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Unions, Training, and Firm Performance: Evidence from the British Workplace Employee Relations Survey

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ABSTRACT

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This paper uses a combination of workplace and matched-employee workplace data from the British 1998 Workplace Employee Relations Survey to examine the impact of unions and firm-provided training (incidence, intensity/coverage, and duration) on establishment performance. The performance effects of training are indexed not just by individual and median establishment earnings but also by subjective measures of plant labor productivity and financial performance. Union effects on training are fairly subtle, and somewhat more positive when using individual rather than plant-wide training data. A positive impact of training on earnings is also detected in both individual and plant-based wage data, although consistent with much recent research the effects of union recognition are at best muted. There are also some signs of a positive interaction term for unionism and training in the earnings equations, but by the same token negative effects are encountered when training duration is expressed in categorical terms and interacted with union recognition. Instrumenting training yielded positive results for labor productivity and the firm's bottom line. While some negative effects of multiple unionism at the workplace now emerge, they seemingly do not operate through the training route.

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I. Introduction

The issues of the productivity of workplace training and union impact on firm performance are two of the more controversial issues in applied labor economics. The training question is complicated by the diversity of training forms, measurement difficulties, and the likelihood that training participants and training firms will differ materially from their counterparts without (or with less) training. The empirical evidence from individual and firm data is mixed, especially as regards the productivity of on-the-job or internal training.

For its part, the union literature is in one sense more settled but lacks traction in the sense that the manner in which unions may influence workforce performance has been a black box. Implicitly, the major exception to this statement is training. Thus, in their early study of productivity using state-by-industry aggregates Brown and Medoff (1978) attempted to go behind their finding of a positive union productivity differential of between 22 and 30 percent by including a quit rate variable in the union-augmented production function. The effect was to reduce the union coefficient estimate by around one-fifth. In the years since this pioneering study, U.S. interest in the mechanisms through which unions might raise productivity has waned *pari passu* with much reduced estimates of the magnitude of that differential at lower levels of aggregation. But the potential for greater training in union regimes (facilitated in part by reduced voluntary turnover) and the issue of its productivity are no less valid topics of empirical inquiry today than heretofore. Indeed, in Britain at least, there is evidence of heightened interest in these issues partly because of an apparent sea change in union impact on firm performance allied in part to bargaining structure and partly because of research into the impact of high performance work practices.

In the present study, we seek to examine these links using private-sector establishment data for Britain. Specifically, we consider the determinants of training to include unionism and then

examine the impact of unions and training on earnings, labor productivity, and financial performance. Although we have information on just one type of training – namely, employer-provided off-the-job training – we shall consider its influence along the dimensions of incidence, intensity (or coverage), and duration, using both individual and plant-level measures. Our earnings analysis uses linked employer-employee data as well as plant-level average earnings. The impact of the two key variables on labor productivity and financial performance use plant-level data alone because of the very limited sampling of workers and here we shall effect comparisons among the plant-level analyses while allowing for the endogeneity of training.

To motivate the present study, we first outline the circumstances in which unions might influence training investments by the firm and the manner in which the productivity of such investments has been addressed in the existing literature. We next describe the dataset used in this inquiry. This is followed by a presentation of our detailed findings. A brief summary concludes.

II. Theoretical Conjectures and the Existing Literature

At the level of theory, unions might be associated with either more or less training.[1] A negative union effect might be expected if the union premium impairs the ability of employers to finance training or where seniority rules reduce the worker's incentive to undertake or invest in training. Deadweight losses resulting from the union premium and wage compression within union branches should accentuate these two effects.[2] Equally, the scale of these effects might be expected to vary directly with union strength or bargaining power.

By the same token, there are situations in which unions can stimulate training. Thus, the expression of union voice, underwritten by the wage premium, should cut down on labor turnover and increase the incentive of the employer to invest in firm-specific training because of the longer payback period. A more thorough-going application of collective voice might improve contract

enforcement and thereby make workers more willing to engage in training, including multiskilling. More concretely, it might tackle a potential 'hold up' problem on the part of employers: firms might 'hold up' the sunk investments of workers in training, leading to an under-investment in human capital. Here, unions could act to prevent the hold up problem by making the firm honour its commitments (Menezes-Filho and Van Reenen, 2003, p. 299). On this reasoning, stronger unions could well imply improved contract execution.

Even if employers in a sense over-train in response to the union premium and turnover is too low – so that society will not benefit – there is no implication that the productivity of training should on this account be lower in union regimes. The principal caveat would presumably be where unions negotiate training.

Past British (if not U.S.) work on the determinants of training has generally reported a positive union effect. That is, not only older research using union density (e.g. Greenhalgh and Mavrotas, 1994; Arulampalam, Booth, and Elias, 1995) but also more recent research using the preferred metric of union recognition point to a statistically significant direct association between unionism and training. Thus, for example, using individual data from the 1993 Quarterly Labor Force Survey and establishment-level data from the 1991 Employers' Manpower and Skills Practices Survey, Green, Machin, and Wilkinson (1999) report that the incidence of training is positively related to union recognition. Union recognition is also reported to lead to an increased duration of that training in hours/days. Reflecting the recent British preoccupation with the structure of bargaining, the authors also report that both the incidence and duration of training (from the employer survey) are unaffected by the structure of bargaining as indexed by multiple unionism at the workplace. The rationale is that the union wage will be higher where there are multiple unions that bargain separately at the workplace, although the authors actual variable is the

presence of multiple unions at the workplace (interacted with union recognition), thus conflating separate and joint bargaining on the part of multiple unions.[3]

Similarly, in an exercise that matches employee to establishment data from the WERS98, Böheim and Booth (2004) report a positive correlation between union recognition and employer-provided training in the private sector for three out of the four worker groups identified, namely, manual and nonmanual males and nonmanual females. In an expanded model that takes account of bargaining structure, the main change is that for male manual workers training incidence is only higher under union recognition where there is multiple unionism with joint bargaining. Otherwise, bargaining structure has no separate effect on training incidence.

The incidence (and extent) of workplace training is one thing, its productive impact quite another. The traditional approach in Britain to measuring the productivity of training has been via earnings functions (some limitations of which are noted below). Although there is an extensive literature on the impact of educational investments, that dealing explicitly with work-related training is less developed. Nevertheless, most studies point to statistically significant positive returns to such training (see the survey by Cohn and Addison, 1998) even if few address the interaction between unionism and training.

