Social Incentives: The Causes and Consequences of Social Networks in the Workplace*

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Abstract

We present evidence on the causes and consequences of workers' social ties in the workplace on individual and firm performance. We combine data from a firm's personnel records on individual productivity, with a survey we administered to workers to identify their social network. Our findings indicate there are social incentives – the presence of friends affects worker's behavior, despite there being no externalities among co-workers due to the technology or compensation scheme. Due to social incentives, workers conform to a common norm when working together. The level of the norm is such that the presence of friends increases the productivity of workers who are less able than their friends and decreases the productivity of workers who are more able than their friends. As workers are paid piece rates based on individual productivity, the strength of social incentives can be quantified in terms of income and are such that – (i) workers who are more able than their friends are willing to forgo 10% of their earnings to conform to the norm; (ii) workers who have at least one friend is who more able than themselves, are willing to exert more effort and increase productivity by 10% to meet the norm. The distribution of worker ability is such that net effect of social incentives on firm performance is positive.

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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 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 the causes and consequences of workers' social ties in the workplace on their own performance, and on the performance of the firm as a whole. To do this we combine data from a firm's personnel records on individual worker productivity, with a survey we administered to workers to elicit their social network of friends in the firm. We present evidence on – (i) the underlying forces that drive the formation of friendship networks; (ii) the presence and nature of social incentives, namely, whether and how workers' behavior is affected by the presence and behavior of those in their social network; (iii) the consequences of such social incentives for the firms's overall performance.[2]

The firm we study is a leading UK farm producer of soft fruit. Each year the firm hires foreign workers on seasonal contracts to pick fruit from fields on the farm. Two features of this setting make it ideal to study the causes and consequences of social incentives in firms. The first is that the workers' compensation scheme and production technology are such that worker's effort places no externalities onto their co-workers. Hence, any behavioral response of workers to the presence of their friends is solely due to their being social concerns of some kind within friendship networks.

The second key feature is that for each worker, the identity of their co-workers changes on a daily basis, for reasons that are documented to be orthogonal to productivity. This implies that on the same field and day some workers are with their friends and others are not. Most importantly, we observe the *same* worker on days in which he works with his friends and on days in which he works with people outside of his social network. In addition, for any given worker, we also observe variation in the identity of his friends that are present on the field, namely we observe the same worker on days in which he works with some subset of his friends, and on days in which he works with another subset of his friends. Together these features allow us to make

[1] In relation to the first literature, Granovetter's [1974] seminal study finds that the majority of surveyed residents of a Massachusetts town had obtained their jobs through social contacts. There is also evidence of the importance of social networks on the demand side of labor markets such that firms use the social networks of their workers to fill vacancies [Fernandez and Weinberg 1997]. In relation to the second literature, the organizational behavior and sociology literatures have stressed the role of social relations within firms. Examples of such work includes that on the effect of manager-subordinate similarity on subjective outcomes such as performance evaluations, role ambiguity, and job satisfaction [Thomas 1990, Wesolowski and Mossholder 1997], and on how social networks within the firm influence within firm promotions [Podolny and Baron 1997].

[2] The interplay between social relations and worker's outcomes has long been studied [Marshall 1890, Mayo 1933, Barnard 1938, Roethlisberger and Dickson 1939, Roy 1952]. More recently, such concerns have begun to be incorporated into economic models of behavior in firms [Encinosa *et al* 1987, Kandel and Lazear 1992, Rotemberg 1994, Bewley 1999].

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]

There are three stages to our analysis. First, we use data on workers' productivity on days in which they work without their friends, to build a measure of individual ability that is unaffected by the physical presence of friends. We use this measure to assess whether workers who share traits that are correlated to their performance are more likely to report forming a friendship.

At the second stage we use data on workers' productivity on days in which they work with their friends to assess whether social incentives are relevant in this setting, namely whether the productivity of friends who work together on the same field and day is correlated over and above the correlation that would arise naturally because of common productivity shocks.

In the third stage of analysis, we estimate the sign and magnitude of social incentives by comparing the productivity of the same worker on days when he works with his friends to his productivity on days when he works with people outside his social network. *A priori*, the effect of social incentives is ambiguous. 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 lead to workers being more productive in the presence of friends. Alternatively contagious malaise, low effort norms, or the presence of 'bad apples' may lead 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. In this case, the performance of low ability workers would improve in the presence of higher ability friends, whereas the performance of high ability workers would worsen in the presence of lower ability friends.

The analysis yields four main findings. First, individuals of similar ability are not more likely to be in the same social network. The data however supports the intuitive notion that individuals form friendships on the basis of similarity on other observable dimensions. For example, workers are significantly more likely to form new friendships with workers who are of the same nationality, of the same gender, or who join the workforce in the same cohort.[4]

Second, we find evidence that social incentives are present in this setting. The productivity of a given worker is correlated to the productivity of his friends when they work on the same field, over and above the correlation that would naturally arise because of common field conditions. Our

[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].

[4] 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].

baseline estimate of the elasticity of a worker's productivity with respect to friends' productivity is .131 once all contextual effects are controlled for. The magnitude of the effect is close to existing estimates of .14 and .17, obtained, respectively, from experimental data [Falk and Ichino 2006] and non-experimental data [Mas and Moretti 2006].

Third, the effect of social incentives is heterogeneous and a function of the worker's ability *relative* to his friends'. A given worker slows down when he works with friends who are less able than him and works faster when he works with friends who are more able than him. The magnitude of the effects suggests that social incentives are a powerful motivator. Given that workers are paid piece rates, the results imply that the average worker is willing to give up 10% of his earnings when he works with friends who are slower than him and to work 10% faster when he works with friends who are more able. To provide some context for these magnitudes, we note that others have previously estimated the causal 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].

Finally, we conduct a series of thought experiments to measure the impact of social incentives on aggregate firm productivity. 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. Compared to a scenario in which workers are never assigned to work with their friends, aggregate productivity would be 10% higher if workers were always assigned to work with their friends. Relative to the assignment of workers observed empirically, aggregate productivity would be 2.6% higher if workers were assigned to always work with their friends. Whether this would have increased profits, however, depends on the cost of keeping friends together in terms of reduced flexibility, which we cannot measure.[5]

The paper is organized as follows. Section 2 presents a theoretical framework of social incentives within the workplace. Section 3 describes our empirical context and data. Section 4 presents evidence in support of our identifying assumptions. Section 5 presents evidence on the formation of friendships. Section 6 presents results on the existence of social effects among friends. Section 7 identifies social incentives and measures their impact on individual and firm productivity. Section 8 concludes with a discussion of the external validity of our findings.

[5] Our analysis is complementary to 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 nascent literature based on experimental evidence to identify social concerns or peer pressure in workplace environments [Charness and Kuhn 2006, Falk and Ichino 2006]. None of these literatures has identified the effect of workers' individual social ties in the firm influencing behavior in settings without any externality across workers arising from the compensation scheme or production technology.

2 Theoretical Framework

[To complete]

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.[6]

Within each field, workers are assigned their own row of fruit to pick. Workers are present on the field-day 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 his own row, his productivity is independent of the efforts of other workers on the same field-day, so there are no complementarities between workers arising from the production technology.

Workers are paid a piece rate per kilogram of fruit picked. Each worker's pay is thus related to his own productivity, which is an increasing function of his effort, the quantity of fruit available on the rows of fruit within the field to which he is assigned, and the general conditions in the field in which he works. Given that the piece rate compensation scheme is based on individual performance, by exerting effort a worker places no externality on the compensation levels that accrue to his co-workers.

As the production technology and worker's compensation scheme are such that worker's effort places no externalities onto their co-workers, in this setting, any behavioral responses of workers to the presence of their friends is solely due to their being social concerns of some kind within friendship networks, as discussed in the previous section.

Finally, we observe workers picking two different fruit types that differ in one important dimension of their production technology. The fruit type grown on the majority of fields on the farm, which we refer to as Type I fruit, is such that workers can costlessly monitor the performance of all co-workers on the same field, and easily communicate and socialize with workers on adjacent rows. The second fruit type, which we refer to as Type II fruit, grows on dense shrubs that are six to seven feet high. While workers are able to physically communicate and socialize with those on

[6] To be recruited, individuals must be full-time university students and have at least one year remaining before graduation. Few workers are hired for consecutive seasons and workers are not typically hired from the local labor market.

adjacent rows when picking Type II fruit, they are unable to accurately monitor the quantity of fruit picked by workers in all rows on the same field-day. While we focus predominantly on Type I fruit, at some stages of the analysis we also exploit Type II fruit as a counterfactual from which to understand the importance of worker's being able to observe others to whom they are socially connected, on the nature of social incentives in the workplace.

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). Hence workers do not themselves decide which field they work on, nor do they decide whom to work with.[7]

The quantity of fruit available for picking varies across fields on any given day because fields vary in their physical size, and within a field over time because plants reach maturity at different times. The fruit is planted some years in advance so that – (i) the total quantity of fruit to be picked is given; (ii) 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 can be 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.

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 his friends on some field-days, and to observe the *same* individual working in the absence of his 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 him, to vary across the field-days on which i picks. Section 4 presents evidence to support the assumption that the COO's assignment of workers to friends is orthogonal to unobservable determinants of the worker's performance.

[7] The COO sets the piece rate on each field-day. The piece rate is the same for all workers on a given field-day and is set to minimize the firm's wage bill each field-day subject to a minimum wage constraint. 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.

