Teams, Teamwork and Absence

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Abstract

We argue that firms with interdependent worker productivity, team production, have a higher cost of absence and as a consequence will spend additional resources on monitoring absence. As a result, firms with team production should have lower absence rates, all else equal. We estimate the determinants of absence for blue-collar workers using a sample of German manufacturing establishments. The presence of work place teams is argued to be a proxy for establishments with team production. The estimates reveal that firms with teams have lower absence rates, as do firms with small shares of women and smaller establishments. The size effect is, however, unique to establishments with teams which fits prior theoretical work but which has not been previously tested.

JEL Classification: J22 and J39

1. Introduction

The economic costs of absenteeism are enormous. Estimates for the United Kingdom in 1980s put the figure at 6 billion pounds a year (Brown and Sessions 1996), in the United States a figure of 24 billion dollars a year has been offered (Dunn and Youngblood 1986) and more recent figures from Germany put the figure at 62 billion DM or nearly 2 percent of German GDP (IWD 1997). While absenteeism has been of concern to economists, it has not generated the attention that such costs would dictate. For example, much more attention has been given to strikes despite the fact that the days lost to strikes are but a small fraction of those lost to absence.[1]

Economists most commonly view absence from work as a dimension of labor supply. Yet, if contractual hours are not defined by the employment relationship, the very concept of absenteeism would not exist. Thus, Brown and Sessions (1996: 38) in their review of the economic literature call for an "explanation for the determination of hours constraints," suggesting that economists place more emphasis on the role of labor demand in determining contractual hours and hence absence.

We respond to this call showing the role of interdependent worker productivity, or "teamwork," in determining both minimum contractual hours and their enforcement. We follow this by estimating the influence of workplace teams on the absence of blue-collar workers. We argue that workplace teams tend to arise in those situations in which the underlying production technology reflects teamwork. In workplaces characterized by teamwork the cost of absence is higher leading to greater expenditures on the part of the firm to reduce absence. These expenditures may improve health and safety or increase worker monitoring. In our theoretical motivation, we focus on monitoring in order to illustrate the firm's incentive to increase absence reducing expenditures under interdependent worker productivity. These greater expenditures imply that the proxy of workplace teams should be associated with reduced absence.

Using data on German manufacturing workplaces, we estimate the determinants of absence rates confirming that the use of workplace teams is associated with significantly reduced absence. This result persists even as many traditional results from the empirical absence literature are confirmed. Workplaces with larger shares of women have greater absence rates and workplace size influences absence. Indicators of scheduling flexibility, flexible hours and part time work, are also associated with reduced absence. Workplaces with profit sharing also have reduced absence.

In what follows, section 2 explains the connection between teamwork and absence. Section 3 describes our data and provides descriptive statistics. Section 4 presents the empirical estimations and section 5 concludes.

2. Teamwork and Absence

Alchian and Demsetz (1972) emphasize that production involving teamwork prohibits supervisors from identifying individual contributions to production. Picking up this idea, Deardorf and Stafford (1976) examine technologies requiring the simultaneous presence of multiple factors of production such as an entire shift of workers showing that in this circumstance the firm will not simply set a wage and let individual workers determine their work hours. Instead, the profitability of the firm depends on its ability to coordinate essentially identical hours for each worker. "(T)he firm will itself decide the length of the working day"(p. 671).

Duncan and Stafford (1980) illustrate this by contrasting two extremes. The first extreme, illustrated with a typing pool, has no teamwork. The output lost by a single worker's absence is only their own increment, the typing of that worker. The second extreme, illustrated with an assembly line, has complete teamwork as the finished product depends on each worker completing his or her step along the line. Here the output lost by a single worker's absence is, in the extreme, the entire output of the shift. Recent theory represents this extreme with the 'o-ring' production function (Kremer 1993).

Weiss (1985) argues more formally that low rates absenteeism is highly valued when production involves teamwork. He imagines a critical number of workers necessary for production. Excess workers add nothing to output and if the number of workers present drops below the critical value, output drops to zero. The number of workers hired beyond the critical number is a function of the absence rate. As the rate increases, the firm expected value maximizes by hiring additional workers which reduces the probability of having fewer workers present than the critical number but does so at the increased likelihood of paying redundant workers. In this fashion a worker's probability of being absent influences the profitability of the firm.