Two very recent studies by Forth and Millward (20004) and Booth, Francesconi, and Zoega (2003) merit attention. The principal focus of the former study is on the role of high performance workplace practices, including employee involvement. Using matched employee-employer data from the WERS98 for the private sector – the wage, training, and human capital/demographic variables are taken from the employee component of the survey and the establishment data from the employer component of the survey (see the data section below) – Forth and Millward report that (log) earnings are strongly positively related to certain training durations (viz. 1-2 days and 2-5

days) relative to no training. Some effect of high performance work practices is also found, seemingly underwritten by job security guarantees. As far as unionism is concerned, only its direct effect on earnings is estimated. Although union recognition is associated with a wage premium of around 10 percent, this arises only in circumstances of multiunionism, both single-table bargaining and where there are multiple bargaining units. That is, there is no such wage differential when there is only a single recognized union at the workplace. Forth and Millward note the results of interacting high performance work practices with unionism, arguing that the premium associated with the former is augmented under multiple unionism. But, to repeat, they do not interact unionism with the training argument.

This omission is tackled by Booth, Francesconi, and Zoega (2003) in a study using information from the British Household Panel Survey Data for a balanced panel of full-time males, 1991-96. The analysis considers both the duration of employer-provided training as in Forth and Millward (but now as a continuous rather than a categorical variable) and also its incidence. The authors find that union-covered workers are significantly more likely to receive training (between 5 and 9 percentage points) and to receive longer training (between 3 and 4 days) than their non-covered counterparts. (The lower estimates are for the panel estimates.) Moreover, the effects of training on wages are found to vary positively with union coverage, even as the positive effect of training on wages found using OLS is not replicated in fixed effects estimates. Taking the authors' fixed effects estimates for incidence, for example, it is found that union workers who receive any training earn roughly 6 percent more than their uncovered counterparts, half of which is the simple union premium. The effect of training duration is small although the interaction of intensity and union recognition is again positive and statistically significant. Finally, in a separate analysis of wage growth that allows for changes in collective bargaining status and training incidence/duration,

the main result is that gaining coverage is much more important for earnings growth than receiving training or obtaining longer training without gaining union coverage. In short, there is little in these data to suggest that unionism is associated with lower returns to training or lower wage growth.

But if unions do not reduce the incentives to acquire work-related training it is too early to conclude from one study that the productivity of training in union plants is higher than in nonunion establishments. Moreover, as Dearden, Reed, and Van Reenen (2000, p. 6) caution, earnings "only tell half the story." The course of earnings reflects not only value marginal product development but also the share principle covering training investments (both firm-specific and also general training in the light of recent theoretical developments stressing labor market imperfections), effort-motivating career wage profiles, product market imperfections, and indeed other types of training investments (principally informal types of training on which the standard data sets are silent). It is therefore necessary to supplement the earnings function approach with a more direct measure of productivity than the wage. Indeed, testing modern theories of wage compression and training require such data to test the implication that productivity increases faster than earnings.

There is a small but growing training-in-the-production-function literature. A summary of the main studies is consigned to Appendix Table 1. As can be seen, just one study is for Britain, namely, Dearden. Reed, and Van Reenen's (2000) analysis of a panel of *industries* between 1983 and 1996, and where the training information is derived from the Labour Force Survey. The study is notable for its use of an extended panel with information on training and productivity for each year of the sample period. This enables the authors to deal with problems of unobserved heterogeneity (some industries may have lower rates of technological change and therefore offer less scope for training) and endogeneity (training may be undertaken when its opportunity costs is lower as when firms experience transitory demand shocks) using GMM system methods. The

upshot of this approach is that weak training effects on productivity detected in OLS are considerably strengthened using a within group estimator and further strengthened using a GMM estimator with endogenous training. In robustness tests, the authors report that collective voice effects do not seem to underpin the stronger training results: the point estimate of training is little affected by the inclusion of a union measure (viz. density) (only available from 1989 onward) while the coefficient estimate for unionism is negative albeit statistically insignificant. (We note parenthetically that the union variable when considered alongside training in the production function literature is often statistically insignificant.)

Finally, Dearden, Reed, and Van Reenen offer a parallel earnings function analysis. Familiarly, the strong association between training and wages is considerably reduced with controls for skills but is stronger in the within group estimates and more so using the GMM estimator. But the wage gradient of training is half the productivity gradient, leading the authors to conclude that the earnings function approach "ignores the benefits the firm may capture through higher profits" (Dearden, Reed, and Van Reenen, 2000, p. 53).

One problem with this important study apart from its neglect of the union-training nexus – the production function studies in Appendix Table 1 typically ignore union impact and none considers the productivity of training in union and nonunion regimes – is possible aggregation bias. That said, this level of analysis may capture externalities from training (knowledge spillovers) that perforce escape identification at the firm level.

The bottom line is that some real progress has been made in charting the impact of unions on workplace training and of training on earnings and output. Very limited progress has been made in determining how unionism might mediate the impact of training on earnings and none has formally examined the interaction between unionism and other measures of establishment

performance. The present exercise seeks in part to redress this imbalance. It does so by exploring the determinants of training in a framework that investigates the impact of training and union recognition on two subjective measures of firm performance, namely, relative labor productivity and financial performance in addition to earnings.

III. Data

Our data are taken from the 1998 Workplace Employee Relations Survey (WERS98). The survey follows closely the format of the earlier Workplace Industrial Relations Surveys/WIRS (1980, 1984, and 1990), albeit with some differences (see Cully et al., 1999). WERS98 is a national survey of 2,191 U.K. establishments in the public and private sectors (excluding coalmining and agriculture) with at least 10 workers (previous WIRS only include establishments with at least 25 workers). The main focus of the survey is a *management questionnaire* that provides detailed information on the composition of the workforce, management of the personnel function, representation at work, consultation and communication, payment systems and pay determination, workplace flexibility, and (largely qualitative) information on workplace performance. In addition, 25 employees at each workplace – or all employees at smaller establishments – are randomly selected for an *employee questionnaire*. This survey of individual workers inquires of the employee respondent the nature of the job held, training received, attitudes toward the organization and management, representation at work, as well as his or her educational level and earnings. Unlike earlier WIRS, therefore, WERS98 includes information on both individual and workplace characteristics. Response rates to the management and employee questionnaires were 80 percent and 64 percent, respectively.

For that part of our analysis dealing with the determinants of training and the effect of training on wages, we will match the employee and workplace (i.e. management survey) components of WERS98. We shall also present parallel results using workplace as opposed to individual data on training and earnings information from the management survey. Earnings from the employee questionnaire are in the form of gross weekly earnings that are reported in twelve earnings bands.[4] Using the relevant midpoint value in conjunction with another question in the employee survey providing the individual's normal weekly hours, we derive a measure of gross hourly wages. Earnings from the management survey are in the form of gross annual wages in six earnings bands. Using midpoint values – this time in association with the number of workers populating each band – we are able to construct a measure of plant 'median' earnings.