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, like workers, are hired on seasonal contracts and from the same pool of individuals. 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.[8]

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. Namely the quantity of fruit available in adjacent rows is negatively correlated.

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 mitigates against finding evidence of some forms of social concern driving behavior, such as the benefits of socializing with friends on the field.

3.4 Data Sources

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

[8] A separate group of individuals, called field runners, are responsible for physically moving fruit from the field to the packaging plant. They do not themselves pick fruit nor do they manage workers.

friends on the farm. 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 each individual.[9]

3.5 Sample Selection

As workers continuously arrive to the farm throughout the summer, the worker survey is administered on three different dates over the peak picking season. The survey covers half the workers that were ever employed during the 2004 season. There are three reasons why a worker may not have been interviewed. First, the worker might have arrived and departed between survey dates. This is a relatively rare occurrence as surveys are administered approximately every five weeks and less than 10% of workers spent less than a month on the farm. Second, on any given survey date, a worker may be present but refuse to answer the survey. This is also quite rare – of the workers asked to respond to the survey, over 95% of them chose to do so. Third, a worker may be present on the farm but not respond to the survey because they are not in the living quarters during the evening when the survey is conducted. This may occur if they are either travelling back from geographically remote fields, or they are engaged in other non-work related activities away from the farm site at the time of the survey.[10]

This last form of non-response raises a concern that a non-representative sample of workers may be surveyed. For example, more outgoing or sociable workers may be both more likely to form friendships in the workplace and to be surveyed on any given survey date. Surveyed workers may then provide a misleading picture of the causes and consequences of social ties in the firm. To address concerns over sample selection, 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.

[9] The survey is translated into a number of Eastern European languages, and administered by enumerators from Eastern Europe. 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. 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.

[10] One concern stems from the fact that the behavior of workers who arrive earlier in the season may contribute relatively more weight to our estimates of the existence and form of social concerns in the workplace. Two points are of note in relation to this. First, the time that individuals arrive on the farm varies for reasons that are exogenous to the worker's performance on the farm, such as their university term dates in their home countries and the date on which their work permit is issued. Second, as we focus on the picking season until the end of September, those that arrive later contribute relatively more worker-field-day observations towards the end of the season. In any case, the majority of workers in our sample arrive by mid June, and all workers are permitted to stay between three and six months on the farm.

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 the left tail of the productivity distribution. Second, the two groups are of similar genders, ages, nationalities, are equally likely to have previously had paid employment, and study similar subjects in their home countries. The key differences between surveyed and non-surveyed workers are that the latter are – (i) resident for less time on the farm and so have significantly lower picking experience; (ii) significantly less likely to reside on the main living site on the farm. In addition, 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. Overall the evidence indicates that the social networks of non-surveyed workers do not overlap with those of surveyed workers on which our analysis is based.

3.6 Reported Friendships

Table 1 shows the pattern of self-reported friendship ties within the workplace. 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.[11,12]

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. 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 number and identity of their

[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 the sense that they have no social interaction with any co-workers. However, central to our analysis is the notion that friendship networks are qualitatively important determinants of worker behavior in firms. In line with this, we later present evidence that the presence of friends influences the performance of connected workers, and that the presence of other groups of individuals does not influence the performance either of connected workers nor of isolated workers.

[12] As is intuitive, 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.

friends in the workplace, Table A2 reports evidence from the survey on the types and frequency of interactions among connected workers and their friends. We collected information on four different dimensions of social interaction – going to the supermarket together, eating together, lending/borrowing money, and talking about problems. The results suggest the first reported friend is whom the worker interacts with most frequently along all dimensions, followed by the second reported friend, and so forth. Moreover the first named friend of i is also most likely to be a pre-existing friend of worker i and themselves report worker i as a friend of theirs. Two points are of note. First, 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 those based on similarity on observables such as gender or nationality. Second, although workers may well have more than seven friends in the firm, the strength of the social ties between workers – measured either by the various forms of interaction in Table A2 or the probability the relationship is reciprocal – decreases as they are reported later in the survey.[13]

4 Building Blocks of the Analysis

The workplace we study has two key features that make it well suited to identify the existence of social incentives among workers, and to identify their effect on productivity. 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.

Second, for each worker, the number of his friends present on the field varies over time, and the specific identity of which of his friends are present also varies across field-days. Hence we observe the *same* worker on days in which he works alongside his friends and on days in which he works without any of his friends.

This variation allows us to address three questions. First, we assess whether friendships are formed among people who share common traits that affect work performance. To do so, we test whether friends' productivity levels are correlated even when they do not work together. Second, we exploit variation in the composition of friends present on different field-days to test whether friends' productivity levels are correlated when they do work together. Third, we exploit the difference in worker's behavior between field-days with and without friends to identify the causal effect of the presence of friends on workers' performance.

Our identification strategy rests on the assumption that the assignment of workers to their friends across field-days is orthogonal to unobservable determinants of workers' performance. Fac-

[13] We also note that comparing workers that report seven friends with those that report less than seven, the two groups 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 seven friends.

tors that can invalidate our empirical strategy can either be field-day, or worker-field-day, specific.

The former category includes factors that affect the performance of all workers on the same field-day. For instance if the COO were to assign individuals to work alongside their friends on field-days in which productivity is naturally lower, then this would generate a spurious negative correlation between the presence of friends and workers' productivity even in the absence of a causal effect of friends on productivity. The latter category includes factors that differentially affect workers on the same field-day. For instance, if the COO were to assign workers to work with their friends on field-days in which they felt particularly motivated or less tired, then this would generate a mechanical positive relationship between worker performance and the presence of friends even in the absence of any social incentives.

In this section we provide evidence in support of our identifying assumptions that the allocation to friends is orthogonal to field-day and worker-field-day specific determinants of productivity.

To rule out field-day specific factors we exploit the fact that on every field-day we observe both connected and isolated workers. In Section 4.1 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 also affect the productivity of the isolated workers.

To rule out field-day-worker specific factors, Section 4.2 tests whether a given worker is more or less likely to work with friends as a function of determinants of productivity that differ for different workers on the same field-day.

4.1 The Assignment of Friends: Field-day Factors

4.1.1 Descriptive Evidence

In Table 2 we examine 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 standard deviation of productivity, and 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 the characteristics of the field-day 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 on Type I fruit picking 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 on 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. The former source of variation implies that within the same field-day, we observe some connected workers with their friends and others working in the absence of their friends. Hence the causal effect of the presence of friends on worker performance can be identified, conditional on factors that drive the performance of all workers within the same field-day, such as field conditions, the piece rate, and the identities of managers. The second source of variation implies the likelihood the friends of a given worker i are present on the field-day varies over time, hence the precise identity of his friends present also varies. This opens up the possibility of identifying the causal effect of one subset of friends on worker i's productivity, such as higher ability friends, relative to another subset of friends, such as lower ability friends.

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 will be 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 provide a comparison of 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 a greater number of workers. Reassuringly, the size of fields on which connected workers pick in the absence of their friends are no different to the size of 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.[14]

4.1.2 Econometric Analysis

We now provide direct evidence in support of the assumption that the allocation of connected workers to friends is orthogonal to field-specific unobservable determinants of productivity. The basis of our approach is to examine how the performance of isolated workers changes with the share of connected workers on the same field-day that have their friends present. We first run the following panel data regression for isolated worker i on field f on day t,

$$y_{ift} = \alpha_i + \lambda_f + \delta X_{ift} + \lambda Z_{ft} + \tau t + u_{ift}, \tag{1}$$

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 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.[15]

At the second stage we take each worker's residual productivity from (1), and estimate a locally weighted regression of each isolated worker i's residual productivity on field-day ft, on the share of

[14] One concern may have been that later in a field's life cycle there is naturally less variation in the quantity of fruit available across different rows. Hence if it was the case that connected workers predominantly pick with their friends later in the season for example, this would induce their performances to be more similar than earlier in the season in the absence of friends, even if workers have no social concerns over those in their friendship network.

[15] 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.

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 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 range. Hence the data does 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 differences in mean productivity, 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. 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.[16]

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 $\theta \in [0, 1]$,

$$Quant_\theta(y_{ift}|.) = \phi_{\theta f}\lambda_f + \delta_\theta X_{ift} + \lambda_\theta Z_{ft} + \tau_\theta t + \mu_\theta S_{ft}, \tag{2}$$

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.

The estimates suggest the conditional distribution of productivity does not become more 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.

4.2 The Assignment of Friends: Worker-Field-Day Factors

We now provide direct evidence in support of the assumption that the allocation of connected workers to friends is orthogonal to unobservables at the worker-field-day that both drive the

[16] The quantile regression method imposes no distributional assumptions on the error term, which in our context relates to the unobservable 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.

likelihood the COO assigns connected workers to their friends, and determine worker productivity.

The following linear probability model is used to estimate the correlates of when a connected worker is assigned to work with his friends or not,

$$D_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + \lambda y_{ift-1} + u_{ift}, \tag{3}$$

where D_{ift} is set equal to one if connected worker i has at least one friend present on field-day ft, and is set equal to zero otherwise. We control for worker fixed effects α_i, and additionally control for field-day fixed effects λ_{ft} to capture labor demand shocks that lead to changes in the number of workers on the field-day. These fixed effects also control for field-day conditions that cause workers to lobby managers or the COO to be able to work alongside their friends.

We 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 last field-day on which he 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 his friends alters over time as he becomes more experienced say, and whether his previous performance influences his subsequent assignment to friends. The results are presented in Table 4.