While others build on Weiss and model absence in an efficiency wage context (Barmby et al. 1994), the empirical literature has not directly examined teamwork. Proxies for the threat of dismissal or the cost of job loss are typically used as independent variables thought to reduce absence.[2] While such variables may play a role, they are endogenous responses to the underlying extent of teamwork. Thus, in firms without teamwork the cost of absence is minimal and the need to threaten dismissal or pay efficiency wages is greatly reduced. When teamwork is extensive, the cost of absence is substantial and the firm increases the threat of dismissal, or pays higher wages, in an effort to reduce the probability of worker absence.[3]

Building from Coles and Treble (1996), Barmby and Stephan (2000) model a situation in which all firms have teamwork and larger firms have more than one production line. If workers in the larger firm can work on multiple lines, the larger firm insures against the risk of absence with proportionally fewer workers. This lower cost of absence reduces the optimal expenditures of the larger firm to control absence and may explain the tendency of larger firms to have greater absence rates. While highlighting an interaction between firm size and absence, the role of teamwork still remains somewhat hidden. The prediction that firm size matters holds constant the extent of teamwork rather than investigating the direct influence of teamwork. We now turn to a demonstration of that influence.

An Axiomatic Illustration

While teamwork makes the monitoring of individual effort on the job more difficult, it makes the monitoring of absence more crucial. Consider N identical workers maximizing expected utility by choosing an absence level, a, in the face of imperfect monitoring. Each worker faces a probability $m \in (0, 1)$ of being monitored. A worker monitored and found with an unexcused absence is fired. Otherwise, an absent worker receives full sick pay. Each worker maximizes

$$[1 - a + a(1 - m)]\mathrm{U}(W) + am\mathrm{U}(R) - \mathrm{C}(1 - a) \qquad (1)$$

where U is the Von Neumann-Morgenstern utility function, W is the current wage and R is the best alternative ($W > R$). The cost of effort depends on a: $\mathrm{C}(1 - a)$ with C’ and C'' > 0. Maximization results in a^*, equalizing the expected marginal benefits and costs: $m[U(W) - U(R)] = C'(1 - a^*)$. As monitoring increases, workers reduce absence: $\partial a^* / \partial m = -[U(W) - U(R)]/C''(1 - a^*) < 0$.

The firm recognizes this and sets monitoring to balance the additional profit from reduced absence with the monitoring costs. We consider otherwise identical firms with teamwork (T) and without (NT) and assume that the firm with teamwork must have k workers present to produce an output Q. If fewer workers than k are present, output is zero. Workers present beyond k are redundant and output remains Q. If workers' absence probabilities are independent, expected profit is

$$\pi^{T} = \text{Prob}(L \geq k : N, a)PQ - WN[1 - am] - Z(m)N \qquad (2)$$

where P is the final product price and L is the number of workers present out of N workers hired. The probability that $L \geq k$ depends on N and a, $\partial \text{Prob}(L \geq k)/\partial a < 0$ and $\partial^2 \text{Prob}(L \geq k)/\partial a^2 > 0$. The cost of monitoring a worker, $Z(m)$, satisfies $Z'(m) > 0$, $Z''(m) > 0$, $Z(0) = 0$, $Z'(0) = 0$ and $Z'(1) = \infty$ and total monitoring costs are $Z(m)N$.

In the absence of teamwork, we assume k machines with which workers can make output and if at least k workers are present output is Q. While workers beyond k remain redundant (have no machines), if fewer than k workers are present output is merely reduced in proportion to those absent. The expected profit is now

$$\pi^{NT} = \text{Prob}(L \geq k : N, a)PQ + \sum_{L=0}^{k-1} \text{Prob}(L)PL(\frac{Q}{k}) - WN[1 - am] - Z(m)N \qquad (3)$$

mimicking (2) except for the addition of the revenue term capturing the expected output when fewer than k workers are present.

Imagine a very short run in which the firm can alter its monitoring intensity but not its number of employees. The first order conditions determining monitoring are:

$$\frac{\partial \pi^{\mathrm{T}}}{\partial m} = 0 \Rightarrow \frac{\partial \mathrm{Prob}(L \geq k)}{\partial a^*} \frac{\partial a^*}{\partial m} PQ + WN(a^* + m\frac{\partial a^*}{\partial m}) = \mathrm{Z}'(m)N \quad (4)$$

$$\frac{\partial \pi^{\mathrm{NT}}}{\partial m} = 0 \Rightarrow$$
$$\frac{\partial \mathrm{Prob}(L \geq k)}{\partial a^*} \frac{\partial a^*}{\partial m} PQ + \frac{\partial a^*}{\partial m} \sum_{L=0}^{k-1} \frac{\partial \mathrm{Prob}(L)}{\partial a^*} PL(\frac{Q}{k}) + WN(a^* + m\frac{\partial a^*}{\partial m}) = \mathrm{Z}'(m)N \quad (5)$$

