0) 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 behavior 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 more able 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.[32]

8 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 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 most 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 [2006] 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. Worker are however paid fixed hourly wages so there are no externalities arising from the monetary incentives in place. Using scanner level data they show 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 more able workers. They 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 that 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 compen-

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

sation 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 2006, Falk and Ichino 2006].[33]

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 behavior 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 behavior, 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 behavior within firms, remains an open question.

9 Appendix

9.1 The Piece Rate

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

[33] 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 productivity norms are set by the most able workers.

subject to a minimum wage constraint. One concern is that the piece rate is manipulated as a function of the presence of connected workers and their friends on the field-day. If so, this confounds identification of social incentives as the presence of friends would also imply variation in the monetary incentives workers face.[34]

To address this concern we estimate whether the composition of workers on the field-day predicts the piece rate, β_{ft}, using the following OLS regression,

$$\beta_{ft} = \lambda_f + \rho S_{ft} + \eta Z_{ft} + \mu R_t + \varepsilon_{ft}, \tag{16}$$

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.[35]

The results, reported in Table A4, show that – (i) the share of isolated workers on the field-day has no significant effect on the piece rate (Column 1); (ii) the share of connected workers with and without friends present has no significant effect on the piece rate (Column 2); (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.

9.2 Robustness Checks: Social Incentives

This subsection presents further evidence and robustness checks relating to the main specification in (10). Throughout the analysis, an identifying assumption has been that the presence of friends is orthogonal to determinants of productivity at the field-day level, such as field conditions, the level of the piece rate, or the identity of managers. While Section 4 has presented evidence in support of this assumption we now address any remaining concerns that the subset of field-days when friends

[34] 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, 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.

[35] 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, the share of workers that are women, that report playing sports at least once a month, 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.

work in the absence of their friends are not a valid counterfactual to when friends are present. We do so using two strategies.

First, Column 1a of Table A6 estimates (10) restricting 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 one 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 6, the average worker is 24.6% more productive when she works with at least one friend who is more able than her compared to herself when she is the most able in her network of friends present on the field-day.

An alternative strategy to address this concern is to control for field-day fixed effects directly in (10). We then exploit the variation arising from the fact that on any given field-day, some connected workers have their friends present, and others do not, to identify γ_1 and γ_2. The result, reported in Column 1b shows 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.

A second empirical concern relates to the calculation of standard errors in (10). In particular, the key regressors are based on estimated ability and so contain some error. This leads to attenuation bias 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 (10) based on 1000 replications and accounting for clustering by worker. The results in Column 2a show these the standard errors to be only incrementally larger than the clustered OLS standard errors reported throughout.[36]

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 result reported in Column 2b shows the main results to be robust to this alternative clustering.

A third empirical concern arises from the fact that friendships are measured only at one point in time – as described in Section 3.6, each worker is interviewed once on one of three survey dates over the season. Suppose for example that self-reported friendships are endogenous to behavior on the field, so that only individuals who conform to the norm are later reported as friends. To assess the

[36] An additional advantage of the specification estimated in Column 1a is that it is estimated from the subset of field-days when at least one friend is present, whereas the ability measures $\widehat{\alpha}_i^0$ are calculated from another subset of field-days when friends are absent.

relevance of this concern we restrict the sample to workers that are interviewed on the first survey date in the season. The result, in Column 2a, shows the signs, magnitude, and significance of the parameters of interest to be similar to those in the baseline estimates. As a second check we allow the effects of the presence of friends to vary by the number of days since the worker has been interviewed. Column 2b shows the estimated social incentives do not vary along this dimension, so that there is little relationship between when a worker is interviewed, who she reports as a friend, and her behavior in the workplace. Finally, this result is robust to allowing there to be a non-linear effect of days since interview (not shown).