Column 1 shows a weak relationship between a worker's picking experience and the likelihood he is assigned to work with his friends. When we allow the relationship to be non-linear in Column 2, the result, in line with the descriptive evidence in Table 3, is that connected workers are more likely to work with their friends when they have less picking experience, although the magnitude of this effect is small. A one standard deviation increase in a worker's picking experience decreases the probability he works with a friend by 1.7%, relative to a baseline probability of 64.4%.

Column 3 then controls for the lagged productivity of the worker, y_{ift-1}. There is no relationship between how a worker has performed in the immediate past and her subsequent assignment to friends. It is not therefore the case that 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 (or not) on the subsequent field-day.[17]

Column 4 analyzes the assignment of workers for Type II fruit, for which as described previously, the production technology is such that workers are unable to monitor all co-workers on the field. If management believe that workers are only influenced by the presence of their friends if they can observe them, we may expect the algorithm by which connected workers are assigned to their friends to differ under the two technologies. The results show this is not the case.[18]

[17] 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 significantly different from zero at the 10% level.

[18] For each fruit type, we also experimented with two alternative specifications. In the first we replaced the

5 Worker Ability and the Formation of Social Networks

Having established the assignment of workers to friends on any given field-day is orthogonal to determinants of worker productivity, we now exploit field-days on which workers are observed in the absence of their friends, to construct a measure of each worker's 'permanent productivity' or 'ability'. This ability measure is, by construction, based on field-days in which workers' performance is unaffected by the physical presence of their friends. In the next subsection we then use this measure of ability to understand the process underlying the formation of friendship ties in the workplace. In particular, we establish whether workers become friends with those of similar ability as this allows us to later assess whether any correlation between a worker's productivity with that of his friends on the same field-day is likely due to any common unobserved ability traits, or to the existence of social concerns among socially connected individuals.[19]

5.1 Building a Measure of Worker Ability

Define D_{ift} to be an indicator that equals one if worker i has at least one friend present on field-day ft, and zero otherwise. We then estimate the following panel data specification restricted to field-days in which worker i has no friends present on the field-day,

$$y_{ift} = \alpha_i^0 + \lambda_f + \delta X_{ift} + \eta Z_{ft} + \lambda t + u_{ift} \text{ if } D_{ift} = 0, \tag{4}$$

and all variables are as previously defined. Each worker's estimated fixed effect, $\widehat{\alpha}_i^0$, thus measures worker i's 'permanent productivity' or 'ability' in the absence of his friends, conditional on other observable determinants of productivity. Among connected workers, $\widehat{\alpha}_i^0$ is based on the sample of field-days in which friends are not present, and hence it is uncontaminated by behavioral responses to the presence of friends. As shown in Table 3, for connected workers $\widehat{\alpha}_i^0$ is estimated from on average of 15.8 observations per worker. For isolated workers, $\widehat{\alpha}_i^0$ is estimated from all the field-days in which they pick fruit, which is on average, 44.

This procedure provides a continuous measure of each worker's ability. The units in which (the exponent of) ability is measured is kilograms of fruit picked per hour and so this metric is directly

field-date fixed effects with field-day level controls such as the total number of pickers on the field-date and the field life cycle. To pick up factors that may alter the marginal rate of substitution between effort and socializing with friends we also controlled for the average temperature and rainfall on the day. Finally we controlled for a linear time trend to capture learning by management and for field fixed effects to capture permanent differences in the labor demand across fields. The previous results were all found to be robust to this change in specification. In the second alternative specification we explicitly accounted for the discreteness of the dependent variable by estimating a conditional logit regression model in which observations are grouped by worker. In this specification it continues to be the case that worker specific variables such as his experience and lagged productivity do not significantly change the likelihood he is assigned to work with his friends.

[19] We contribute to the small literature on the formation of networks outside of laboratory settings [Conley and Udry 2005, Marmaros and Sacerdote 2006].

comparable to productivity. Among connected workers, their average ability is estimated to be .812 kg/hr with a standard deviation of .176. The average ability among isolated workers is estimated to be .905 kg/hr with a standard deviation of .198. Hence there is considerable heterogeneity in ability among both isolated and connected workers. Relative to the average productivity on field-days on which these workers pick in the absence of their friends, around 9.8% (10.9%) of the average isolated (connected) worker's performance can be attributed to their ability, with the remainder being attributable to the other factors conditioned on in specification (4).[20]

5.2 The Formation of Friendships

We now use the measure of each worker's ability to understand whether workers form friendships with those of similar ability. They may do so if similarity in ability is correlated to similarity on other traits and individuals enjoy the company of those who are similar to them. More specific to this setting, similarity in ability may determine friendship ties if such workers are assigned to work with each more often and so become friends as a result of their similarity in ability. Understanding whether friends have correlated levels of ability is key to assessing whether friends affect each other's behavior. Indeed, if workers purposefully match on ability, their performance would be correlated with their friends' performance even in the absence of any social incentives.

To estimate how friendship ties are formed we first define a dummy variable, l_{ij}, equal to one if worker i reports j as a friend, and zero 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, $(\widehat{\alpha}_i^0, \widehat{\alpha}_j^0)$. In total, there are 138 workers in this sample with 9591 potential worker friendship pairs defined. We then estimate the following logit regression,

$$Pr(l_{ij} = 1) = \Lambda(X_{ij}, \left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|), \tag{5}$$

where $Pr(l_{ij} = 1)$ is the probability that $l_{ij} = 1$, $\Lambda(.)$ is the logistic CDF, X_{ij} are measures of similarity between i and j, and $\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|$ is the absolute difference in worker i and j's ability, measured in kilograms/hr. Table 5 presents the results. The coefficients are presented as log odds

[20] Three other issues are of note. First, we can use this measure to quantify the heterogeneity among friends in their ability. The standard deviation in ability among worker i and his friends is .245. As shown more formally in the next subsection, workers do not sort into friendship groups on the basis of ability. Second, the ability measures can be used to assess whether management sorts workers into fields by ability over time. Depending on the true nature of social concerns, such sorting of workers may either bias against finding evidence of social concerns, or may lead to us over estimating the true influence such concerns have on worker behavior. To check for this we first calculate the standard deviation in ability of workers at the field-day level, and we 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. Third, an alternative procedure by which to build the ability measure for worker i is to estimate (4) for all workers except i and then impute the fixed effect for i. This procedure leads to similar results to those presented.

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 measure is divided by its standard deviation so that the reported coefficient can be interpreted as the change in the odds of two workers forming a friendship tie with a one standard deviation change in the absolute difference in their abilities.

To begin with, Column 1 estimates (5) controlling only for the ability differential $\left|\widehat{\alpha}_i^0 - \widehat{\alpha}_j^0\right|$. The result shows that 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.[21]

Column 2 additionally includes other factors that are likely to drive the formation of friendships and that might also be correlated with ability. We include the following characteristics – 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 of each other and who arrive in the same cohort.[22,23]

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 may work at similar speeds on a field.

Column 2 shows that workers are significantly more likely to form new friendships with workers if they are of the same nationality, arrival cohort, living site on the farm, gender, study the same

[21] We also used two alternative measures of the ability difference. First, rather than the absolute difference in abilities which is a continuous measure, we build a dummy variable which is equal to one if both workers are either above or both below the median ability of all workers in the sample. Second, we use an imputed measure of ability as described in the previous subsection. For both alternative measures of ability, there is no evidence that workers match with those of similar ability.

[22] 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. Management often organize social activities for groups of workers and these groups are typically formed on the basis of the location of their caravans in the living quarters. Hence individuals in neighboring caravans are more likely to interact during such activities than are individuals not housed in close proximity to each other.

[23] 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. The variation in time of arrival to the farm is caused by different university term dates in the home countries of workers, and differences in the times when work permits are submitted and issued across individuals.

subject in their home country, have both had paid employment in the past, and both play sports. The data therefore supports the intuitive notion that individuals that are similar on observables are significantly more likely to form friendships in the workplace, than those that are dissimilar. 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.[24]

A possible cause for concern is that the process underlying the formation of new friendships in the workplace differs from that for friendships outside of the work environment. In particular, individuals may 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 3 shows that new friendships are no more likely to form on the basis of similarity in worker ability.

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. Although we aim to survey workers two weeks after their arrival – to allow for new friendships to form and be reported – some individuals are surveyed much later relative to their time of arrival. Such workers may have had more time to sort by ability or may be more aware of the net benefits of having friendships ties with those of similar ability. Column 4 restricts the sample to those 52 workers that were interviewed more than three weeks after their time of arrival on the farm, 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 on ability either.[25]

Taken together, Columns 3 and 4 cast doubt on whether there are any strategic advantages or disadvantages for workers to purposefully seek to befriend those with similar ability. This may have been the case if the COO were to assign workers of similar ability to each other say by sorting workers into fields by ability. This idea is not supported by the evidence on how friendships are formed in the workplace.

A third concern is that 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

[24] A concern is that workers' spuriously report who are their friends. To check for this we randomly assign each worker the same number of friends as he actually reports and reestimate (5). 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.

[25] In this subsample, being of the same nationality is a perfect predictor of the friendship tie so this regressor is dropped from Column 4.

ability may be 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 7, shows most of the estimates of the odds ratios to be similar to the baseline estimates in Column 2, 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 8 shows the results to be qualitatively similar to those in the baseline specification in Column 2. Again once heterogeneity across workers is accounted for, there is no evidence that workers match on ability.[26]

6 Social Incentives: Existence

We now exploit variation in the identity and average productivity of worker i's friends across field-days to establish whether the productivity of a given worker is correlated to the productivity of his friends when they work on the same field-day, over and above the correlation that would naturally arise due to common productivity shocks. To reiterate, there is no reasons for such a correlation to exist due to the production technology or compensation schemes in place.