The firm with teamwork sets monitoring such that the decreased expected sick pay and the increased expected revenue associated with reduced absence are equal to the marginal cost of monitoring. For the firm without teamwork, the same increase in monitoring yields a smaller expected increase in revenue if the expected revenue associated with having less than k workers present declines. A sufficient condition for this happen is for $\partial \Pr\mathrm{ob}(L)/\partial a^* > 0$ for all L < k. Assuming a binomial distribution with probability of being present (1 – a), this will hold when $N/L > 1/(1 - a)$. Thus, if N = 50 and k = 40, the requirement would be that $a < .2$. Thus, for reasonable absence rates the teamwork firm suffers more from absence and hence monitors more resulting in lower absence than for the firm without teamwork, $a^{*\mathrm{T}} < a^{*\mathrm{NT}}$.

The Role of Firm Size

Coles and Treble (1996) claim that larger employment in firms with team production acts as an insurance device increasing the likelihood that the firm will have the minimum number of workers present. This increased likelihood reduces the equilibrium expenditures on absence prevention and so increases the absence rate. Barmby and Stephan (2000) argue that larger establishments with teamwork can further diversify the risk of absence by operating multiple lines.

In our model, the increase in size is most meaningfully thought of as an increase in scale of Q, N and k. Thus, for example, when the scale doubles, the output will double and the required number of workers to produce that output also doubles. To simplify the presentation of the no teamwork case we imagine a particular value of $k = N$. This represents a special case of production without teamwork with constant returns to scale. We introduce a scale parameter, γ, and rewrite (5):

$$\frac{\partial \pi^{\mathrm{NT}}}{\partial m} = 0 \Rightarrow \frac{\partial a^*}{\partial m} \sum_{L=0}^{\gamma N} \frac{\partial \mathrm{Prob}(L)}{\partial a^*} PL(\frac{\gamma Q}{\gamma N}) + W\gamma N(a^* + m\frac{\partial a^*}{\partial m}) = \mathrm{Z}'(m)\gamma N \qquad (6)$$

The first term from (5) does not appear in (6) because there is no longer a critical level beyond which workers are redundant. As all other terms, including the expected output, increase by the same scale factor, the equilibrium in (6) is invariant to scale.[4] In short, the firm optimizes monitoring with regard to each individual worker and increases in scale do not change this optimization: $\partial m/\partial\gamma = 0$.

With team production scale becomes critical:

$$\frac{\partial \pi^{\mathrm{T}}}{\partial m} = 0 \Rightarrow \frac{\partial \mathrm{Prob}(L \geq \gamma k)}{\partial a^*} \frac{\partial a^*}{\partial m} P\gamma Q + W\gamma N(a^* + m\frac{\partial a^*}{\partial m}) = \mathrm{Z}'(m)\gamma N \qquad (7)$$

The comparative static can be expressed:

$$\begin{aligned} \frac{\partial m}{\partial \gamma} = -\Big\{ & [\frac{\partial \mathrm{Prob}(L \geq \gamma k)}{\partial a^*} \frac{\partial a^*}{\partial m} PQ + WN(a^* + m\frac{\partial a^*}{\partial m}) - \mathrm{Z}'(m)N] \\ & + \frac{\partial^2 \mathrm{Prob}(L \geq \gamma k)}{\partial \gamma \partial a^*} \frac{\partial a^*}{\partial m} P\gamma Q) \Big\} / \mathrm{SOC} \end{aligned} \qquad (8)$$

The denominator is negative by the necessary conditions and the entire term in brackets of the numerator is zero by (8). Thus, the sign of (9) is the same as the second term of the numerator, $\frac{\partial^2 \text{Prob}(L \geq \gamma k)}{\partial \gamma \partial a^*} \frac{\partial a^*}{\partial m} P\gamma Q$. Note that $\partial a^*/\partial m$ does not vary with γ and has a negative sign. The derivative of the probability with respect to absence is unambiguously negative while computer simulation of that derivative (available from the authors) confirms that it becomes less negative as scale increases.[5] Thus, second term is positive and $\partial m/\partial \gamma < 0$. As scale increases the teamwork firm decreases monitoring and the absence rate increases.