9.3 Robustness Checks: The Formation of Friendships

This subsection presents further evidence on the formation of friendship ties, as estimated in (14). In particular, we demonstrate the main result – that workers do not form friendships on the basis of their ability differential (Column 2, Table 7) – is robust to a number of empirical concerns. A first concern is that the process underlying the formation of new friendships in the workplace differs from that for friendships formed outside of the work environment. In particular, individuals might have stronger incentives to assortatively match with those of similar ability when forming friendships with co-workers, or if there is reverse causality, then new friendships are more likely to be formed with those of similar ability. To check for this, we redefine l_{ij} to be equal to one if worker i reports j as a *new* friend, and equal to zero if worker i does not report j as a new friend nor as a pre-existing friend. The result in Column 1 if Table A7 shows that new friendships are no more likely to form on the basis of similarity in worker ability.[37]

A second concern is that on any given survey date, there is variation in the duration for which individuals have been present on the farm for, and therefore in the time they have had to form friendships. Although we aim to survey workers two weeks after their arrival, some individuals are surveyed much later. Such workers might have more time to sort by ability or might be more aware of the net benefits of befriending those of similar ability. Column 2 restricts the sample to those 52 workers that were interviewed more than three weeks after their arrival, and sheds light on whether the individuals they report as newly formed friends have similar ability. The results show that these workers do not match positively or negatively on ability either.[38]

A third concern is there may be unobserved heterogeneity across workers that drives the formation of new friendships. For example, some individuals may naturally be more outgoing or sociable and therefore more likely to form new friendships than others. The effect of matching on ability may be

[37] Recall that in the survey individuals were asked to report, for each friend, whether the social tie existed prior to the individuals arriving to the workplace – which would be the case if for example the individuals are friends from their home country – or whether it newly formed in the workplace.

[38] In this subsample, being of the same nationality is a perfect predictor of the friendship tie so this regressor is dropped from Column 2.

inconsistently estimated if the unobserved heterogeneity relates to the pre-existing network of friends that worker i has. In particular, if worker i is of similar ability to his pre-existing network of friends, this may alter his incentives to form new friendships on the basis of ability. To address this, we estimate a conditional logit regression where observations are grouped by worker i. This can only be estimated among workers that report at least one new friend. The result, reported in Column 3, shows most of the estimates of the odds ratios to be similar to the baseline estimates, and we continue to find no evidence that workers match on ability.

A similar set of concerns relate to unobserved heterogeneity across the workers being matched to – worker j. To address such concerns we estimate a conditional logit regression where observations are grouped by worker j. This can only be estimated for worker j's that are reported to be neither the friend of no other surveyed worked, nor the friend of all surveyed workers. In this specification we cluster standard errors by worker j. Column 4 shows the results to be qualitatively similar to those in the baseline specification. Again once heterogeneity across workers is accounted for, there is no evidence workers befriend others on the basis of their ability differential.[39]

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[39] We also conducted a number of further robustness checks. First, we limited the sample to those workers that report at most six friendships. In this case there is no evidence of workers matching by ability. Second, our definition of l_{ij} is based on the unidirectional friendship ties of worker i to worker j. However the results are also robust to using a bidirectional measure of friendship ties that is equal to one if either worker i reports j as his friend or *vice versa*. Third, to check whether workers randomly name co-workers as friends, we randomly assign each worker the same number of friends as she actually reports and re-estimate (14). In this case similarity between i and j does not predict their randomly assigned friendship tie. In line with the evidence in Table A2, this suggests there is some informational content in the identities of those reported to be friends and workers are not randomly naming friends in the survey we administered.

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Table 1: Reported Friendships of Surveyed Workers

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 (30.1)	1.49 (1.59)
1	33 (11.4)	1.45 (1.73)
2	24 (8.30)	1.58 (1.18)
3	29 (10.0)	1.79 (1.23)
4	48 (16.6)	2.38 (1.38)
5	19 (6.57)	2.68 (1.63)
6	16 (5.54)	2.94 (1.29)
7	33 (11.4)	2.64 (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 survey we administered to workers. There were 289 individuals interviewed. Each individual was asked to list up to seven of their friends on the farm