We estimate the following panel data regression for connected workers on the subset of field-days when at least one of their friends is present,

$$y_{ift} = \gamma \overline{y}_{ift} + \alpha_i + \lambda_{ft} + \delta X_{ift} + u_{ift} \tag{6}$$

where y_{ift} is the logarithm of the productivity of worker i on field f on day t, $\overline{y}_{ift}$ is the logarithm of the average productivity of the friends of worker i that are present on field-day ft, α_i and λ_{ft} are workers' and field-day fixed effects respectively, and X_{ift} is the worker's cumulative picking experience.

The parameter of interest is the elasticity of worker i's productivity with respect to his friends' productivity, γ. This parameter reflects any correlation between the productivity of worker i

[26] We also conducted a number of further robustness checks on these results. 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*.

and the productivity of his friends over and above that related to common productivity shocks, captured in the field-day fixed effects λ_{ft}. As is well known, the causal effect of a worker's friends productivity on his own productivity is not identified because of the reflection problem, namely the feedback from y_{ift} to $\overline{y}_{ift}$ [Manski 1993].

To estimate γ, we exploit variation in the identity and average productivity of worker i's friends across field-days, and variation in the productivity of different groups of friends within the same field-day. The estimate of γ is thus purged of time invariant unobserved heterogeneity across workers that might arise from differences in ability or motivation. Most importantly, γ is also purged of contextual effects, namely features of the field-day that affect the productivity of all workers on that field-day, such as the quantity of fruit available, the level of the piece rate, and the identity of managers.

Columns 1 and 2 in Table 6 report estimates of (6), with and without controlling for field-days fixed effects. The elasticity of own productivity with respect to friends' productivity is $\widehat{\gamma} = .663$ when contextual effects are not controlled for, and $\widehat{\gamma} = .131$ when they are. The magnitude of the effect is close to existing estimates of .14 and .17, obtained, respectively, from experimental data [Falk and Ichino 2006] and non-experimental data [Mas and Moretti 2006].[27]

To provide further evidence that this estimate is purged of common productivity shocks within friendship networks in the same field-day, we implement a placebo test using a spuriously defined network. To do so we match each worker with seven randomly selected individuals from the sample, and estimate the correlation between the worker's productivity and the average productivity of these randomly assigned friends on the field-day. Columns 4 and 5 show that the correlation is .497 in absence of field-date fixed effects, and falls to zero when we control for contextual effects. Hence it is not the case that worker's productivity remains correlated with that of others on the field-day once field-day fixed effects are controlled for.[28]

While our estimate of $\widehat{\gamma}$ is purged of contextual effects, the correlation between friends' productivity might capture common personality traits if friends match on traits that are correlated to their productivity on the field. If $\widehat{\gamma}$ were capturing a common trait, however, friends' productivity should be correlated also when they do not work together on the same field. The evidence from Section 5, on the formation of friendship ties, shows this is not the case – workers are no more likely to form friendships with those of similar ability. The remaining Columns of Table 6 provide further evidence on this issue.

To begin with, Column 6 shows the elasticity of productivity with respect to friends' productiv-

[27] This baseline result is robust to – (i) weighting observations by the number of friends present on the field-day; (ii) restricting the sample to individuals that report less than seven friends in the workplace.

[28] Further results show that when a worker's actual and randomly assigned friends are both present, worker i's productivity is only correlated with that of truly reported network of friends. In addition, the productivity of isolated workers is also uncorrelated with the average productivity of randomly assigned workers in the same field-day.

ity to be similar across friendship networks of different vintage, namely for friendships that formed on the farm, or existed prior to arrival in the workplace. If friendships were formed because of similarity in productivity we would expect the correlation to be higher among new friends, as old friendships were formed in a different context where productivity in fruit picking is irrelevant.

In Column 7 we exploit the fact that we observe some of the same workers picking another type of fruit, Type II fruit, for which the production technology is such that workers cannot observe the performance of others on the field. If $\widehat{\gamma}$ were capturing a common trait, productivity within friendship networks ought to be correlated also when picking Type II fruit. Column 7 replicates our baseline findings for the subsample of workers who also pick Type II fruit. The estimated $\widehat{\gamma}$ is close to that for Type I fruit, .734. Column 8 then shows that for Type II fruit the correlation falls to zero when we control for common productivity shocks by conditioning on field-day fixed effects. To address the concern that those workers assigned to pick Type II fruit may differ from those assigned to Type I fruit, Column 9 re-estimates our baseline specification from Column 3 for Type I fruit, for the subsample of workers that are also observed picking Type II fruit. The previous results are robust to focusing on this particular group of workers.[29]

7 Social Incentives: Productivity Effects

In our context the behavior of workers can only be influenced by the presence of their friends because of social concerns, since neither the production technology nor the workers' compensation scheme generate externalities among workers. While the evidence in Table 6 indicates that friends' productivity levels are positively correlated, the aim of this section is to establish – (i) whether the presence of friends has a positive or negative effect on worker performance; (ii) the effect of the presence of friends on aggregate firm performance, which is key to being able to shed light on the optimal organization of the workplace.

On the one hand, the presence of friends might make work more enjoyable, generate contagious enthusiasm, provide positive role models, or generate 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. Alternatively contagious malaise, low effort norms, or the presence of 'bad apples' may

[29] In interpreting these results it is important to bear in mind that although the personnel data records the identity of all workers on the field-day, it does not record which rows within the field-day they are assigned to. We are therefore unable to control for contextual effects at the sub field-day level, which might create a spurious correlation between worker i's productivity and his friends' if, for instance, friends were assigned to adjacent rows and if the quantity of fruit available on adjacent rows were similar. However, as discussed in Section 3, the production technology is such that more plentiful rows are interspersed with less plentiful rows, creating a negative correlation in the quantity of fruit on adjacent rows. In this context, a spurious positive correlation can arise if friends are allocated to similarly plentiful rows, but which are not therefore adjacent to one another. The physical distance between friends may then reduce the likelihood that behavior is driven by some forms of social concern, such as the desire to socialize with friends in the workplace. We discuss this issue in more detail in the next Section.

lead 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. In this case, the performance of low ability workers would improve in the presence of higher ability friends, whereas the performance of high ability workers would worsen in the presence of lower ability friends. The remainder of this Section presents evidence to distinguish between these forms of social concern driving workers' behavior.

7.1 Social Incentives: Effects on Individual Productivity

7.1.1 Heterogeneous Effects: Descriptive Evidence

To shed light the effect of social incentives on individual worker productivity, we first present descriptive evidence on how worker productivity varies in the presence of their friends.

The first row of Table 7A shows that unconditionally, the productivity of connected workers is on average not significantly different when they work in the presence of their friends, relative to when they work alone. This evidence is inconsistent with the mechanism behind social concerns being such that there would be a positive or negative effect for *all* workers in the friendship network. The finding that the presence of friends does not affect mean productivity can be reconciled with the previous finding that friends' productivity levels are correlated when working together if the presence of friends has heterogeneous effects on different workers.

To assess whether this is the case, we estimate the following panel data specification that is analogous to (4) but where the sample is restricted to the subset of field-days in which connected workers have at least one friend present on the field-day,

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

and all variables are as previously defined. Each worker's estimated fixed effect, $\widehat{\alpha}_i^1$, thus measures worker i's 'permanent productivity' in the presence of his friends, conditional on other observable determinants of productivity. As shown in Table 3, for connected workers $\widehat{\alpha}_i^1$ is estimated from on average of 24.4 observations per worker.

Figure 2 then shows a cross plot of the exponents of each worker's average productivity in the absence of friends, $\widehat{\alpha}_i^0$, against the same workers average productivity in the presence of friends $\widehat{\alpha}_i^1$, where other observable determinants of productivity have been conditioned on in each case. The circle around each observation measures the number of field-days the worker is observed in total, with a larger circle identifying a worker who is observed more frequently.

The cross plot shows that, indeed, the effect of social incentives varies in magnitude and sign 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. The figure also shows the line of best fit and we note that this line has a slope coefficient that is – (i) significantly less than one, so that there is a differential effect of the presence of friends by workers ability; (ii) 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.[30]

Table 7A reports mean unconditional productivity with and without friends for workers at different quartiles of the ability distribution. The table shows 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.

Both the absolute and proportionate effects on low ability workers' productivity are greater than for high ability workers. Relative to when their friends are absent, the productivity of workers in the bottom quartile increases by 52%, whereas the productivity of workers in the top quartile decreases by 13%. The final row in Table 7A shows the productivity differences between the first and fourth quartiles of ability in the presence and absence of friends. We see that when working in the presence of 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.

These findings reiterate that low ability workers increase their performance in the presence of friends, and that high ability workers decrease their performance. Given that as documented in Section 4, friendships do not form on the basis of the similarity in workers ability, individuals of high ability are likely to have friends of lower ability and *vice versa*. Hence these results hints at the possibility that the underlying mechanism that drives worker's behavior in the presence of their friends relates to their ability *relative* to that of their friends. We now explore this hypothesis in more detail.