This result follows because as the scale increases the odds of a given share of workers being present increases holding the individual absence rate constant. This represents an application of the law of large numbers. Because the odds of having that share of workers present increases with scale, monitoring can be profitably decreased and so the absence rate will increase.

Teams and Teamwork

In our empirical work, teams proxy underlying team production. Management has increasingly viewed the organization of workers in teams as a tool to increase productivity (Spreitzer et al. 1999). Yet, it is apparent that teams succeed only in certain circumstances. In particular, there is a close, albeit imperfect, tie between teams and underlying team production. Theoretical work illustrates the connection between teams and interdependent worker productivity. Teams facilitate communication and information sharing among team members. Aoki (1990) and Carter (1995) emphasize that this communication is much more important when there are gains associated with coordinating workers' actions and allocating their tasks. Such coordination and allocation is the essence of team production suggesting that teams will be far more likely in circumstances characterized by interdependent worker productivity.

Such theoretical work is complemented by empirical evidence. If there is a tie between teams and team production, teams imply that the identification of workers' individual contributions to production is difficult (Alchian and Demsetz 1972). Accordingly, teams should be associated with a reduced use of individual based incentives and an increased use of group based incentives. Indeed, Heywood and Jirjahn (2002) demonstrate that teams are positively related to the presence of group payment schemes. Brown et al. (2003) use Australian data demonstrating the link between indicators of team production and the use of teams. Production technologies allowing individual piece rates are less likely to organize work around teams. Similarly, workers associated with greater expected absence and lower labor force attachment, women and part-time workers for example, are thought less likely in firms with team production (Goldin 1986, Heywood and Wei 1997). In the Australian evidence, workplaces employing these workers are also less likely to use teams.

Viewing teams as a proxy for teamwork, our theoretical analysis suggests that workplaces with teams should report lower absence due to increased expenditures on monitoring. However, teams as a tool of human resource management may reduce absence without increased monitoring expenditures. Teams increase the social interaction among workers perhaps causing them to acquire sentiment for each other and giving rise to pro-social motivation, high effort and reduced absence (Akerlof 1982). Moreover, workers might enjoy increased job satisfaction through the greater autonomy associated with teams and this might also reduce absence.

Yet, the impact of teams on job satisfaction and human relations is not clear. While Kandel and Lazear (1992) argue that worker involvement through teams may generate mutual monitoring and increased peer pressure, Barron and Gjerde (1997) demonstrate the possibility that excessive peer pressure can harm both employees and the firm. Similarly, while Batt and Appelbaum (1995) find that the greater autonomy associated with teams increases higher job satisfaction, they show that the higher stress and work-load associated with teams lowers job satisfaction. Finally, Hamilton et al. (2003) show that high-productivity workers prefer to work in teams but that low productivity workers prefer not to work in teams. This finding indicates that low-productivity workers may experience reduced utility from working in teams even as self-selection of higher productivity workers may help explain the productivity (and perhaps the absence) effect of teams.

In summary, teams do not automatically increase firm performance or worker satisfaction. A firm using teams as a reflection of underlying teamwork must invest in measures that induce the optimal level of pro-social motivation, mutual monitoring and/or peer pressure. In a broad sense this investment can be seen as part of the resources spent on monitoring performance in general and absence in particular. Moreover, our theory not only predicts a negative link between teams and absence but also predicts that the association of firm size with absence differs between firms with and without teams. Neither the job satisfaction hypothesis nor the peer pressure hypothesis yields a similar prediction.

Finally, another notion from human resource management is that teams allow "cross-training" which reduces the cost of absence (Cappelli and Rogovsky 1994). A negative link between teams and absence is not at odds with this notion. Indeed, the very concept of cross-training recognizes that team production exists, that the absence of a particular worker reduces output of the entire team. It is this recognition that leads to training other workers to perform the tasks associated with the absent worker.[6] Put somewhat differently, the need to cross-train arises only with team production and it is unlikely that cross-training completely eliminates the increased cost of absence associated with team production.

Additional Determinants of Absence

While focusing on the teams as a determinant of absence, a variety of other determinants will be controlled for. Our second core variable is establishment size. We will control for establishment size but will also test the hypothesis outlined earlier that size has a different influence on those establishments with and without teams, a hypothesis not previously tested.

Profit sharing will be included as it may create independent incentives to reduce absence through peer pressure (Kandel and Lazear 1992, Brown et al. 1999). Since each worker participates in the outputs of the other workers, profit sharing may induce peer pressure even when there is no interdependent worker productivity.