Table 2: Characteristics of Surveyed Workers, By Number of Reported Friends

Means, standard errors in parentheses, p-value on Mann Whitney Test in brackets

		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/hr]**	8.76	8.74	-.022	[.702]
		(.273)	(.183)	(.328)	
	SD of productivity, no friends present [kg/hr]	3.68	3.71	.029	[.894]
		(.129)	(.101)	(.163)	
	Total picking experience [field days]	77.1	67.3	-9.85	[.174]
		(6.83)	(3.78)	(7.80)	
B. Friendship Networks	**Number of reported friends**	-	3.87		
			(.140)		
	Number of times mentioned as a friend by another surveyed worker	1.49	2.16	.669***	[.001]
		(.171)	(.116)	(.206)	
C. Worker Characteristics	**Gender [female=1]**	.471	.446	-.026	-
		(.054)	(.035)	(.064)	
	Age [years]	22.1	22.1	-.004	[.620]
		(.268)	(.352)	(.442)	
	Have had paid employment before [yes=1]	.840	.859	.019	-
		(.041)	(.025)	(.048)	
	Main nationality	Polish (42.5%)	Polish (60.9%)	-	[.071]
	Main subject studying	Social Science (38.2%)	Agriculture (34.5%)	-	[.751]
	Live on main site on farm [yes=1]	.552	.520	-.032	[.457]
		(.054)	(.035)	(.064)	

Notes: *** 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. 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 1st May to 30th 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.

Table 3: Descriptive Evidence on the Allocation of Workers to Field-Days

Worker-field-day Level Variables

Means, standard deviation between workers on the field-day in parentheses, standard deviation within worker over field-days in brackets

Standards errors on differences are clustered by worker

	Connected Workers		Isolated Workers	Difference	
	(1) No Friends Present	(2) At Least One Friend Present	(3) Report No Friends	Group 2 - Group 1 (standard error)	Group 3 - Group 1 (standard error)
Number of workers	167	195	89		
Number (%) of worker-field-day observations	2637 (28.4)	4767 (51.3)	1895 (20.4)		
Observations per worker [worker-field-day]	15.8	24.4	44.0		
Probability (friends present | report at least one friend)		.644			
		(.305)			
		[.370]			
Number of friends present	0	2.09			
	-	(1.01)			
		[.817]			
Picking experience [field-days]	53.0	40.0	54.0	-13.0*	1.06
	(44.5)	(30.0)	(40.4)	(7.97)	(11.5)
	[29.4]	[27.8]	[36.8]		
Total number of pickers on the field-day	41.3	54.6	45.6	13.4***	4.37
	(15.8)	(11.7)	(11.9)	(2.43)	(3.13)
	[19.6]	[24.1]	[22.1]		
Field life cycle	.452	.445	.463	-.006	.012
	(.118)	(.096)	(.129)	(.015)	(.016)
	[.220]	[.240]	[.227]		

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. This data is obtained from the firm's personnel records, and the survey we administered to workers. A fruit picker is defined to be an individual present that picks fruit on at least 14 field-days during the period of 1st May to 30th September 2004. Picking experience is the number of field-days for which the worker has picked Type I fruit. The field life cycle is defined as the nth day the field is picked divided by the total number of days the field is picked over the season. The decomposition of the standard deviation into that between workers on the field-day and within workers over field-days, takes into account that the panel is unbalanced. The standard errors on the differences are estimated from running the corresponding least squares regression allowing for standard errors to be clustered by worker.

Table 4: Average Worker Productivity (kg/hr) With and Without Friends Present, by Worker Ability

Means, standard errors in parentheses are clustered by worker

	Without Friends	With Friends	Difference
All workers	9.28	8.82	-.457
	(.343)	(.243)	(.349)
Quartile of distribution of fixed effects in the absence of friends			
Quartile 1	5.68	8.63	2.95***
	(.436)	(1.05)	(1.02)
Quartile 2	7.95	8.48	.528
	(.360)	(.421)	(.497)
Quartile 3	9.14	8.65	-.491
	(.398)	(.244)	(.352)
Quartile 4	11.5	10.0	-1.50***
	(.488)	(.545)	(.508)
Difference (Quartile 4 - Quartile 1)	5.84***	1.39	-4.45***
	(.668)	(1.16)	(1.12)

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Throughout we only use observations from workers that report having at least one friend and where the fixed effect estimates with and without friends are both based on at least five worker-field-day observations. Workers are divided into the quartiles by their fixed effect estimate on field-days in which none of their reported friends are present. The standard errors on the differences are estimated from running the corresponding least squares regression allowing for standard errors to be clustered by worker.