The critical training variable also differs as between the two components of WERS98, even if in each case it refers to formal off-the-job training. For the employee survey the training question asks "During the last 12 months, how much training have you had, either paid for or organized by your employer?"[5] The employee is asked is required to tick one of six 6 boxes: 'none,' 'less than 1 day,' '1 to less than 2 days,' '2 to less than 5 days,' '5 to less than 10 days,' and '10 days or more'). From these responses, we construct two training measures: first, we define *training incidence* to take the value of 1 if the respondent received any such training, zero otherwise; second, we define *training duration* as either 0 or the midpoint of the reported bands.

The (main) training question in the management survey asks "What proportion of experienced employees in the largest occupational group have had formal off the job training over the past 12 months?"[6] There are seven possible responses, comprising upper and lower limits of 'all' and 'none' and five intermediate bands. We define *training incidence* to be 1 where the employer responds that more than 0 percent received training. We also use the question to define

training intensity (or *coverage*)*,* assigning the plant to one of the seven intervals, using the midpoints of the bands as appropriate. We also employ responses to a second training question in the employer survey to derive a measure of *training duration* analogous to that contained in the employee survey. This second question asks the employer to identify which of six intervals best describes "on average, about how much time did these… employees … spend in formal off-the-job training sessions over the past 12 months?" We weight these hourly values by the corresponding intensity or coverage values to produce an estimate of plant-level training duration.

In addition to the conventional use of earnings as a performance indicator (see the literature review above) we also use two other outcome indicators, namely, labor productivity and financial performance, taken from the management survey. Given the partial sampling of employees in the employee survey, we do not link these data to the employee survey. Thus, when we form an instrument for training for inclusion in the performance equations this is based on plant-level data alone

We next briefly describe the labor productivity and financial performance dependent variables. Each is subjective, the manager respondent being asked to "assess your workplace's labor productivity/financial performance" vis-à-vis the average of "other establishments in the same industry." Responses in each case are coded 'a lot better/better than average,' 'above average,' 'about average,' and 'a lot below/below average.' For both indicators, we define *above average performance* as 1 (combining the first three responses), zero otherwise.

Our measure(s) of unionism is the same across all estimations and is a plant-level measure. *Union recognition* is set equal to 1 if the employer recognizes any trade union at the place of work for the purpose of negotiating pay and conditions for any sections of the workforce. We also use an alternative measure of unionism based on *bargaining structure*. Vis-à-vis no recognition (the

omitted category), we identify circumstances in which the employer bargained with a single union or either jointly or severally with multiple unions.

The remaining variables are more easily described because they have been widely used in previous empirical work. Thus, the equations using as dependent variables individual-level earnings and training data from the employee questionnaire contain standard human capital arguments (such as educational attainment, occupational controls, and age and tenure) and demographic controls (such as marital status, gender, and ethnicity). They also include the same workplace covariates as are used in all equations based on management survey data alone – other than those used to identify the plant-level training equations fitted to those data. In addition to various high performance working practices (described below), the workplace-level arguments include labor force composition (proportion of female, part-time, and manual workers), plant and wider organization characteristics (establishment/organizational size, status as a single operating establishment or otherwise, and capital intensity), product market competition, firm ownership, and (eight) industry dummies.

As for the high performance working practices, these comprise *team working* (at least 60 percent of employees work in the largest occupational group work in formally designated teams), *quality circles* (presence of workplace groups that solve specific problems or discuss aspects of performance or quality), *briefing groups* (system of briefing nonmanagerial employees at the workplace that occurs at least monthly and where at least 10 percent of time is dedicated to questions/contributions from employees), *information disclosure*, (management regularly provides workers with information on the plant's financial situation and external investment plans), and *financial participation* (at least 60 percent of nonmanagerial employees are eligible to participate in an ESOP arrangement or have received profit- or performance-related pay in the preceding 12

month period). We do not allow for the bundling such practices or for their frequency and intensity (on which, see Forth and Millward, 2004) as our main interest lies elsewhere Moreover, one practice that is often considered to belong to this group is included in our treatment under a separate 'heading.' Here we refer to *job security guarantees* which we use to help identify the training equation when instrumenting training. We would anticipate that job security guarantees either call for a more flexible (i.e. more highly trained) workforce or stimulate training in the downturn. We also deploy two other rather more obvious training-related arguments. As an indication of the scope for training, we deploy a dummy variable set equal to 1 if *it normally takes at least one month before new employees in the largest occupational group are able to do their job*, and 0 if less than that. And as an indication of the priority accorded training, we use another dichotomous variable that assumes the value of 1 if the establishment *sets targets for workplace training*.

Finally, we restrict our analysis to the private sector and use the sampling weights given in the survey. Altogether our cross sections cover 17,092 individuals, with complete data on 1,100 establishments. Descriptive statistics at the worker-level and workplace-level are provided in Appendix Tables 2 and 3.

IV. Findings

Our starting point is the determinants of training and earnings. In each case we will provide results using both individual and plant-level measures of training and earnings. As noted above, the former are derived from the employee survey and are linked to human capital and demographic data from that survey and also matched to establishment-level information from the management survey. Analysis of this information provides the closest form of contact with the existing British literature.

The latter are based on workplace-level data from the management survey alone and are organically linked to the subsequent analyses of plant productivity and financial performance.

(Table 1 near here)

Table 1 provides probit and tobit regression results for individual-level training incidence and duration, respectively, using two measures of unionism in each case. As can be seen, whether or not a worker receives training appears uninfluenced by the union recognition status of the plant or by the structure of collective bargaining. Few of the variables taken from the employee survey are statistically significant. Rather, it is plant- level variables such that dominate. The likelihood that the worker receives training frequency is higher the greater the capital-labor ratio, the larger the plant, and for three out of five high performance work practices; it is lower in single plant firms, the larger the share of part-timers and manual workers in the workforce, and where there is (moderate) product market competition.

For its part, training duration appears unaffected by union recognition. But this result masks important differences between types of recognition: compared with plants without union recognition, workers in establishments that bargain with multiple (single) unions have longer (shorter) training spells over the course of a year. Most of the plant-level variables found to influence training incidence operate in the same manner as regards training duration – the notable exception being U.K.-owned plants that now train less. The major difference is that individual level variables now play a role. Note for example the conspicuous decline in training duration with age and tenure, the shorter duration of training for single workers, females, and minorities and the longer training of the British counterpart of high-school graduates and the members of more highly skilled occupations.

(Table 2 near here)

The corresponding results for training using plant-level variables alone are given in Table 2. (These equations include three plant-level measures not encountered in Table 1 that are used to identify our plant-level training equation for subsequent stages of the analysis.) The first four columns of the table give results for the incidence and coverage of training by union measure, and the last two provide our imputed duration of training measure. The most notable result is the general statistical insignificance of the union variable. Union recognition is not statistically significant in any model. The different union bargaining structures show either insignificant or inconclusive impacts: for incidence, single-table bargaining is positive; for duration, multiple bargaining is negative. The results for training frequency (incidence and coverage) in the first four columns are roughly coincident. Thus, training frequency is declining in the share of part-timers and manual workers and increasing in establishment size and with all types of high performance work practices other than briefing groups. As far as training duration is concerned, much the same arguments are statistically significant although the role of high performance practices is more muted. Interestingly, two out of the three variables we consider as identifiers – picking up the scope for training (time taken for new workers to become proficient) and the priority accorded training (targets set for workplace training) – are both positive and well determined across all six regressions.