Measures of flexibility are routinely associated with reduced absence. Thus, if an employer has flexible starting or finishing times, allows worker determined breaks or provides the option of part-time employment, the constraint of contractual attendance is less binding (Brown and Sessions 1996). On the other hand, indicators of the absence of flexibility, say the use of shifts, may be associated with greater absence.

Women are generally recognized as having greater absence rates (Leigh 1983, Bridges and Mumford 2001) and we control for the share of women in the establishment. Further, we control for the share of apprentices in the establishment as these workers are still training and the completion of their training depends upon a successful tenure with the firm. Thus, we anticipate establishments with large shares of apprentices will have lower absence, all else equal. Similarly, we include a managerial perception of the age of the employees. Older workers have a greater incidence of sickness and absence. Moreover, older workers may have a shorter expected employment until retirement lowering the cost of job loss.[7] Thus, when management sees the workers as too old, we anticipate an increased absence rate.

Empirical examinations with Anglo-Saxon data usually find a positive correlation between unionization and absenteeism (Chaudhurry and Ng 1992). However, German industrial relations are characterized by a dual structure of employee representation with both works councils and unions (Hübler und Jirjahn 2003). Works councils provide a highly developed mechanism for establishment-level participation while collective bargaining agreements are negotiated between unions and employers' associations on an industrial level. In order to capture the different influences, we include indicators of both whether or not the establishment is covered by a collective bargaining agreement and whether or not the establishment has a works council.

High wages may reduce absence (Allen 1984, Weiss 1985). While the causation is disputed, the most common view is that higher wages make the job more valuable increasing the cost of job loss and making workers less likely to be absent. Wages in Germany are generally subject to negotiated floors. While the floors may vary by region or industrial sector, they apply to the vast majority of workers. In an effort not to pick up the variation associated with the floors but rather the payment of wages above the floors, we include a dummy variable equal to one if the establishment pays wages above the floor.

In addition, we capture two dimensions of human resource management by including whether or not the management holds routine meetings with workers and whether or not employment levels have been stable indicating a more continuous group of workers. Meetings may be part of improving work group norms and worker satisfaction and, we anticipate, will be associated with reduced absence. Continuity in the workforce is often taken as essential for the development of peer pressure (Kandel and Lazear 1992) and should also be associated with reduced absence.

Finally, we include fourteen dummies to account for industrial groupings within manufacturing recognizing that the nature of production and the type of work varies dramatically with the product being produced.

3. Data and Descriptive Statistics

The data are drawn from the third, 1996, wave of the Hannover Panel (see Brand et al. 1996) which contains accurate information on the presence of teams. The establishments in the survey are a representative sample of private sector manufacturing establishments from Lower Saxony, a highly industrial area of Germany. After eliminating observations for which full information is unavailable, the sample size is 618. Definitions and descriptive statistics are presented in Table 1.

The critical dependent variable is the absent rate among blue-collar (manual) workers. The establishments report the average proportion of such workers absent over the first half of 1996.[8] As shown, the average proportion is .056 or 5.6 percent.

Estimating the determinants of this proportion requires a transformed dependent variable in which the proportion, θ, becomes $\ln[\theta/(1-\theta)]$.[9] This log-odds or logistic transformation insures that predictions of θ remain within the zero to one range while the transformed variable ranges from minus infinity to positive infinity. The transformed absence rate becomes a linear function of the explanatory variables including whether or not the firm uses workplace teams to organize its blue-collar workers. As usual, it is important to correct the logistic transformation of heteroscedasticity (Allen 1981). Since the variance of the dependent variable equals $[N\theta(1-\theta)]^{-1}$, weighted least squares regressions are performed:

$$\omega \ln[\theta/(1-\theta)] = \boldsymbol{\beta}'\boldsymbol{X}\omega + \varepsilon \tag{9}$$

where $\omega = [N\theta(1-\theta)]^{1/2}$, N represents the number of blue collar workers in the establishment, $\boldsymbol{\beta}$ is the vector of coefficients and $\boldsymbol{X}$ is the vector of independent variables. To calculate the marginal influence of x on θ requires multiplying its coefficient, β, by the mean proportion and its inverse: $\Delta\theta = \beta(\overline{\theta})(1-\overline{\theta})\Delta x$.

The survey question attempts to identify meaningful teams by associating teams with expanded decision-making and responsibility. In total 37.9 percent of establishments identify they use such teams. This question is followed by responses identifying the extent of teams within the establishment: less than 10 percent of blue-collar workers, between 10 and 50 percent of blue-collar workers or 50 percent or more of blue-collar workers. The largest proportion of workplaces is in the middle category of coverage but this is followed closely by the highest category of coverage.