Table 5: Productivity Effects of Social Incentives

Dependent Variable: Log of worker's productivity (kg/hr) on the field-day

Standard errors in parentheses are clustered by worker

	All Workers	Worker i in fourth quartile of ability distribution	Worker i in second or third quartile of ability distribution	Worker i in first quartile of ability distribution	All Workers	Worker i in fourth quartile of ability distribution	Worker i in second or third quartile of ability distribution	Worker i in first quartile of ability distribution
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Friends on field-day [yes=1]	.007	-.088**	.008	.298***				
	(.020)	(.036)	(.020)	(.087)				
Friends on field-day x most able friend in first quartile of ability distribution					-.100	-.259***	-.120*	.249
					(.063)	(.050)	(.065)	(.205)
Friends on field-day x most able friend in second or third quartile of ability distribution					-.040	-.080	-.035	.233
					(.033)	(.064)	(.030)	(.263)
Friends on field-day x most able friend in fourth quartile of ability distribution					.073	-.032	.095*	.312***
					(.045)	(.046)	(.053)	(.101)
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Field fixed effects	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Adjusted R-squared	.300	.307	.250	.345	.299	.299	.261	.330
Observations (worker-field-day level)	4792	1537	2638	617	4081	1367	2216	498

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. The dependent variable is the log of worker productivity on the field-day, measured in kilograms of fruit picked per hour. Throughout we only use observations from workers that report having at least one friend and where the fixed effect estimates with and without friends are both based on at least five worker-field-day observations. In all specifications, the log of the number of field-days of picking experience of the worker is controlled for. Field-day controls are 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 5 to 8 the sample is additionally restricted to workers whose friends are themselves observed at least five field-days with and without their friends. Standard errors are clustered by worker.

Table 6: Further Productivity Effects of Social Incentives

Dependent Variable: Log of worker's productivity (kg/hr) on the field-day

Standard errors in parentheses are clustered by worker

	(1) Relative Ability	(2) Good and Bad Field-days	(3) Heterogeneous Effects Across Workers
Friends on field-day x no friend more able than worker i	-.099***		
	(.029)		
Friends on field-day x at least one friend more able than worker i	.104***		
	(.033)		
Friends on field-day x no friend more able than worker i x good field-day (φ_1)		-.078**	-.065*
		(.035)	(.037)
Friends on field-day x no friend more able than worker i x bad field-day (φ_2)		-.109***	-.107***
		(.041)	(.045)
Friends on field-day x at least one friend more able than worker i x good field-day (φ_3)		.152***	.152***
		(.031)	(.033)
Friends on field-day x at least one friend more able than worker i x bad field-day (φ_4)		.060	.059
		(.047)	(.062)
Worker fixed effects	Yes	Yes	Yes
Field fixed effects	Yes	Yes	Yes
Field-day fixed effects	No	No	No
Worker fixed effects x good field-day	No	No	Yes
Adjusted R-squared	.316	.378	.411
Observations (worker-field-day level)	4081	4081	4081

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. The dependent variable is the log of worker productivity on the field-day, measured in kilograms of fruit picked per hour. Throughout we only use observations from workers that report having at least one friend and where the fixed effect estimates with and without friends are both based on at least five worker-field-day observations. In all specifications, the log of the number of field-days of picking experience of the worker is controlled for. Field-day controls are 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 all columns the sample is additionally restricted to workers whose friends are themselves observed at least five field-days with and without their friends. Standard errors are clustered by worker.

Table 7: The Formation of Friendships

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

	(1) Ability Measure	(2) Baseline	(3) Discrete Ability Measure
Absolute difference in ability	1.04	.909	
	(.105)	(.111)	
Both above or below median ability			1.20
			(.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**
		(.413)	(.497)
Same subject study		3.94***	3.93***
		(.931)	(.927)
Both have done paid work before		1.37	1.39
		(.342)	(.346)
Both play sports		1.01	1.00
		(.218)	(.216)
Observations	9591	9591	9591

Notes: *** 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. Standard errors are clustered by worker i.