Table 7B compares the productivity of connected workers when they work in the absence of their friends, relative to when – (i) they are the most able worker among their friends on the field-day; (ii) they are the least able worker among their friends on the field-day; (iii) they are in the middle of the distribution of ability among their network of friends on the field-day. These classifications are based on the each worker's ability measure, $\widehat{\alpha}_i^0$ relative to those of his friends

[30]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.

on the field-day, $\widehat{\alpha}^{0}_{n(i)ft}$.[31]

The table shows that relative to when working in the absence of their friends – (i) workers are significantly more productive when they work with friends that are more able than them; (ii) are significantly less when they work with friends that are less able than them; (iii) their productivity is unchanged when they lie in the middle of the distribution of ability among the friendship network. Taken together, the descriptive evidence points to the ability of a worker relative to those of his friends present, to be the key driver of individual behavior in this setting.

7.1.2 Heterogeneous Effects: Estimates

We now shed light on whether and how the behavior of workers is affected by the presence of their friends and their ability relative to their friends, conditional on unobserved heterogeneity across workers, fields, and field-day determinants of productivity. To do so, we first 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 friends of worker i is present of field-day ft, and zero otherwise, and all other variables are as previously defined. The parameter of interest, β, measures the effect on worker productivity of the presence of at least one friend relative to when workers pick fruit in the absence of their friends.

Column 1 of Table 8 reports the estimate of (8). We find that $\hat{\beta} = 0$, so that the presence of friends has no significant effect on the productivity of the average worker conditional on other determinants of productivity. In line with the evidence in Section 4, this suggests the COO does not non-randomly assign workers to their friends on field-days on the basis of unobserved determinants of productivity.

Moreover, the result helps rule the presence of social concerns in which *all* workers either increase or decrease their productivity in the presence of friends. This implies the presence of friends does not generate contagious enthusiasm, provide positive role models, or generate 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. Alternatively, the results also rule out social concerns in the form of contagious malaise, low effort norms, or the presence of 'bad apples' that lead all workers to be less productive in the presence of friends.

Next, we analyze whether the sign and the magnitude of the social incentives effect depend on the worker's ability relative to his friends. To do so we exploit variation in friends' identity, that

[31] Throughout, this network of friends, $n(i)$, is defined to be the unidirectional friends of worker i at distance one to him. This ensures that the friendship network is specific to each worker.

is we observe the same workers working alongside different friends on different days. This allows us to potentially identify the causal effect of one subset of friends – say higher ability friends – relative to another subset of friends – say lower ability friends, if the assignment of friends to each other is orthogonal to productivity. For this to be the case, we require the allocation of connected workers to friends of higher or lower ability is orthogonal to unobservables at the worker-field-day that both drive the likelihood the COO assigns connected workers to a particular subset of their friends, and determine worker productivity.

To provide such supportive evidence we focus on the subset of field-days on which connected workers have at least one friend present, and estimate a linear probability model that is analogous to the specification in (3), but where the dependent variable is a dummy variable, A_{ift}, which is set equal to one if connected worker i has no friend more able than himself present on the field-day, and zero if worker i has at least one friend of lower ability on the field-day,

$$A_{ift} = \alpha_i + \lambda_{ft} + \delta X_{ift} + \lambda y_{ift-1} + u_{ift}, \tag{9}$$

where all controls are as previously defined. The results are presented in Table A3 are show that – (i) there is no relationship between a worker's picking experience and the likelihood he is assigned to work with his friends (Columns 1, 2); (ii) there is no relationship between how a worker has performed in the immediate past and her subsequent assignment to more or less able 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 more able friends (or less able friends) on the subsequent field-day.[32,33]

To estimate whether the presence of friends has heterogenous effect on worker productivity by the workers' ability relative to their friends we estimate,

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

where $A_{ift} = 1$ if worker i is the most able among his friends on the field-day and 0 otherwise. The parameters of interest are – (i) γ_1, the effect on worker productivity of the presence of at least one friend that is less able relative to when workers pick fruit in the absence of their friends;

[32] If two lags for productivity are introduced, the coefficient (standard error) on the first lag is -.002 (.002) and on the second lag is -.003 (.002), and neither lag is significantly different from zero at the 10% level.

[33] A final concern is that some groups of friends may be less likely to work with each other than others. For example, if management were concerned that when working with friends, individuals shirk and exert the effort of the least able individual in the friendship network, then they would purposefully aim to prevent groups of friends that are very heterogeneous in terms of their underlying ability from working with each other. To check for this type of non-random assignment, we first calculate the standard deviation of ability among i and his friends, $sd(\widehat{\alpha}_i^0, \widehat{\alpha}_{n(i)}^0)$. We then regress the share of field-days worker i has his friends present on the standard deviation of ability among i and his friends. Reassuringly, we find there to be no significant relation between the two.

(ii) γ_2, the effect on worker productivity of the presence of at least one friend that is more able, relative to when workers pick fruit in the absence of their friends. In both specifications standard errors are clustered by worker.[34]

The result in Column 2 of Table 8 shows the previous estimate of $\hat{\beta}$ is an average of two distinct effects – (i) the average worker is 10.4% more productive if at least one of his more able friends is on the field day, relative to himself on field-days when none of his friends are present; (ii) the average worker is 9.9% less productive if he is the most able among his friends on the field-day, relative to himself on field-days when none of his friends are present.

To address any remaining concerns that the subset of field-days when friends work in the absence of their friends are not a valid counterfactual to when friends are present, Column 3 then restricts the sample to field-days when worker i works with at least one friend and identifies γ_1 and γ_2 from variation in the precise identity of friends present. In line with the previous findings, the average worker is 24.6% more productive when he works with at least one friend who is more able than him compared to when he is the most able in his network of friends.

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 explicitly control for field-day effects in (10) and exploit the variation in D_{ift} within the same field-day. This variation arises from the fact that on any given field-day, some connected workers have their friends present, and others do not.

The result, reported in Column 4, Table 7, 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 3, and both remain significantly different from zero at conventional levels of significance.

In this specification the underlying identifying assumptions are that D_{ift} and A_{ift} are orthogonal to productivity shocks that are specific to worker i on field-day ft so that $Cov(D_{ift}, u_{ift}) = Cov(A_{ift}, u_{ift}) = 0$. The result that the sign of the behavioral response of workers depends on their ability relative to theirs friends can be spuriously generated only if workers are matched with more able friends on field-days when they have a positive productivity shock, *and* their friends have a negative productivity shock.

With the inclusion of field-day fixed effects, we also control for the presence of particularly charismatic or focal workers that may drive the behavior of others in the field. However it remains an open question as to whether workers respond to the presence of workers that are of different ability to themselves, rather than specifically to whether their friends that are present are more

[34]Since A_{ift} is built using estimated measures of ability, we restrict sample to workers that work at least 10 field-days with and without friends. There are 79 workers that satisfy this restriction.

or less able. To shed light on this we match each worker with seven randomly selected individuals from the sample, and estimate if and how workers respond to the presence and relative ability of these randomly assigned friends on the field-day. Column 5 shows that, in contrast to the behavioral response of workers to their friends, workers do not change their productivity in the presence of more or less able workers on the field-day *per se*.

Finally, the magnitude of the effects suggest that social incentives are a powerful motivator. Given that workers are paid piece rates, the estimated coefficients imply that the average worker is willing to give up 10% of his earnings when he works with friends who are slower than him and to work 10% faster when he works with friends who are more able. To provide some context for these magnitudes, we note that others have previously estimated the causal 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].

7.1.3 Heterogeneous Effects: Interpretation

The evidence indicates that when working together, friends conform to a common norm. At the norm, the level of productivity lies in between that of the most able and least able workers in the group of friends. In other words, workers improve their performance when they work alongside friends who are more able than them, while they slow down when they work alongside friends who are less able than them.

Workers' 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 his friends. This may be driven, for example, by – (i) workers having a structural preference for conformity [Bernheim 1994]; (ii) workers being averse to inequality among their friendship group [Fehr and Schmidt 1999, Charness and Rabin 2002]. In this setting, as workers are paid piece rates, by maintaining a similar level of productivity, groups of friends ensure pay equality among themselves.

There are some aspects of this setting that allow us to rule out alternative explanations of conformist behavior. For example, one explanation would be that friends have similar productivity because they prefer to work at the same speed to ensure they remain physically close on the field and this allows provides them opportunities to socialize. However, given the quantity of fruit on adjacent rows is typically negatively correlated, if workers wanted to minimize the physical distance between each other, the worker on the more plentiful row ought to be observed working faster to pick all the available fruit. In other words, productivity levels would diverge if friends wanted to be next to each other to facilitate socialization. The evidence in Tables 6 and 9 do not support this hypothesis.

A second explanation that the evidence rules out is that workers aim to insure each other against income shocks due to variation in the quantity of fruit on rows to which they are assigned.

Such insurance may take place through more able workers donating labor or fruit to their less able friends. For such a mechanism, the observability of friends on the field is irrelevant and so there ought to be a correlation in worker's productivity with that of their friends on both Type I and Type II fruit. In addition, such transfers of labor or fruit are equally feasible with both fruit types. The results in Table 6 – that the productivity of workers is only correlated with their friends on Type I fruit – would seem to rule out this explanation.[35]

7.2 Social Incentives: Effects on Aggregate Firm Productivity

The fact that the presence of friends affects workers' productivity naturally raises the question of whether and how it affects the aggregate performance of the firm. In our context the answer is not straightforward because the presence of friends increases the productivity of some workers and decreases the productivity of others. The net effect depends both on the number of workers for whom productivity decreases and increases and on the relative magnitude of the productivity changes.