To correspond to the absence measure for blue-collar workers, the share of blue-collar workers in the establishment will be added as an independent variable. The average share of blue-collar workers in the sample is 63.9 percent.

Table 2 shows the sample means divided by whether or not the establishment uses teams. Critically, the absence rate is approximately one-half of a percentage point lower in establishments with teams (5.27 vs. 5.77). Yet, those establishments using teams are also significantly larger and more likely to use profit sharing. Establishments with teams are also significantly more likely to have regular meetings and provide flex-time. These differences highlight the importance of the estimates to follow, as each of these variables correlated with teams are anticipated to influence the absence rate.

4. Results

Table 3 presents the initial results. Column one shows the log-odds estimation as a function of the independent variables. Many of the variables take coefficients of the expected sign. Establishments with large shares of women report significantly greater absence. Firm size is associated with greater absence although at a decreasing rate. Flex-time and part-time are both negative determinants of the absence rate suggesting that flexibility makes the constraint of contractual attendance less binding. Profit sharing, which binds together the fortunes of the establishment's workers, is associated with reduced absence.[10] Establishments with large shares of apprentices report lower absence rates. Work councils are associated with increased absence.

Of primary importance, establishments using teams have lower absence rates. The marginal effect of teams can be approximated by multiplying the teams coefficient by the product of the probability and its inverse. Thus, the change in the probability of absence is equal to (.0942)(.056)(.944) or -.0049 as the independent variable is a dummy variable. This is a substantial influence. Given the mean absence of .056, the presence of teams results in a nearly ten percent reduction in absence.[11]

As a further check, the specification in column 1 is re-estimated substituting the dichotomous teams indicator with the three measures of the extent of teams. As the result in column two shows, virtually all of the previous results remain as before with nearly identical size and significance for the coefficients of the controls. The team coverage variables present a unified pattern. Each takes a negative coefficient with the size of that coefficient increasing as the extent of coverage does. The two greater coverage variables are statistically significant at the 5 percent level. The coefficient for the greatest team coverage implies a reduction in absence probability of -.0066.

The use of meetings by managers may interact with the presence of teams. We anticipate that meetings may reflect increased employee involvement and that such involvement increases worker satisfaction and may reduce absence. While this has not been confirmed in the estimates to date, we now enter an additional variable that interacts the presence of meetings with that of teams. As the third column of table 3 shows, the interaction emerges with a significant positive coefficient while the meeting indicator emerges with a significant negative coefficient. As all three coefficients have essentially the same size, this indicates that teams may reduce absence or meetings may reduce absence but the effects are not additive. Thus, meetings can reduce absence but only in workplaces in which there are no teams.

The coefficient on the teams variable is now larger than that originally indicated. The influence of teams in an establishment without regular meetings is now -.0079, indicating teams are associated with a reduction of more than 14 percent of the mean absence rate of .056. In addition to this fundamental result, the tenor of the other controls is similar. The coefficient on profit sharing is negative and now statistically significant (at 5 %) and the indicator of older workers is statistically significant.

As discussed, Barmby and Stephan (2000) hypothesize that the influence of firm size on absence results from the ability of large firms with multiple lines to more cheaply diversify the risk of absence. They compare a hypothetical firm with one production line to a firm with two production lines showing that if the second firm can use workers redundant on one line to replace absent workers from the other, the expected cost of absence is below that of the smaller firm. The result is greater absence in the larger firm. This seems sensible as “massed reserves” are often crucial in determining economies of scale. Specifically, Barmby and Stephan claim that among firms with team production increased size should reduce absence rates.

Table 4 shows the effects of splitting the basic estimation by the teams variable. In column one are the determinants of absence for firms not using teams. This subsample constitutes the large majority of the observations but yields insignificant size variables. This contrasts with the establishments having teams in which the size effect remains large and the linear component remains highly significant. Indeed, the coefficient of the linear size component is nearly twice as large as the point estimate among firms without teams. Thus, the size effect appears to be a unique feature of firms with team production and support is provided for the proposition that among firms with team production, larger firms have greater absence.

5. Conclusions

The estimates in this paper rest on the assumption that work place teams reflect, in part, underlying team production. The worker interdependencies associated with such production generate the need for teams and their value. We modify past work to argue that absence is more expensive for establishments with team production and lowering these costs provides an added incentive to monitor workers. The additional monitoring results in lower absence rates.