Table A1: Characteristics of Surveyed and Non-Surveyed Workers

Means, standard errors in parentheses, p-value on Mann Whitney Test in brackets

		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/hr]**	8.75	8.82	.070	[.795]
		(.152)	(.165)	(.225)	
	Total picking experience [field-days]	70.3	62.6	-7.65	[.007]
		(3.36)	(3.35)	(4.74)	
C. Friendship Networks	**Number of times mentioned as a friend by a surveyed worker**	1.96	.452	-1.51***	[.000]
		(.097)	(.056)	(.112)	
D. Worker Characteristics	**Gender [female=1]**	.453	.422	-.031	-
		(.029)	(.030)	(.042)	
	Main nationality	Polish (55.4%)	Polish (56.7%)	-	[.278]

Notes: *** 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 present that picks fruit on at least 14 field-days during the period of 1st May to 30th 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	42.5	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	19.6	12.5	73.2	37.5	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 reciprcal, and for each activity type, the percentage of respondents that reported any given frequency of interactic

Table A3: Predictors of Friends Being Present on the Field-Day

Dependent Variable (Columns 1 to 3): Dummy =1 if worker has at least one friend present on the field-day, 0 otherwise

Dependent Variable (Columns 4 to 6): Dummy =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

Dependent Variable (Columns 7 to 9): Dummy =1 if worker i and his friend j are present on the field-day, 0 otherwise

Linear probability model, standard errors in parentheses are clustered by worker i

	A. Assignment to Friends			B. Assignment to Friends of Lower Ability			C. Pairwise Assignment to Friends		
	(1) Experience	(2) Experience Squared	(3) Lagged Performance	(4) Experience	(5) Experience Squared	(6) Lagged Performance	(7) Ability Differential	(8) Within Worker	(9) Controls
Picking experience [field-days]	.000	-.003	-.004	-.002	-.000	-.000			.000
	(.001)	(.002)	(.002)	(.001)	(.005)	(.005)			(.002)
Picking experience squared		.000	.000		.000	.000			-.000
		(.000)	(.000)		(.000)	(.000)			(.000)
Lagged productivity [kg/hr]			-.002			-.001			.000
			(.001)			(.002)			(.002)
Absolute difference in ability							-.047	-.005	.198
							(.059)	(.100)	(.164)
Absolute difference in ability x time trend									-.002
									(.001)
Time Trend									-.001
									(.001)
Mean of dependent variable	.644	.644	.638	.435	.435	.444	.473	.473	.466
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Field-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Adjusted R-squared	.497	.499	.510	.871	.871	.870	.001	.188	.229
Observations (worker-field-day)	7404	7404	6553	3596	3596	3157			
Observations (worker-friend-field-day)							10218	10218	9164

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. The sample is restricted to workers that report having at least one friend. The dependent variable in Columns 1 to 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 to 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. Hence observations are at the worker-field-day level in Columns 1 to 6. The dependent variable in Columns 7 to 9 is a dummy variable equal to one if worker i has friend j present on the field day and is zero if friend j is not present on the field day. Hence observations are at the worker-friend-field-day level in Columns 7 to 9. 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. In Columns 7 to 9, the absolute difference in ability refers to that between worker i and his jth friend. Standard errors are clustered by worker i.

Table A4: Intertemporal Productivity Spillovers

Dependent Variable: Log of worker's productivity (kg/hr) on the field-day

Standard errors in parentheses, clustered by worker

	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	-.079			-.063		
	(.071)			(.0790		
Worked with friends on previous field-day [Yes=1]		-.051	-.034		-.022	-.018
		(.038)	(.030)		(.028)	(.029)
Worked with friends two field-days ago [Yes=1]			-.035			.011
			(.035)			(.025)
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Field fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	.377	.381	.385	.329	.338	.332
Observations (worker-field-day level)	2637	2593	2544	4767	4600	4443

Notes: *** 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 to 3 (4 to 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. Standard errors are clustered by worker.