To calibrate the impact of social incentives on aggregate productivity, we use the previously estimated average residual productivity of each worker in the absence of his friends, $\widehat{\alpha}_i^0$, and in the presence of his friends, $\widehat{\alpha}_i^1$. Aggregate residual 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 they work with and without their 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, we then have that aggregate productivity is equal to,

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

Under the assumption that worker's productivity with and without friends is independent of the share of days spent working with friends, we can use the estimates of $\widehat{\alpha}_i^1$ and $\widehat{\alpha}_i^0$ to conduct thought experiments as to what would have been aggregate productivity under different scenarios in which management are able to 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 would have been aggregate productivity if workers were never assigned to work with their friends, namely if $s_i^1 = 0$ and $s_i^0 = 1$ for all i.

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

[35] 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. In principle workers may also try to reassign themselves across rows, although it seems unlikely that such behavior would not be observed by the field managers whoa re responsible for such assignments in the first place.

In the second scenario, the assignment is such that workers who are more productive in the presence of friends always work with them whereas workers who are less productive in the presence of friends never work with their friends. 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 an hypothetical scenario meant 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.

Finally, we note that the observed allocation, namely using the sample shares (s_i^1, s_i^0) for each worker, generates a level of aggregate productivity which is 6.8% higher relative to the baseline scenario in which workers never work alongside their friends.

Overall, the findings indicate that, although social incentives reduce the productivity of some workers, the net effect is positive. The firm could have increased productivity by 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 keeping friends together in terms of reduced flexibility to adjust the workforce across fields within the same day.

8 Conclusion

This paper presents evidence on the causes and consequences of workers' social ties in the workplace on their own performance, and on the performance of the firm as a whole. Our findings indicate there are social incentives – the presence of friends affects worker productivity, despite there being no externalities of worker effort onto their co-workers due to the production technology or compensation scheme in place. Due to social incentives, workers conform to a common norm when working together. The level of the norm is such that the presence of friends increases the productivity of workers who are less able than their friends and decreases the productivity of workers who are more able than their friends.

Social incentives are a quantitatively important determinant of workers performance. As workers are paid piece rates based on individual productivity, the strength of social incentives is such that – (i) workers who are more able than their friends are willing to forgo 10% of their earnings to conform to the norm; (ii) workers who have at least one friend is who more able than themselves, are willing to increase productivity by 10% to meet the norm. Overall, the distribution of worker ability is such that the latter effect dominates so the net effect of social incentives on firm performance is positive.

Inevitably, microeconomic evidence from one firm raises issues of external validity. Reassuringly, our estimate of the correlation between productivity levels of workers in the same social networks is remarkably similar to comparable estimates from the experimental and field literature [Falk and Ichino 2006, Mas and Moretti 2006]. Nevertheless, the precise nature by which social

networks form and the nature of social incentives they provide are likely to depend on the specific features of our context.

First, the work and social environment are very closely linked as individuals work and live in the farm site. The motives driving the formation of friendships might differ in settings with a higher degree of separation between the two environments. In particular, similarity in ability might be a stronger determinant of social relations in the workplace, which would limit the scope for social incentives as socially related workers would perform similarly in any case.

Second, the effect of social incentives might depend on the structure of monetary incentives and *vice versa*. In our setting workers face high powered monetary incentives, which make conformity costly for high ability workers. In a setting with low powered incentives where reducing effort has a negligible impact on workers' pay, the level of the norm could be set by the slowest workers, implying that social incentives might have a negative effect on firm performance.

While the strength and type of social incentives are likely to depend on firm specific features, the essence of the findings may be of general interest. Other things equal, we have shown that some workers are willing to sacrifice earnings and others are willing to exert extra effort in the presence when working with colleagues they are socially connected to. Social incentives can thus be seen as alternative or complementary measures to classic incentive mechanisms such as pay for performance schemes.[36]

More generally, the existence of social ties between workers can be expected to impact on many aspects of firm and worker behavior, including how workers can be expected to respond to a given set of incentives, the optimal compensations structures for workers at different tiers of the firm hierarchy, and the optimal organizational design of the firm.

References

[1] ANGRIST.J AND V.LAVY (1999) "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement", *Quarterly Journal of Economics* 114: 533-75.

[2] BANDIERA.O, I.BARANKAY, AND I.RASUL (2005) "Social Preferences and the Response to Incentives: Evidence From Personnel Data", *Quarterly Journal of Economics* 120: 917-62.

[3] BARNARD.C (1938) *The Functions of the Executive*, Cambridge: Harvard University Press.

[36] The literature has emphasized a number of channels through social ties between workers can affect firm performance. For example, socially tied workers might be more likely to cooperate and share information with each other [Lazear 1989, Ichniowski and Shaw 2005], more likely to trust each other and so not engage in opportunistic behavior [Nagin *et al* 2002, Fehr and List 2004], engage in collusive behavior against the principal [Tirole 1986, Kofman Lawarree 1993], engage in influence activities [Milgrom 1988], or display favoritism towards each other [Prendergast and Topel 1996].

[4] BERNHEIM.D (1994) "A Theory of Conformity", *Journal of Political Economy* 102: 841-77.

[5] BEWLEY.T.F (1999) *Why Wages Don't Fall During a Recession*, Cambridge: Harvard University Press.

[6] CHARNESS.G AND P.KUHN (2006) Does Pay Inequality Affect Worker Effort? Experimental Evidence, mimeo University of California Santa Barbara.

[7] CHARNESS.G AND M.RABIN (2002) "Understanding Social Preferences with Simple Tests", *Quarterly Journal of Economics* 117: 817-69.

[8] CONLEY.T.G AND C.R.UDRY (2005) "Social Networks in Ghana", in C.B.Barrett (ed,), *The Social Economics of Poverty: Identities, Groups, Communities and Networks*, London: Routledge.

[9] EHRENBERG.R AND M.BOGNANNO (1990) "The Incentive Effects of Tournaments Revisited: Evidence from the European PGA Tour", *Industrial Labor Relations Review* 43: 74-89.

[10] ENCINOSA.W.E, M.S.GAYNOR AND J.B.REBITZER (1997) The Sociology of Groups and the Economics of Incentives: Theory and Evidence on Compensation Systems, NBER Working Paper 5953.

[11] FALK.A AND A.ICHINO (2006) "Clean Evidence on Peer Effects", *Journal of Labor Economics* 24: 39-57.

[12] FEHR.E AND J.A.LIST (2004) "The Hidden Costs and Returns of Incentives – Trust and Trustworthiness Among CEOs", *Journal of the European Economic Association* 2: 1-29.

[13] FEHR.E AND K.M.SCHMIDT (1999) "A Theory of Fairness, Competition and Cooperation", *Quarterly Journal of Economics* 114: 817-68.

[14] FERNANDEZ.R.M AND N.WEINBERG (1997) "Sifting and Sorting: Personal Contacts and Hiring in a Retail Bank", *American Sociological Review* 62: 883-902.

[15] GRANOVETTER.M (1974) *Getting a Job*, University of Chicago Press: Chicago.

[16] HAMILTON.B.H, J.A.NICKERSON, AND H.OWAN (2003) "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation", *Journal of Political Economy* 111: 465-9.

[17] HOXBY.C (2000) "The Effects of Class Size on Student Achievement: New Evidence from Natural Population Variation", *Quarterly Journal of Economics* 116: 1239-86.

[18] ICHINO.A AND G.MAGGI (2000) "Work Environment and Individual Background: Explaining Regional Shirking Differentials in a Large Italian Firm", *Quarterly Journal of Economic*s 115: 1057-90.

[19] ICHNIOWSKI.C AND K.L.SHAW (2005) Connective Capital: Building Problem-Solving Networks Within Firms, mimeo, Stanford University.

[20] JONES.D AND T.KATO (1995) "The Productivity Effects of Employee Stock-Ownership Plans and Bonuses: Evidence from Japanese Panel Data", *American Economic Review* 85: 391-414.

[21] KANDEL.E AND E.LAZEAR (1992) "Peer Pressure and Partnerships", *Journal of Political Economy* 100: 801-13.

[22] KNEZ.M, AND D.SIMESTER (2001) "Firm-Wide Incentives and Mutual Monitoring at Continental Airlines", *Journal of Labor Economics* 19: 743-72.

[23] KOFMAN.F AND J.LAWARREE (1993) "Collusion in Hierarchical Agency", *Econometrica* 61: 629-56.

[24] KRUEGER.A (1999) "Experimental Estimates of Education Production Functions", *Quarterly Journal of Economics* 114: 497-532.

[25] LAZEAR.E.P (1989) "Pay Equality and Industrial Politics", *Journal of Political Economy* 97: 561-80.

[26] LAZEAR.E.P (2000) "Performance Pay and Productivity", *American Economic Review* 90: 1346-61.

[27] MANSKI.C.F (1993) "Identification of Endogenous Social Effects: The Reflection Problem", *Review of Economic Studies* 60: 531-42.

[28] MARMAROS.D AND B.SACERDOTE (2006) "How Do Friendships Form?", *Quarterly Journal of Economics* 121: 79-119.

[29] MARSHALL.A (1890) *Principles of Economics*, Macmillan and Co.: London.

[30] MAS.A AND E.MORETTI (2006) Peers at Work, mimeo, University of California, Berkeley.

[31] MAYO.E (1933) *The Human Problems of an Industrial Civilization*, New York: Macmillan.