(Table 3 near here)

The impact of training and unions on (log) hourly pay using matched employee-establishment data is shown in Table 3. As before, two representations of unionism are provided. Also as before, we consider both training incidence and duration, but now also enter duration as a categorical measure (following the actual bands used in the employee questionnaire) as well as in continuous form. All specifications include interactions between training and unionism, although in

the case of the categorical training measure we confine the interactions to union recognition alone for reasons of tractability, although we shall also report on the results of running separate equations for workers in union and nonunion firms when using this training measure.

The more important results from Table 3 are as follows. First, training incidence is positively associated with earnings but union recognition per se is not – the latter result is not new but it is contemporaneous – while the interaction between training incidence and union recognition is positive and marginally significant.[7] Once we amend the union measure to reflect bargaining structure, it can be seen that (direct) union effects on earnings seem to be confined to multiple unionism, while the interaction between unionism and training incidence is positive and significant for one type of multiple unionism, namely, where these unions bargain jointly. Second, where training duration is expressed as a continuous variable neither it nor union recognition is statistically significant, and the same is true of their interaction. Nevertheless, the union argument is well determined in the case of multiunionism, although here there is no evidence of a positive interaction between multiple unionism and training duration. Third, when training duration is entered in categorical form a more differentiated pattern of results obtains. As can be seen, the effect of duration is not linear: some intermediate levels of duration have well determined positive effects. While union recognition in this specification is strongly significant, the interactions terms are negative (with the one exception of the interaction with training of more than ten days; but in that case training itself is not positively associated with wages). When we ran the equation separately by union recognition status, the pattern of training coefficients was broadly similar across the two regimes. However, workers in nonunion establishments reported earnings premia for training (of duration 1-2, 2-4, and 5-9 days), which were significantly higher than the premia for workers in union settings.

(Table 4 near here)

There are few surprises as regards the other arguments in Table 3. The results are consistent with those reported in the literature (most notably Forth and Millward, 2004, table 3), and so we turn without further comment to Table 4 which presents the results of fitting a wage equation using the plant-level median (annual) wage constructed from the management survey and linked to plant-level covariates alone. Inspection reveals some statistically significant associations between training and wages for training intensity and duration if not incidence. But there are no systematic union effects on earnings, and where significant the effects are inconclusive. Just two of a total of twelve union-training interaction terms are significant. We note parenthetically that when we estimated the equations without the union-training interactions, the coefficient estimates for each training measure were uniformly positive and statistically significant while those for unionism were always poorly determined.

By way of summary, our findings differ from the extant literature in a number of respects. One is the absence of any simple effect of unions on training incidence, duration, or coverage. And while our findings on the union wage premium are consistent with the literature – in denying a simple association between unionism and pay and noting that the premium where observed hinges on bargaining structure – the near absence of significantly positive interaction effects between unionism and training conflicts with the optimistic findings of the one British study to have investigated this issue.

(Table 5 near here)

These observations and the limitations of wages as a measure of productivity led us to consider whether stronger effects of training (and unions) might be discernible using the labor

productivity question in the WERS98, as well as the longer-term financial performance indicator. Beginning with labor productivity, when we regressed our outcome indicator (*above average labor productivity* =1, 0 otherwise) on the reported values of various training and union arguments, the results were unspectacular. In particular, just one association was statistically significant (a negative coefficient estimate for single-table bargaining under multiple unionism). Table 5 indicates the outcome of instrumenting our three training variables, using the specifications in Table 2. The coefficient estimates for predicted training incidence, coverage and duration are each positive and statistically significant. For its part, the simple union variable – union recognition – was with one exception poorly determined, and the interaction term between union recognition and (predicted) training is never significant. For equations taking account of the bargaining structure there are few statistically significant coefficients, except for single-table multiunion bargaining which shows a negative relationship to labor productivity (the remaining interaction terms are also uniformly negative).

(Table 6 near here)

Very similar results were found for financial performance, as reported in Table 6. Thus, all three predicted training measures were associated with improved performance – and all but the duration of training measure were also statistically significant in estimations using actual rather than predicted values of the variables. And while union recognition had no effect on financial performance, multiple unions that bargained jointly were associated with lesser performance in two of the three training regimes. The interaction terms were inconclusive, with mainly negative signs.

Given the subjective nature of the productivity and financial performance variables we would be wary of placing too much emphasis on the specifics. Moreover, the results are of course non-

commensurate with the earnings findings. That said, there is a measure of consistency in our findings. Moreover, the type of training considered here does seem to be pro-productive and unionism does not seem to adversely impact its payoff in most specifications.

V. Conclusions

This study is the first to examine the impact of training at the workplace on earnings, labor productivity, and financial performance. It does so in a framework that accords equal emphasis to labor unions.

Contrary to the predictions of the simple competitive model at least, union recognition does not appear to reduce the frequency of employer-provided off-the-job training. Indeed, individual worker data suggest that training duration may be longer in multiple- if not single-union situations. Plant-level training data also contain no suggestion of any reduction in training incidence or coverage in union regimes, but do suggest that its duration may be reduced in situations where multiple unions bargain separately.

What of the productivity of training? Although there are some differences between individual and plant-level earnings data, the productivity of training is mostly confirmed. The suggestion that single-table bargaining may actually be associated with higher returns to training (to incidence in the matched employee-employer regressions and to duration in the workplace-level estimates) has also to be considered alongside some other less positive results (specifically, the negative interaction between union recognition and training duration in one of the specifications in the matched data).

If we were to stop here, we might conclude that the balance of our evidence is more favorable to the new view if unionism than to the standard competitive model. But we are not speaking of a ringing endorsement, which in turn led us to experiment with a more direct measure

of output than earnings. Our investigation of subjective measures of labor productivity and financial performance taken from the management survey cast some doubt on the new view of unionism while strengthening the pro-productivity effects of training. Note, however, in both cases that the sources of the negative effects of unions on both productivity and financial performance do not seem to stem from a reduced payoff to training in union regimes.

Finally, we should note the difficulties of measuring training and identifying its impacts across entire establishments. Many individual workers may engage in and benefit from training, even in firms where little training is undertaken; these effects will be hard to capture if there is significant within-firm variation in training compared to between-firm variation. Here we are constrained by the data, such that fixed effects treatments cannot be utilized. However, we are able to use both workplace and worker-level data, with multiple measures of wages, training, and unionization. Moreover, our inquiry is able to fully trace the impacts to important establishment-level outcomes of overall labor productivity and financial performance.