Table A5: Monetary Incentives

Dependent Variable = Piece rate on field-day (£ per kilogram picked)
Standard errors allow for field specific AR(1)

	(1) Isolated Versus Connected	(2) Composition of Connected Workers
Share of workers that are isolated	.098	
	(.135)	
Share of workers that are connected, friends present		-.033
		(.140)
Share of workers that are connected, friends not present		-.240
		(.164)
Field life cycle	.538***	.518***
	(.124)	(.121)
Average picking experience of workers	-.003***	-.003***
	(.001)	(.001)
SD of picking experience of workers	-.005***	-.005
	(.002)	(.002)
Time trend	.007***	.007***
	(.001)	(.001)
Rainfall (mm)	.008**	.008**
	(.004)	(.004)
Minimum temperature (Celsius)	-.003	-.004
	(.007)	(.007)
Share of workers that are women	.122	.135
	(.134)	(.132)
Share of workers that play sports	-.555***	-.505***
	(.170)	(.174)
Share of workers that came for earnings	.832***	.783***
	(.216)	(.220)
Number of managers	-.016	-.018
	(.018)	(.018)
Number of workers	.002	.002
	(.001)	(.001)
Field fixed effects	Yes	Yes
R-squared	.646	.642
Number of observations	496	496

Notes: *** 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.

Table A6: Robustness Checks on Social Incentives

Dependent Variable: Log of worker's productivity (kg/hr) on the field-day

Standard errors in parentheses are clustered by worker

	Non Random Assignment to Fields		Standard Errors		Endogenously Reported Friendships	
	(1a) Conditional on Friends Present	(1b) Field-Day Fixed Effects	(2a) Bootstrapped	(2b) Alternative Clustering	(3a) Interviewed on First Survey Date	(3b) Days Since Interview
Friends on field-day x no friend more able than worker i	-.246***	-.057*	-.099***	-.099***	-.120***	-.126***
	(.062)	(.030)	(.029)	(.033)	(.036)	(.039)
Friends on field-day x at least one friend more able than worker i		.069*	.104***	.104***	.110**	.104**
		(.038)	(.034)	(.038)	(.048)	(.041)
Friends on field-day x no friend more able than worker i x days since interview						-.001
						(.001)
Friends on field-day x at least one friend more able than worker i x days since interview						.001
						(.001)
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Field fixed effects	Yes	No	Yes	Yes	Yes	Yes
Field-day fixed effects	No	Yes	No	No	No	No
Adjusted R-squared	.298	.685	-	.316	.298	.313
Observations (worker-field-day level)	2267	4081	4081	4081	2894	3663

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. The dependent variable is the log of worker productivity on the field-day, measured in kilograms of fruit picked per hour. Throughout we only use observations from workers that report having at least one friend and where the fixed effect estimates with and without friends are both based on at least five worker-field-day observations. In all specifications, the following variables are controlled for - the log of the number of field-days of picking experience of the worker, the log of the field life cycle plus one, a linear 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. The sample in Column 1a is restricted to field-days where the worker has at least one friend present. In Column 1b we control for field-day fixed effects. In Column 2a we estimate bootstrapped standard errors based on 1000 replications and accounting for clustering by worker. In Columns 1a, 1b, 3a, and 3b standard errors are clustered by worker. In Column 2b standard errors are clustered by the two groups of workers in the same field-day that have, and do not have, at least one friend present. The sample in Column 3a is restricted to those workers that are surveyed on the first survey date in the season. Column 3b introduces three way interactions with the days since the worker was interviewed on survey day.

Table A7: Robustness Checks on The Formation of Friendships

Dependent Variable (Columns 1-2): Dummy equals 1 if worker i reports j as a new friend, 0 otherwise and worker j is not a pre-existing friend

Dependent Variable (Columns 3-4): Dummy equals 1 if worker i reports j as a friend, 0 otherwise