[32] MCPHERSON.M, L.SMITH-LOVIN, AND J.M.COOK (2001) "Birds of a Feather: Homophily in Social Networks", *Annual Review of Sociology* 27: 415-44.

[33] MILGROM.P.R (1988) "Employment Contracts, Influence Activities, and Efficient Organization Design", *Journal of Political Economy* 96: 42-60.

[34] MOFFITT.R (2001) "Policy Interventions, Low-Level Equilibria, and Social Interactions", in Durlauf.S,N and H.P.Young (eds.) *Social Dynamics*, Washington, DC: Brookings Institution Press.

[35] NAGIN.D, J.B.REBITZER, S.SANDERS, AND L.J.TAYLOR (2002) "Monitoring, Motivation, and Management: The Determinants of Opportunistic Behavior in a Field Experiment", *American Economic Review* 92: 850-73.

[36] PODOLNY.J.M AND J.N.BARON (1997) "Resources and Relationships: Social Networks and Mobility in the Workplace", *American Sociological Review* 62: 673-93.

[37] PRENDERGAST.C AND R.H.TOPEL (1996) "Favoritism in Organizations", *Journal of Political Economy* 104: 958-78.

[38] ROETHLISBERGER.F.J AND W.DICKSON (1939) *Management and the Worker*, Cambridge: Harvard University Press.

[39] ROTEMBERG.J.J (1994) "Human Relations in the Workplace", *Journal of Political Economy* 102: 684-717.

[40] ROY.D (1952) "Quota Restriction and Goldbricking in a Machine Shop", *American Journal of Sociology* 57: 427-42.

[41] SACERDOTE.B (2001), "Peer Effects With Random Assignment: Results for Dartmouth Roommates", *Quarterly Journal of Economics* 116: 681-704.

[42] SHEARER.B.S (2004) "Piece Rates, Fixed Wages and Incentives: Evidence From a Field Experiment", *Review of Economic Studies* 71: 513-34.

[43] TIROLE.J (1986) "Hierarchies and Bureaucracies: On the Role of Collusion in Organizations", *Journal of Law, Economics and Organizations* 2: 181-214.

[44] THOMAS.D.A (1990) "The Impact of Race on Managers' Experiences of Developmental Relationships", *Journal of Organizational Behavior* 11: 479-92.

[45] WESOLOWSKI.M.A AND K.W.MOSSHOLDER (1997) "Relational Demography in Supervisor-Subordinate Dyads: Impact on Subordinate Job Satisfaction, Burnout, and Perceived Procedural Justice", *Journal of Organizational Behavior* 18: 351-62.

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. All statistics relating to productivity refer 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, 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

Table 4: Predictors of Friends Being Present on the Field-Day

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

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

	(1) Experience	(2) Experience Squared	(3) Lagged Performance	(4) Type II Fruit
Picking experience [field-days]	.000	-.003	-.004	.002
	(.001)	(.002)	(.002)	(.004)
Picking experience squared		.000	.000	.000
		(.000)	(.000)	(.000)
Lagged productivity [kg/hr]			-.002	.006
			(.001)	(.006)
Mean of dependent variable	.644	.644	.638	.636
Worker fixed effects	Yes	Yes	Yes	Yes
Field-day fixed effects	Yes	Yes	Yes	Yes
Adjusted R-squared	.497	.499	.510	.710
Observations (worker-field-day)	7404	7404	6553	2574

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 is a dummy variable equal to one if worker i has at least one friend present on the field-day, and zero otherwise. 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 number of field-days for which the worker has picked Type I fruit, except in Column 4 where this refers to experience on Type II fruit. Standard errors are clustered by worker.

Table 5: The Formation of Friendships

Dependent Variable (Columns 1-2, 5-6): Dummy equals 1 if worker i reports j as a friend, 0 otherwise

Dependent Variable (Columns 3-4): Dummy equals 1 if worker i reports j as a new friend, 0 otherwise and worker j is not a pre-existing friend

Logit regressions, log odds ratio reported

Standard errors in parentheses are clustered by worker i Columns 1 to 5, and by worker j in Column 6

	(1) Ability Measure	(2) Baseline	(3) New Friends	(4) Late New Friends	(5) Conditional Logit (Worker i)	(6) Conditional Logit (Worker j)
Absolute difference in ability	1.04	.909	.859	1.24	.800	1.18
	(.105)	(.111)	(.137)	(.258)	(.159)	(.223)
Same nationality		14.7***	42.1***		17.0***	36.2***
		(8.60)	(29.1)		(9.43)	(13.1)
Same living site		9.71***	8.67***	11.3***	15.6***	13.8***
		(2.74)	(3.20)	(6.40)	(5.85)	(7.80)
Same arrival cohort		14.3***	9.80***	8.80***	14.5***	11.7***
		(4.10)	(3.16)	(4.09)	(5.98)	(4.82)
Same gender		1.80***	2.23***	1.74	1.48	2.23***
		(.413)	(.618)	(.704)	(.396)	(.632)
Same subject study		3.94***	2.21***	3.12***	5.62***	4.87***
		(.931)	(.652)	(1.31)	(2.02)	(1.60)
Both have done paid work before		1.37	1.16	1.02	1.03	1.13
		(.342)	(.339)	(.451)	(.298)	(.281)
Both play sports		1.01	1.14	,898	1.09	.904
		(.218)	(.288)	(.310)	(.310)	(.249)
Observations	9591	9591	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 all Columns except 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. In Columns 3 and 4 the dependent variable 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. 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 Columns 1 to 4 logit regressions are estimated. In Column 5 (6) a conditional logit regression is estimated where observations are grouped by worker i (j). Hence the sample falls in Column 5 because workers that name zero or seven friends are dropped. The sample falls in Column 6 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 4 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 5 standard errors are clustered by worker i. In Column 6 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.

Table 6: Correlation in Productivity Among Friends

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

Standard errors in parentheses are clustered by worker

	(1) Worker Fixed Effect	(2) Picking Experience	(3) Field-day Fixed Effects	(4) Randomly Assigned Friends	(5) Randomly Assigned Friends	(6) Old and New Friends	(7) Type II Fruit	(8) Type II Fruit	(9) Type I Fruit: Fruit Type II Workers
Average productivity of friends	.664***	.663***	.131***				.734***	.023	.177***
	(.041)	(.040)	(.046)				(.038)	(.067)	(.051)
Average productivity of randomly assigned friends				.504***	-.014				
				(.031)	(.043)				
Average productivity of pre-existing friends						.153**			
						(.073)			
Average productivity of newly formed friends						.177***			
						(.066)			
Worker fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Field-day fixed effects	No	No	Yes	No	Yes	Yes	No	Yes	Yes
Adjusted R-squared	.540	.546	.689	.476	.692	.800	.655	.792	.723
Observations (worker-field-day)	4767	4767	4767	2314	2314	1174	1746	1746	2894

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. In Columns 1 to 6 and 9 this refers to Type I fruit in which workers can observe their co-workers. In Columns 7 and 8 this refers to Fruit Type II in which workers cannot observe their co-workers. In all Columns we also control for the log of the number of field-days of picking experience of the worker. The sample in Column 6 is restricted to field-days where both pre-existing and newly formed friends are present. 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 sample in Column 9 (for Type II fruit) is restricted to those workers that are used in Column 8 (Type I fruit). Standard errors are clustered by worker.

Table 7A: 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)

Table 7B: Productivity Difference from When Friends are Not Present (kg/hr), by Worker Ability Relative to Friends on the Field-day

Means, standard errors in parentheses are clustered by worker

	Most able worker among friends on field-day	Middle ranking ability among friends on field-day	Least able worker among friends on field-day
Productivity on field-day minus average productivity when alone (without actual friends)	-2.19***	.947	1.81**
	(.618)	(.629)	(.792)

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. In Panel A workers are divided into the quartiles by their fixed effect estimate on field-days in which none of their reported friends are present. In Panel B the worker's ability is measured relative to the average ability among his friends on the field-day. Standard errors are clustered by worker. 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 8: The Form of the Peer Effect

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

Standard errors in parentheses are clustered by worker

	(1) Presence of Friends	(2) Relative Ability	(3) Relative Ability, Conditional on Friends Present	(4) Relative Ability, Field Day Fixed Effects	(5) Randomly Assigned Friends
Friends on field-day [yes=1]	.007				
	(.020)				
Friends on field-day x no friend more able than worker i		-.099***		-.057**	
		(.029)		(.030)	
Friends on field-day x at least one friend more able than worker i		.104***	.246***	.069*	
		(.033)	(.062)	(.038)	
Randomly assigned friends on field-day x no randomly assigned friend more able than worker i					-.012
					(.041)
Randomly assigned friends on field-day x at least one randomly assigned friend more able than worker i					.027
					(.034)
Worker fixed effects	Yes	Yes	Yes	Yes	Yes
Field-day controls	Yes	Yes	Yes	No	No
Field fixed effects	Yes	Yes	Yes	No	No
Field-day fixed effects	No	No	No	Yes	Yes
Adjusted R-squared	.312	.316	.299	.684	.597
Observations (worker-field-day level)	4792	4081	2267	4081	4035

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 2 to 5 the sample is additionally restricted to workers whose friends are themselves observed at least five field-days with and without their friends. The sample in Column 3 is restricted to field-days where the worker has at least one friend present.