Endnotes

1. On some *practical* industrial relations issues, see Green, Machin, and Wilkinson, (1999), pp. 180-181.

2. Modern theories of training would counter that where labor markets are imperfectly competitive because of search frictions the wage compression associated with unions might serve to increase (general) training investments by the firm (see Acemoglu and Pischke, 1999).

 3. There is also some indication in this study that the positive impact of union recognition on training may be increased in the presence of employee involvement mechanisms.

4. As a practical matter the lowest and highest bands refer to earnings of 'less than £50 per week' and '£681 or more per week,' respectively. In these cases, we compute a hypothetical midpoint assuming that the range matches that of the next and the previous earnings band, respectively. The selfsame procedure is used in the case of all other variables with open intervals.

5. The employee is asked to "include only training away from your normal place of work, but it could be on or off the premises."

6. The survey explicitly includes the *prompt*: "off the job training is training away from the normal place of work, but either on or off the premises.

7. When we do not employ an interaction term the coefficient estimate for union recognition is positive and well determined.

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Table 1: Determinants of Training in Matched Employee-Employer Sample

	Training Incidence		Training Duration	
	(1)	(2)	(3)	(4)
Union	-0.0011		-0.0667	
	(0.0318)		(0.1267)	
Single-table barg.		0.0145		0.6972
		(0.0485)		(0.1835)***
Joint barg.		0.0321		0.6860
		(0.0562)		(0.2023)***
Single union		-0.0117		-0.4665
		(0.0348)		(0.1386)***
Female	-0.0166	-0.0167	-0.6403	-0.6408
	(0.0338)	(0.0337)	(0.1293)***	(0.1292)***
Tenure	0.0011	0.0011	-0.0391	-0.0387
	(0.0009)	(0.0009)	(0.0034)***	(0.0034)***
Tenure^2	-0.0000	-0.0000	0.0002	0.0002
	(0.0000)	(0.0000)	(0.0000)***	(0.0000)***
Single	0.0027	0.0033	-0.5746	-0.5603
	(0.0405)	(0.0405)	(0.1507)***	(0.1506)***
Minority	0.0443	0.0437	-0.8079	-0.8398
	(0.0684)	(0.0684)	(0.2484)***	(0.2481)***
Education: GCSE	-0.0123	-0.0126	0.2193	0.2052
	(0.0385)	(0.0384)	(0.1423)	(0.1422)
Education: A-level	0.0694	0.0694	0.4891	0.4776
	(0.0504)	(0.0503)	(0.1837)***	(0.1836)***
Education: BA	0.0644	0.0644	0.3767	0.3901
	(0.0533)	(0.0532)	(0.2004)*	(0.2002)*
Children	0.0263	0.0260	-0.1645	-0.1762
	(0.0330)	(0.0330)	(0.1227)	(0.1225)
Disabled	0.0836	0.0826	-0.2098	-0.2539
	(0.0606)	(0.0606)	(0.2107)	(0.2106)
Age <20	-0.0575	-0.0560	-0.1357	-0.0998
	(0.0698)	(0.0697)	(0.2506)	(0.2504)
Age 20-24	-0.0092	-0.0074	-0.7460	-0.7108
	(0.0703)	(0.0701)	(0.2516)***	(0.2515)***
Age 25-29	0.0332	0.0352	-1.1816	-1.1308
	(0.0695)	(0.0694)	(0.2513)***	(0.2511)***
Age 30-39	-0.0742	-0.0725	-1.6793	-1.6383
	(0.0741)	(0.0740)	(0.2672)***	(0.2670)***
Age 40-49	-0.0924	-0.0895	-2.9670	-2.9060
	(0.0765)	(0.0763)	(0.2774)***	(0.2775)***
Occ.: Manager	-0.0820	-0.0810	3.0389	3.0687
	(0.0602)	(0.0601)	(0.2350)***	(0.2347)***
Occ.: Professional	-0.1033	-0.1024	2.6114	2.6267
	(0.0691)	(0.0690)	(0.2620)***	(0.2618)***
Occ.: Tech.	0.0206	0.0219	1.9588	1.9965
	(0.0717)	(0.0716)	(0.2667)***	(0.2666)***
Occ.: Clerical	-0.0855	-0.0845	0.9985	1.0274
	(0.0570)	(0.0569)	(0.2268)***	(0.2267)***
Occ.: Craft	-0.1240	-0.1229	1.2177	1.2473

	(0.0600)**	(0.0601)**	(0.2188)***	(0.2188)***
Occ.: Services	-0.0552	-0.0549	2.3617	2.3617
	(0.1055)	(0.1051)	(0.3086)***	(0.3083)***
Occ.: Sales	-0.2038	-0.2028	2.0607	2.0731
	(0.0591)***	(0.0590)***	(0.2282)***	(0.2281)***
Occ.: Assembly	-0.0561	-0.0554	-0.2811	-0.2760
	(0.0558)	(0.0558)	(0.2087)	(0.2086)
Establishment age	0.0001	0.0000	0.0034	0.0024
	(0.0004)	(0.0004)	(0.0014)**	(0.0014)*
U.K.-owned	0.0518	0.0542	-0.5307	-0.4409
	(0.0323)	(0.0325)*	(0.1270)***	(0.1278)***
Single establishment firm	-0.2259	-0.2263	-0.8674	-0.8794
	(0.0395)***	(0.0395)***	(0.1624)***	(0.1622)***
% female workers	0.0617	0.0631	0.2623	0.3668
	(0.0821)	(0.0817)	(0.3101)	(0.3108)
% part-time workers at workplace	-0.7785	-0.7725	-0.8192	-0.6637
	(0.0832)***	(0.0833)***	(0.3210)**	(0.3213)**
% manual workers at workplace	-0.4204	-0.4185	-0.7098	-0.5898
	(0.0554)***	(0.0552)***	(0.1921)***	(0.1928)***
Establishment employs shift workers	0.0334	0.0333	0.0344	0.0309
	(0.0311)	(0.0311)	(0.1233)	(0.1232)
Capital-labor ratio 0-25%	0.0665	0.0654	-0.2945	-0.3077
	(0.0413)	(0.0414)	(0.1616)*	(0.1617)*
Capital-labor ratio 26-50%	0.1004	0.0988	-0.3510	-0.3882
	(0.0393)**	(0.0393)**	(0.1589)**	(0.1590)**
Capital-labor ratio 51-75%	0.2091	0.2079	-0.2591	-0.3081
	(0.0457)***	(0.0456)***	(0.1623)	(0.1623)*
Log (employment size)	0.0934	0.0919	0.3123	0.2560
	(0.0142)***	(0.0143)***	(0.0452)***	(0.0458)***
Few competitors in industry	-0.0793	-0.0777	-0.1202	-0.0673
	(0.0418)*	(0.0418)*	(0.1487)	(0.1488)
Many competitors in industry	0.0034	0.0061	-0.0681	0.0251
	(0.0366)	(0.0370)	(0.1396)	(0.1401)
Organization size >100,000	0.1225	0.1160	0.1914	0.0466
	(0.0556)**	(0.0564)**	(0.1886)	(0.1908)
Organization size 50,000-99,999	0.0244	0.0223	0.3040	0.2302
	(0.0333)	(0.0334)	(0.1340)**	(0.1343)*
Team working	0.1586	0.1588	0.8000	0.7800
	(0.0281)***	(0.0281)***	(0.1149)***	(0.1153)***