Logit regressions, log odds ratio reported

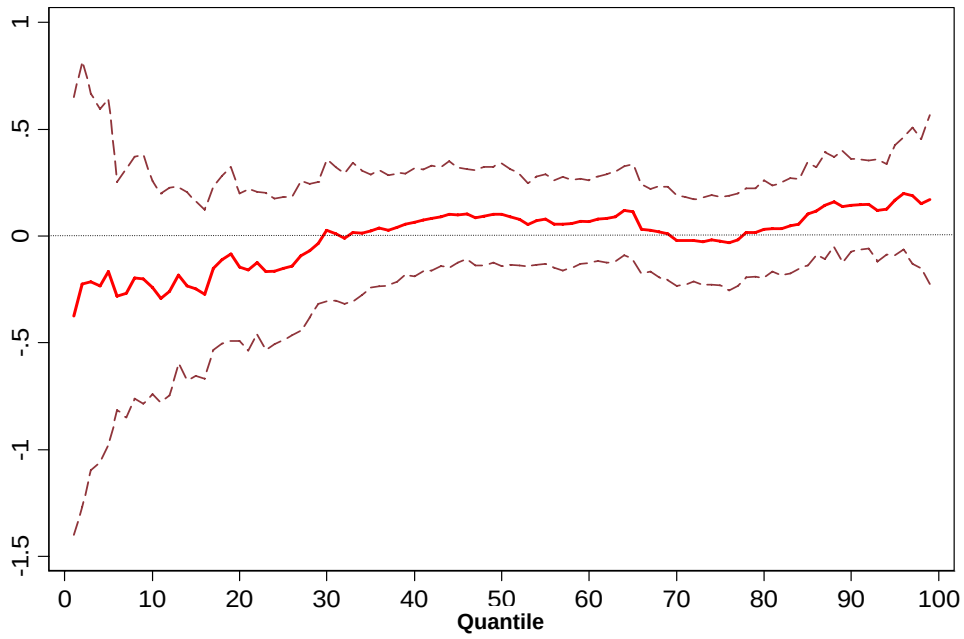
Standard errors in parentheses are clustered by worker i Columns 1 to 3, and by worker j in Column 4

	(1) New Friends	(2) Late New Friends	(3) Conditional Logit (Worker i)	(4) Conditional Logit (Worker j)
Absolute difference in ability	.859	1.24	.800	1.18
	(.137)	(.258)	(.159)	(.223)
Same nationality	42.1***		17.0***	36.2***
	(29.1)		(9.43)	(13.1)
Same living site	8.67***	11.3***	15.6***	13.8***
	(3.20)	(6.40)	(5.85)	(7.80)
Same arrival cohort	9.80***	8.80***	14.5***	11.7***
	(3.16)	(4.09)	(5.98)	(4.82)
Same gender	2.23***	1.74	1.48	2.23***
	(.618)	(.704)	(.396)	(.632)
Same subject study	2.21***	3.12***	5.62***	4.87***
	(.652)	(1.31)	(2.02)	(1.60)
Both have done paid work before	1.16	1.02	1.03	1.13
	(.339)	(.451)	(.298)	(.281)
Both play sports	1.14	.898	1.09	.904
	(.288)	(.310)	(.310)	(.249)
Observations	9546	1538	5357	4688

Notes: *** 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 in Columns 1 and 2 is equal to one if worker i reports worker j as being as being a newly formed friend in the workplace, and zero if worker j is not a pre-existing friend of worker i. The dependent variable in Columns 3 and 4 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 (4) a conditional logit regression is estimated where observations are grouped by worker i (j). Hence the sample falls in Column 3 because workers that name zero or seven friends are dropped. The sample falls in Column 4 because workers that are named by zero or all other workers are dropped. In all Columns the sample is based on workers for whom an ability measure is constructed. There are 138 workers in this sample. In Column 2 the sample is further restricted to those 52 workers that were interviewed more than three weeks after their time of arrival on the farm. In this specification, worker i and worker j being of the same nationality is a perfect predictor of the friendship link. In Columns 1 to 3 standard errors are clustered by worker i. In Column 4 standard errors are clustered by worker j. 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.