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)	
	Age [years]	22.1	21.9	-.223	[.578]
		(.236)	(.217)	(.321)	
	Have had paid employment before [yes=1]	.853	.761	-.092	-
		(.021)	(.064)	(.067)	
	Main nationality	Polish (55.4%)	Polish (56.7%)	-	[.278]
	Main subject studying	Agriculture (34.2%)	Agriculture (46.3%)	-	[.177]
	Live on main site on farm [yes=1]	.529	.439	-.090	[.000]
		(.029)	(.055)	(.062)	

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 referes 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, 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 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 Relatively More or Less Able Friends Being Present on the Field-Day

Dependent Variable (Columns 1 to 4): 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 on the field-day

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

	(1) Experience	(2) Experience Squared	(3) Lagged Performance
Picking experience [field-days]	-.002	-.000	-.000
	(.001)	(.005)	(.005)
Picking experience squared		.000	.000
		(.000)	(.000)
Lagged productivity [kg/hr]			-.001
			(.002)
Mean of dependent variable	.435	.435	.444
Worker fixed effects	Yes	Yes	Yes
Field-day fixed effects	Yes	Yes	Yes
Adjusted R-squared	.871	.871	.870
Observations (worker-field-day)	3596	3596	3157

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 is a dummy variable equal to one if worker i has no friend more able than himself present on the field-day, and equal to zero if there is at least one friend of lower ability on the field-day. 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 number of field-days for which the worker has picked Type I fruit. Standard errors are clustered by worker.

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

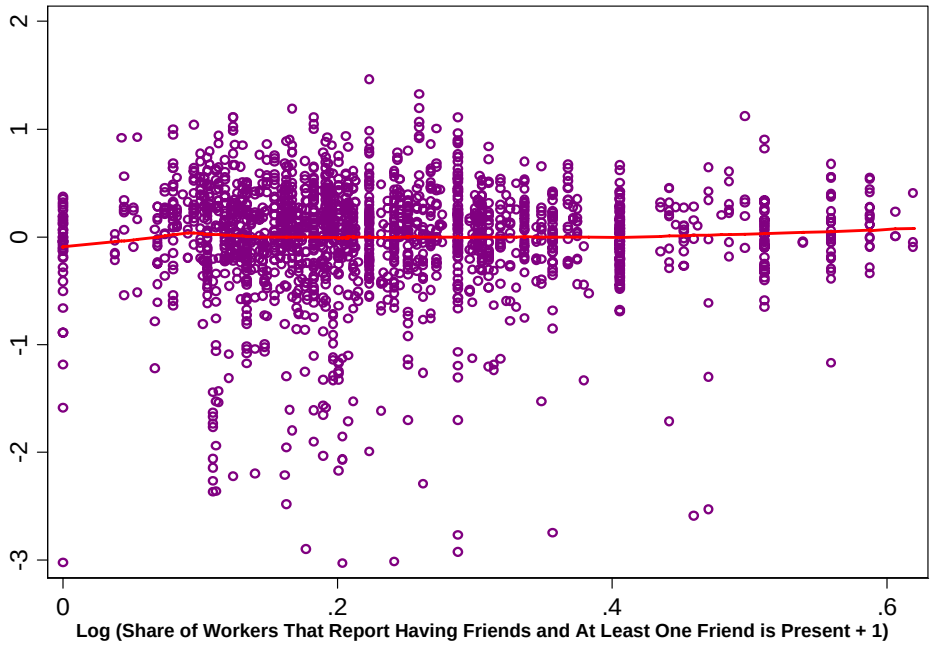
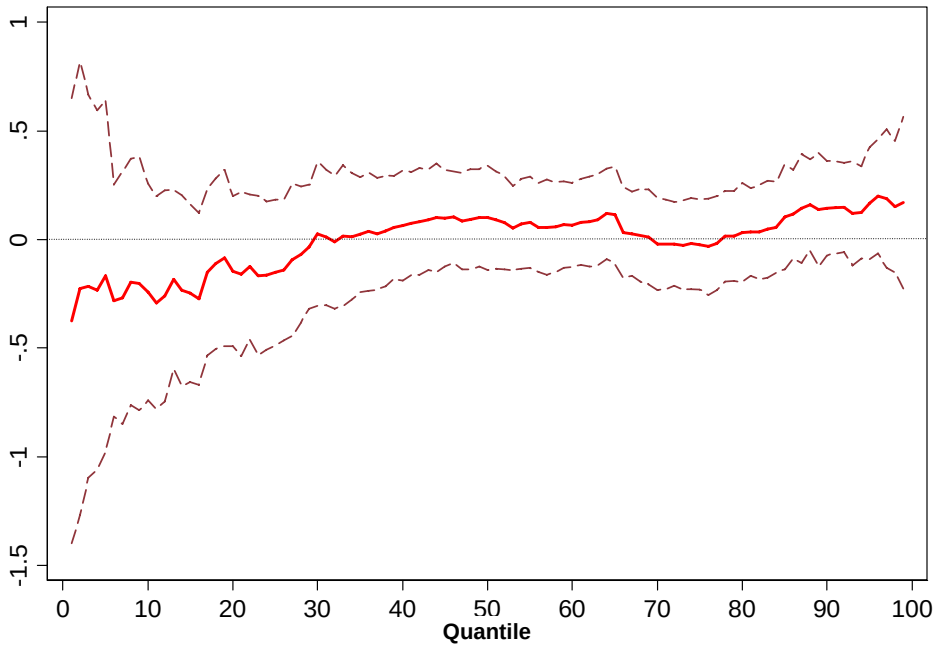
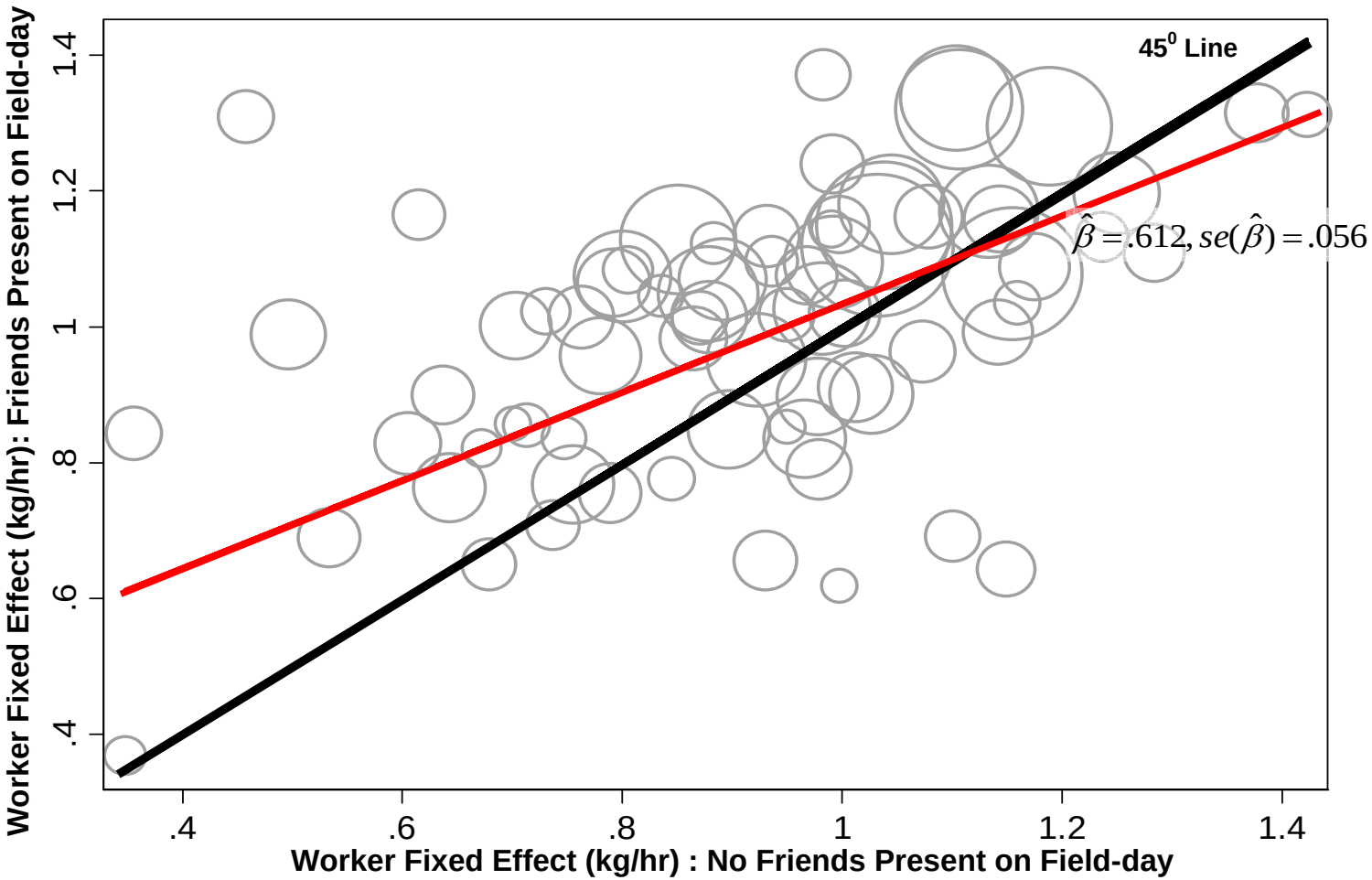


Figure 1B: The Elasticity of Worker Productivity With Respect to the Share of Workers That Report Having Friends and At Least One of Their Friends is Present



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.