Quality circles	0.1734	0.1723	0.6894	0.6520
	(0.0260)***	(0.0261)***	(0.1114)***	(0.1114)***
Briefing groups	0.0124	0.0124	0.2741	0.2694
	(0.0269)	(0.0269)	(0.1026)***	(0.1025)***
Information disclosure	0.1392	0.1371	1.0478	0.9845
	(0.0394)***	(0.0394)***	(0.1619)***	(0.1619)***
Financial participation	0.0009	0.0025	0.4711	0.5133
	(0.0330)	(0.0330)	(0.1238)***	(0.1238)***
n	*17092*	*17092*	*17092*	*17092*

Robust standard errors in parentheses.
Notes: Probit estimation of (1) and (2); Tobit estimation of (3) and (4). Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Table 2: Determinants of Training at Workplace Level

	Training Incidence		Training Intensity		Training Duration	
	(1)	(2)	(3)	(4)	(5)	(6)
Union	0.0861		2.4125		-0.2540	
	(0.1328)		(2.8368)		(0.2281)	
Single-table barg.		0.8585		5.4552		-0.4880
		(0.3905)**		(4.3461)		(0.3475)
Joint barg.		-0.1687		-4.4933		-0.8369
		(0.2305)		(4.4728)		(0.3610)**
Single union		0.0451		3.2029		-0.0378
		(0.1437)		(3.1496)		(0.2534)
Experience reqd. to do job >1 month	0.3726	0.3939	13.1535	13.8603	1.1682	1.2037
	(0.1108)***	(0.1132)***	(2.5290)***	(2.5438)***	(0.2050)***	(0.2060)***
Job security guarantees	-0.0790	-0.0637	-1.3122	0.4570	-0.0708	0.0636
	(0.4399)	(0.4484)	(6.5732)	(6.6077)	(0.5247)	(0.5278)
Targets set for training	0.2207	0.2302	15.3616	15.6911	0.7102	0.7451
	(0.1198)*	(0.1211)*	(2.4336)***	(2.4352)***	(0.1960)***	(0.1964)***
Establishment age	0.0002	0.0002	0.0298	0.0289	0.0038	0.0042
	(0.0013)	(0.0013)	(0.0281)	(0.0283)	(0.0023)*	(0.0023)*
U.K.-owned	0.0232	0.0599	2.4069	3.0362	-0.1728	-0.1928
	(0.1494)	(0.1515)	(3.0449)	(3.0738)	(0.2449)	(0.2471)
Single establishment firm	-0.2115	-0.2072	-8.9059	-9.0790	-0.2440	-0.2521
	(0.1445)	(0.1452)	(3.5055)**	(3.4983)***	(0.2833)	(0.2827)
% female workers	0.1555	0.1902	5.9573	7.4033	0.5805	0.6127
	(0.2877)	(0.2894)	(6.3209)	(6.3496)	(0.5091)	(0.5118)
% part-time workers at workplace	-1.5868	-1.5883	-28.6127	-29.6468	-1.7083	-1.8224
	(0.2862)***	(0.2871)***	(6.5060)***	(6.5224)***	(0.5327)***	(0.5356)***
% manual workers at workplace	-0.5786	-0.5451	-12.0342	-11.1851	-1.2143	-1.2133
	(0.1850)***	(0.1884)***	(3.8365)***	(3.8565)***	(0.3104)***	(0.3119)***
Establishment employs shift workers	0.0949	0.0788	2.4134	2.3181	0.3373	0.3423
	(0.1232)	(0.1237)	(2.7935)	(2.7899)	(0.2269)	(0.2267)
Capital-labor ratio 0-25%	0.2977	0.3105	9.7697	10.0578	0.2856	0.2821
	(0.1875)	(0.1892)	(3.8120)**	(3.8088)***	(0.3070)	(0.3068)
Capital-labor ratio 26-50%	-0.0589	-0.0604	5.0848	5.2039	0.2549	0.2686
	(0.1752)	(0.1772)	(3.7215)	(3.7127)	(0.2999)	(0.2993)
Capital-labor ratio 51-75%	0.3659	0.3719	2.9906	3.4336	0.2155	0.2521
	(0.1918)*	(0.1941)*	(3.8293)	(3.8270)	(0.3096)	(0.3097)
Log (Employment Size)	0.2220	0.2209	1.2954	1.4159	-0.0328	-0.0003
	(0.0500)***	(0.0526)***	(0.9732)	(1.0056)	(0.0806)	(0.0828)

	(1)	(2)	(3)	(4)	(5)	(6)
Organization size >100,000	0.0777	0.1366	-2.3149	-1.0886	-0.2732	-0.1878
	(0.2108)	(0.2152)	(4.2248)	(4.2543)	(0.3407)	(0.3427)
Organization size 50,000-99,999	0.2551	0.2427	-2.4788	-2.5121	0.1688	0.1903
	(0.1523)*	(0.1545)	(3.0946)	(3.0907)	(0.2487)	(0.2484)
Few competitors in industry	0.1110	0.1138	1.9378	1.1354	-0.2814	-0.3472
	(0.1806)	(0.1821)	(3.5118)	(3.5238)	(0.2820)	(0.2832)
Many competitors in industry	-0.0352	-0.0164	-2.5590	-3.1211	-0.1644	-0.2273
	(0.1587)	(0.1600)	(3.2504)	(3.2598)	(0.2615)	(0.2624)
Team working	0.2559	0.2389	12.3963	11.8900	0.5924	0.5725
	(0.1121)**	(0.1129)**	(2.5573)***	(2.5616)***	(0.2071)***	(0.2074)***
Quality circles	0.2000	0.1835	9.1788	9.1093	0.5603	0.5839
	(0.1202)*	(0.1211)	(2.5646)***	(2.5655)***	(0.2062)***	(0.2063)***
Briefing groups	-0.0156	-0.0385	-0.4557	-0.3956	-0.1681	-0.1677
	(0.1102)	(0.1110)	(2.3502)	(2.3445)	(0.1892)	(0.1888)
Information disclosure	0.5134	0.5090	8.4358	8.2675	0.3975	0.4033
	(0.1329)***	(0.1333)***	(3.4499)**	(3.4439)**	(0.2799)	(0.2796)
Financial participation	0.3536	0.3433	6.4722	6.4838	0.4903	0.4634
	(0.1632)**	(0.1656)**	(2.9628)**	(2.9671)**	(0.2383)**	(0.2386)*
n	1100	1100	1100	1100	1100	1100

Standard errors in parentheses.