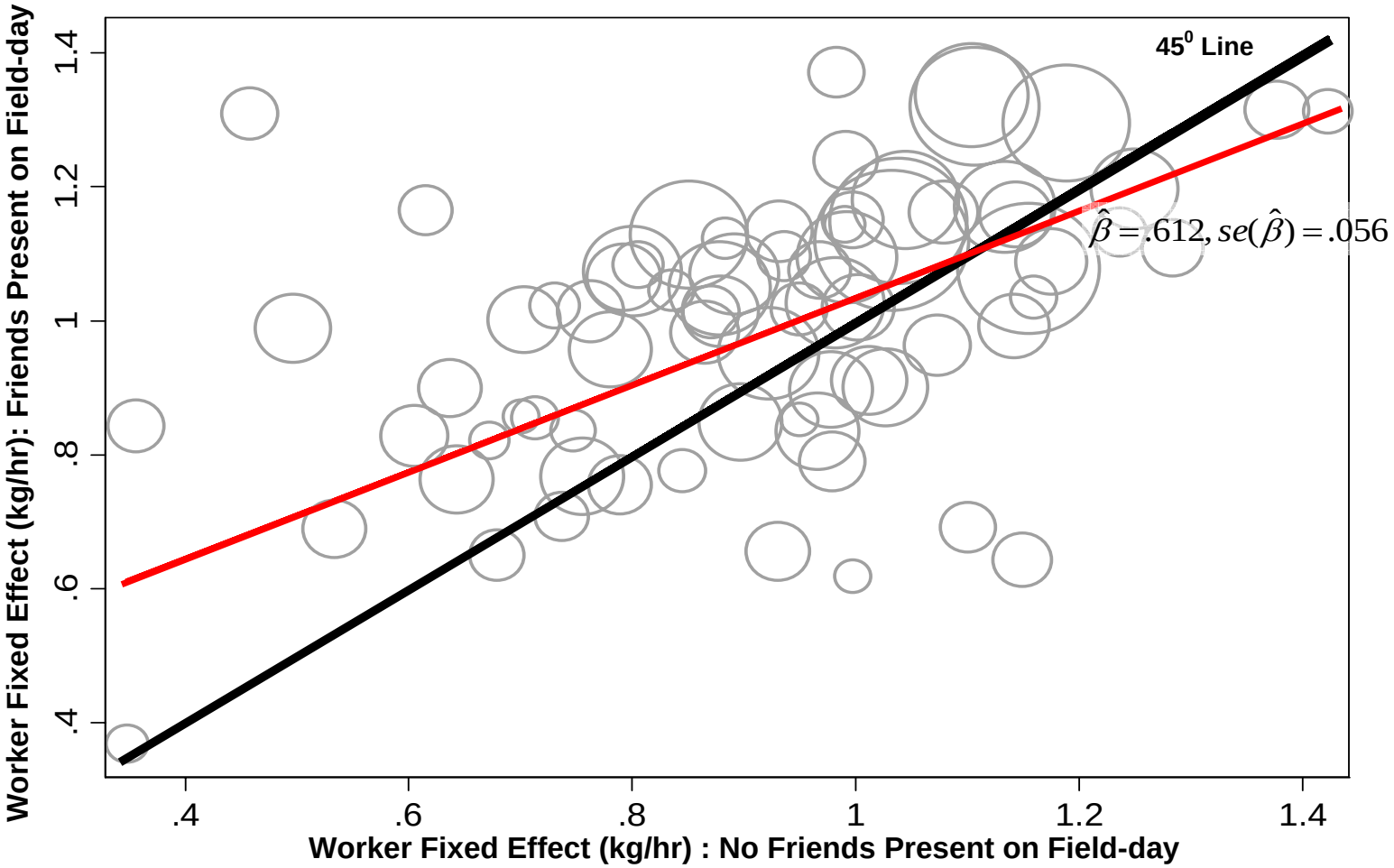
Figure 1A: Locally Weighted Regression of Residual Productivity on the Composition of Workers in the Field

Figure 1B: The Elasticity of Worker Productivity With Respect to the Share of Workers That Report Having Friends and At Least One of Their Friends is Present



Notes: Both figures are graphed for the subset of workers that report having no friends. Figure 1A 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 1B 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 that 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.

Figure 2: Cross Plot of Worker Fixed Effects



Notes: The Figure uses observations from workers that report having at least one friend on the farm. Throughout we only use observations from workers that report having at least one friend and where the fixed effect estimates with and without friends are both based on at least five worker-field-day observations. Figure 2 shows a scatter plot and fitted regression line of the worker's fixed effect with and without their friends on the field day. The bubble around each observation signifies the number of field-days the worker is observed in total, with a larger bubble identifying a worker who is observed more frequently. The fitted regression line corrects the intercept and slope coefficients for measurement error in both the dependent and independent variables.