Estimations using German establishment data reveal the presence of teams to be among the strongest determinants of absence rates. Moreover, we demonstrate the important interaction between establishment size and teams in determining absence rates. Only among establishments with teams is the relationship between size and higher absence observed, a result that fits the conjecture that larger firms can insure against the risk of absence more cheaply. This empirical result is important as it suggests teams may be a reasonable proxy for team production.

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Table 1: Variable Definitions and Descriptive Statistics

Variable	Description (mean, standard deviation)
Absence	Average absence rate of blue-collar workers, Jan-Jun 1996 , (.056, .032)
Apprentices	Apprentices as a proportion of total employees (.043, .059).
Blue-collar	Blue collar workers as a proportion of total employees (.639, .173).
CollBarg	Dummy variable equal to 1 if the establishment is covered by a collective bargaining agreement (.681, .466).
High wage	Dummy variable equals 1 if the establishment pays wages above the level specified in the relevant or potential relevant collective agreement (.715, .452).
Flex-time	Dummy variable equals 1 if flexible work time arrangements exist (.421, .494).
Industry	Dummy variables for 14 broad industrial groups in the manufacturing sector.
Meeting	Dummy variable equals 1 if regular meetings inform employees about the economic development of the establishment (.398, .490).
Meeting*Team	An interaction of Team with Meeting (.183, .387).
Odds	Ln[Absence/(1 – Absence)] (-3.216, 1.604).
Old workers	Dummy variable equals 1 if management feels that the average age of employees is too high (.138, .345).
Part-time	Part-time employees as a proportion of total employees (.080, .121).
Profit sharing	Dummy variable equals 1 if profit sharing exists for nonexecutives (.147, .355).
Size	Total employees in the establishment divided by 1000 (.168, .494).
Shift work	Workers doing shift work as a proportion of total employees (.161, .245).
Stable workforce	Dummy variable equals 1 if the employment in 1995 at least equals that of the two previous years (.468, .499).
Team	Dummy variable equal to 1 if blue collar workers are organized in teams with expanded involvement in decision-making and responsibility (.379, .485).
Team1	Dummy variable equal to 1 production teams exist but less than 10 percent of all blue collar workers are in production teams (.045, .203).
Team2	Dummy variable equal to 1 if 10 percent to less than 50 % of blue collar workers are organized in production teams (.183, .350).
Team3	Dummy variable equals 1 if at least 50 % of blue collar workers are organized in production teams (.147, .327).
Works Council	Dummy variable equals 1 if a works council is in the establishment (.610, .488).
Women	Women as a proportion of all employees (.278, .230)

Table 2: Descriptive Statistics of Establishments with and without Teams

Variable	No Teams		Teams		|t|
Absence	$5.768 \cdot 10^{-2}$	($3.334 \cdot 10^{-2}$)	$5.265 \cdot 10^{-2}$	($2.970 \cdot 10^{-2}$)	1.896*
CollBarg	0.677	(0.468)	0.688	(0.464)	0.283
Works council	0.60	(0.49)	0.620	(0.49)	0.552
Size	0.140	(0.461)	0.215	(0.541)	1.773*
Profit sharing	0.12	(0.32)	0.200	(0.40)	2.579**
Women	0.274	(0.230)	0.285	(0.231)	0.573
Stable workforce	0.456	(0.499)	0.487	(0.501)	0.759
Blue-collar	0.645	(0.171)	0.630	(0.178)	1.051
Part-time	$7.761 \cdot 10^{-2}$	(0.119)	$8.312 \cdot 10^{-2}$	(0.125)	0.549
Apprentices	$4.026 \cdot 10^{-2}$	($5.507 \cdot 10^{-2}$)	$4.801 \cdot 10^{-2}$	($6.522 \cdot 10^{-2}$)	1.518
Old workers	0.14	(0.35)	0.13	(0.34)	0.525
Shift work	0.159	(0.244)	0.164	(0.246)	0.246
Flex-time	0.38	(0.49)	0.49	(0.50)	2.604**
Meeting	0.346	(0.476)	0.483	(0.501)	3.349**
High wage	0.721	(0.449)	0.705	(0.457)	0.433
Number of observations	384		234		

Notes: *Statistically significant difference at the ten percent level. **Statistically significant difference at the five percent level. An approximation t-test was used when indicated by a stratically significant F-test for equality of sample variances. Standard deviations are in parentheses.