Notes: Probit estimation of (1) and (2); Tobit estimation of (3)-(6). Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Table 3: Determinants of Log Hourly Pay with Training/Union Interactions

	Specification				
	(1)	(2)	(3)	(4)	(5)
Training incidence	0.0266 (0.0107)**	0.0312 (0.0107)***			
Training duration			-0.0016 (0.0013)	-0.0013 (0.0013)	
Union	0.0086 (0.0120)		0.0163 (0.0101)		0.0379 (0.0125)***
Incidence * union	0.0311 (0.0164)*				
Duration * union			0.0026 (0.0019)		
Single-table barg.		0.0369 (0.0172)**		0.0722 (0.0182)***	
Joint barg.		0.0750 (0.0199)***		0.0666 (0.0182)***	
Single union		-0.0012 (0.0135)		-0.0039 (0.0113)	
Incidence*Sing.-table barg.		0.0740 (0.0265)***			
Incidence * Joint barg.		-0.0001 (0.0275)			
Incidence * Single union		-0.0025 (0.0183)			
Duration*Single-table barg.				0.0024 (0.0033)	
Duration*Joint barg.				0.0027 (0.0030)	
Duration * Single union				0.0003 (0.0022)	
Training (<1 day)					0.0314 (0.0193)
Training (1-2 days)					0.0656 (0.0162)***
Training (2-4 days)					0.0758 (0.0166)***
Training (5-9 days)					0.0703 (0.0206)***
Training (>10 days)					-0.0477 (0.0212)**
Training (<1 day)*union					-0.0340 (0.0276)
Training (1-2 days)*union					-0.0294 (0.0240)
Training (2-4 days)*union					-0.0501 (0.0226)**
Training (5-9 days)*union					-0.0528 (0.0309)*
Training (>10 days)*union					0.0670

					(0.0310)**
Female	-0.1150	-0.1148	-0.1152	-0.1152	-0.1129
	(0.0102)***	(0.0101)***	(0.0102)***	(0.0101)***	(0.0102)***
Tenure	0.0012	0.0012	0.0012	0.0012	0.0012
	(0.0003)***	(0.0003)***	(0.0003)***	(0.0003)***	(0.0003)***
Tenure^2	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
Single	-0.0627	-0.0613	-0.0623	-0.0615	-0.0629
	(0.0122)***	(0.0120)***	(0.0122)***	(0.0122)***	(0.0122)***
Minority	-0.0327	-0.0330	-0.0318	-0.0336	-0.0313
	(0.0221)	(0.0220)	(0.0221)	(0.0219)	(0.0222)
Education: GCSE	0.0588	0.0571	0.0587	0.0576	0.0564
	(0.0124)***	(0.0124)***	(0.0124)***	(0.0125)***	(0.0123)***
Education: A-level	0.1201	0.1190	0.1212	0.1203	0.1171
	(0.0150)***	(0.0150)***	(0.0151)***	(0.0151)***	(0.0151)***
Education: BA	0.2331	0.2342	0.2341	0.2348	0.2292
	(0.0174)***	(0.0173)***	(0.0174)***	(0.0174)***	(0.0173)***
Children	0.0136	0.0129	0.0140	0.0130	0.0126
	(0.0097)	(0.0097)	(0.0098)	(0.0098)	(0.0098)
Disabled	-0.0311	-0.0343	-0.0297	-0.0320	-0.0295
	(0.0161)*	(0.0160)**	(0.0163)*	(0.0163)*	(0.0163)*
Age <20	0.1059	0.1087	0.1056	0.1082	0.1037
	(0.0238)***	(0.0238)***	(0.0238)***	(0.0238)***	(0.0237)***
Age 20-24	0.2050	0.2073	0.2046	0.2069	0.2017
	(0.0232)***	(0.0232)***	(0.0231)***	(0.0231)***	(0.0231)***
Age 25-29	0.2808	0.2844	0.2810	0.2844	0.2775
	(0.0232)***	(0.0232)***	(0.0231)***	(0.0232)***	(0.0230)***
Age 30-39	0.2874	0.2908	0.2865	0.2890	0.2836
	(0.0247)***	(0.0247)***	(0.0247)***	(0.0247)***	(0.0246)***
Age 40-49	0.2589	0.2637	0.2575	0.2613	0.2554
	(0.0250)***	(0.0249)***	(0.0249)***	(0.0248)***	(0.0248)***
Occ.: Manager	0.5784	0.5811	0.5770	0.5797	0.5687
	(0.0190)***	(0.0190)***	(0.0191)***	(0.0191)***	(0.0194)***
Occ.: Professional	0.5003	0.5016	0.4987	0.4996	0.4933
	(0.0228)***	(0.0226)***	(0.0228)***	(0.0228)***	(0.0228)***
Occ.: Tech.	0.3288	0.3326	0.3285	0.3313	0.3219
	(0.0197)***	(0.0196)***	(0.0198)***	(0.0197)***	(0.0199)***
Occ.: Clerical	0.1600	0.1628	0.1587	0.1604	0.1549
	(0.0163)***	(0.0163)***	(0.0164)***	(0.0164)***	(0.0166)***
Occ.: Craft	0.1778	0.1808	0.1759	0.1777	0.1759
	(0.0205)***	(0.0204)***	(0.0207)***	(0.0204)***	(0.0206)***
Occ.: Services	0.0353	0.0352	0.0342	0.0346	0.0289
	(0.0320)	(0.0319)	(0.0321)	(0.0320)	(0.0322)
Occ.: Sales	0.0966	0.0964	0.0937	0.0946	0.0851
	(0.0198)***	(0.0197)***	(0.0197)***	(0.0197)***	(0.0197)***
Occ.: Assembly	0.0307	0.0323	0.0299	0.0307	0.0314
	(0.0154)**	(0.0152)**	(0.0154)*	(0.0154)**	(0.0154)**
Establishment age	0.0002	0.0001	0.0002	0.0001	0.0002
	(0.0001)	(0.0001)	(0.0001)*	(0.0001)	(0.0001)*
U.K.-owned	-0.1009	-0.0927	-0.1000	-0.0936	-0.0993
	(0.0100)***	(0.0097)***	(0.0100)***	(0.0098)***	(0.0100)***
Single establishment firm	-0.0247	-0.0277	-0.0289	-0.0301	-0.0232
	(0.0117)**	(0.0116)**	(0.0117)**	(0.0116)***	(0.0117)**