Table 3: Initial Log-odds Regression Results for the Absence Rate

Variable	(1)		(2)		(3)	
	$\hat{\beta}$	|t|	$\hat{\beta}$	|t|	$\hat{\beta}$	|t|
Constant	-2.890**	(18.63)	-2.879**	(18.40)	-2.857**	(18.29)
Teams	-.0942**	(2.262)			-.1499**	(2.796)
Team1			-.0153	(0.200)		
Team2			-.1025**	(1.983)		
Team3			-.1257**	(2.067)		
Teams * Meeting					.1318*	(1.646)
Women	.2792**	(2.443)	.2685**	(2.341)	.2690**	(2.354)
Size	.2193**	(3.209)	.2196**	(3.212)	.2255**	(3.299)
Size squared	-.0284**	(3.391)	-.0283**	(3.367)	-.0297**	(3.521)
Profit sharing	-.1004*	(1.718)	-.0963*	(1.693)	-.1100**	(2.008)
Flex-time	-.0926**	(2.177)	-.0957**	(2.246)	-.0911**	(2.144)
Part-time	-.4370*	(1.726)	-.4467*	(1.763)	-.4368*	(1.728)
Apprentices	-.8878*	(1.718)	-.9020*	(1.745)	-.9013*	(1.747)
Blue-collar	.1886	(1.180)	.1675	(1.045)	.1809	(1.133)
High wage	-.0309	(0.617)	-.0291	(0.580)	-.0292	(0.583)
Meeting	-.0479	(1.183)	-.0447	(1.102)	-.1038**	(1.976)
Works council	.1513**	(2.617)	.1465**	(2.524)	.1554**	(2.690)
CollBarg	-.0609	(1.135)	-.0633	(1.177)	-.0662	(1.232)
Old workers	.0903	(1.611)	.0907	(1.618)	.0926*	(1.654)
Stable workforce	-.0665	(1.590)	-.0637	(1.513)	-.0661	(1.581)
Shift work	.0984	(1.160)	.1012	(1.191)	.1047	(1.234)
14 Industry Dummies	Yes		Yes		Yes	
R-squared	.149		.151		.158	
Number of observations	618		618		618	

Notes: Asymptotic t-statistics are in parentheses. *Statistically significant at the ten percent level; **at the five percent level.

Table 4: Size Effects

	Establishments without teams		Establishments with teams	
	$\hat{\beta}$	|t|	$\hat{\beta}$	|t|
Size	.1326	(0.686)	.2350**	(2.189)
Size squared	-.0227	(1.033)	-.0227	(1.260)
R-squared	.137		.258	
Number of observations	384		234	

Notes: The regressions include all of the controls listed in Table 2 but they have been suppressed to save space. Asymptotic t-statistics are in parentheses. *Statistically significant at the ten percent level; **at the five percent level.

Endnotes

[1] Brown and Sessions (1996) claim the days lost to strikes are 7 percent of those lost to absence.

[2] See Brown and Sessions (1996) for a review of these studies.

[3] Coles et al. (2001) make a related point arguing that "just in time" inventory technology increases the cost of absence.

[4] This point is worked out in more detail in a demonstration available from the authors.

[5] The influence of scale on the derivate was examined in MAPLE VI for a range of relevant absence rates including .02, .03, .04, .05 and .06. We imagined a series of pairs of N and k including 25 and 20, 35 and 30, and 45 and 40. We then examined the derivative under a continuous range of γ from 1 to 9. In every case the derivate is unambiguously negative.

[6] Indeed, Lindbeck and Snower (2000) identify increased cross-training as resulting from new information technology which allows better task integration across workers and from increased versatility of capital equipment. This may be seen as a growth in the extent of team production.

[7] It is also possible that if earnings profiles are heavily backloaded, older workers may have larger quasi-rents increasing their cost of job loss.

[8] Prior to 1996 German workers received full sick pay at the employer's expense. The Kohl government reduced minimum sick pay to 80% of wages although most bargaining agreements ensured full sick pay. The Schröder government returned the entitlement to full sick pay.

[9] Following convention, for absence rates of zero the value is set equal to .00001.

[10] Available from the authors are specifications including indicators of group piece rates and group premium pay showing no change in the team results as these indicators are rarely significant.

[11] It might be that teams have their influence as a monitoring mechanism in the face of profit sharing rather than indicating underlying team production. To test this we interacted profit sharing with teams expecting that if teams act as a monitoring mechanism they should have a greater influence in the face of profit sharing. We found no significant interaction effects.