% female workers	-0.0572	-0.0492	-0.0573	-0.0495	-0.0631
	(0.0246)**	(0.0243)**	(0.0248)**	(0.0245)**	(0.0248)**
% part-time workers at workplace	-0.3459	-0.3366	-0.3543	-0.3453	-0.3468
	(0.0290)***	(0.0289)***	(0.0288)***	(0.0286)***	(0.0287)***
% manual workers at workplace	-0.1533	-0.1472	-0.1614	-0.1541	-0.1615
	(0.0168)***	(0.0167)***	(0.0168)***	(0.0169)***	(0.0168)***
Establishment employs shift workers	-0.0136	-0.0143	-0.0134	-0.0133	-0.0140
	(0.0089)	(0.0089)	(0.0089)	(0.0089)	(0.0089)
Capital-labor ratio 0-25%	0.0150	0.0153	0.0153	0.0141	0.0144
	(0.0129)	(0.0129)	(0.0130)	(0.0130)	(0.0130)
Capital-labor ratio 26-50%	-0.0039	-0.0066	-0.0026	-0.0054	-0.0029
	(0.0117)	(0.0116)	(0.0118)	(0.0118)	(0.0118)
Capital-labor ratio 51-75%	-0.0124	-0.0150	-0.0099	-0.0136	-0.0096
	(0.0150)	(0.0148)	(0.0152)	(0.0151)	(0.0151)
Log (employment size)	0.0357	0.0315	0.0375	0.0333	0.0369
	(0.0044)***	(0.0043)***	(0.0045)***	(0.0044)***	(0.0045)***
Organization size >100,000	-0.0555	-0.0639	-0.0541	-0.0639	-0.0527
	(0.0140)***	(0.0142)***	(0.0140)***	(0.0142)***	(0.0141)***
Organization size 50,000-99,999	-0.0194	-0.0257	-0.0190	-0.0244	-0.0188
	(0.0100)*	(0.0098)***	(0.0101)*	(0.0099)**	(0.0101)*
Few competitors in industry	-0.0699	-0.0655	-0.0718	-0.0688	-0.0687
	(0.0137)***	(0.0134)***	(0.0139)***	(0.0137)***	(0.0138)***
Many competitors in industry	-0.0483	-0.0414	-0.0478	-0.0414	-0.0459
	(0.0129)***	(0.0127)***	(0.0129)***	(0.0128)***	(0.0130)***
Team working	0.0385	0.0374	0.0408	0.0393	0.0391
	(0.0083)***	(0.0083)***	(0.0083)***	(0.0083)***	(0.0083)***
Quality circles	0.0060	0.0027	0.0086	0.0061	0.0069
	(0.0077)	(0.0077)	(0.0077)	(0.0077)	(0.0078)
Briefing groups	-0.0258	-0.0251	-0.0262	-0.0266	-0.0259
	(0.0080)***	(0.0078)***	(0.0081)***	(0.0080)***	(0.0080)***
Information disclosure	0.0164	0.0121	0.0184	0.0141	0.0134
	(0.0125)	(0.0125)	(0.0124)	(0.0124)	(0.0124)
Financial participation	0.0492	0.0532	0.0485	0.0518	0.0471
	(0.0092)***	(0.0091)***	(0.0092)***	(0.0092)***	(0.0092)***
R^2	0.56	0.57	0.56	0.57	0.57
n	17092	17092	17092	17092	17092

Robust standard errors in parentheses.
Notes: OLS estimation. Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Table 4: Determinants of Log Median Annual Wage, Workplace-level Estimation

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Training incidence	0.0426	0.0438				
	(0.0324)	(0.0322)				
Union	0.0333		0.0163		0.0160	
	(0.0442)		(0.0279)		(0.0229)	
Incidence * union	-0.0188					
	(0.0486)					
Single-table barg.		-0.2303		-0.0420		-0.0228
		(0.1382)*		(0.0517)		(0.0406)
Joint barg.		0.0831		0.0419		0.0349
		(0.0716)		(0.0558)		(0.0495)
Single union		0.0307		0.0221		0.0175
		(0.0442)		(0.0293)		(0.0239)
Incidence * Single-table barg.		0.2387				
		(0.1406)*				
Incidence * Joint barg.		-0.0332				
		(0.0896)				
Incidence * Single union		-0.0246				
		(0.0484)				
Training intensity			0.0007	0.0007		
			(0.0003)**	(0.0003)**		
Intensity * union			0.0000			
			(0.0005)			
Intensity * Single-table barg.				0.0009		
				(0.0009)		
Intensity * Joint barg.				0.0003		
				(0.0010)		
Intensity * Single union				-0.0003		
				(0.0005)		
Training duration					0.0073	0.0074
					(0.0042)*	(0.0042)*
Duration * union					0.0029	
					(0.0068)	
Duration * Single-table barg.						0.0207
						(0.0123)*
Duration * Joint barg.						0.0154
						(0.0225)
Duration * Single union						-0.0033
						(0.0066)
Establishment age	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
U.K.-owned	-0.0922	-0.0944	-0.0923	-0.0951	-0.0903	-0.0936
	(0.0265)***	(0.0257)***	(0.0255)***	(0.0243)***	(0.0255)***	(0.0241)***
Single establishment firm	-0.0171	-0.0154	-0.0158	-0.0140	-0.0195	-0.0178
	(0.0254)	(0.0252)	(0.0254)	(0.0253)	(0.0254)	(0.0253)
% female workers	-0.3861	-0.3916	-0.3864	-0.3962	-0.3866	-0.3966
	(0.0525)***	(0.0530)***	(0.0520)***	(0.0529)***	(0.0521)***	(0.0528)***
% part-time workers at	-0.0928	-0.0882	-0.0954	-0.0879	-0.1028	-0.0947

workplace						
	(0.0626)	(0.0630)	(0.0605)	(0.0611)	(0.0604)*	(0.0610)
% manual workers at workplace	-0.2288	-0.2312	-0.2231	-0.2261	-0.2219	-0.2231
	(0.0292)***	(0.0293)***	(0.0286)***	(0.0282)***	(0.0286)***	(0.0281)***
Establishment employs shift workers	-0.0507	-0.0491	-0.0518	-0.0515	-0.0525	-0.0518
	(0.0210)**	(0.0210)**	(0.0207)**	(0.0206)**	(0.0205)**	(0.0204)**
Capital-labor ratio 0-25%	-0.0478	-0.0497	-0.0512	-0.0525	-0.0465	-0.0454
	(0.0294)	(0.0289)*	(0.0294)*	(0.0286)*	(0.0289)	(0.0279)
Capital-labor ratio 26-50%	-0.0591	-0.0615	-0.0632	-0.0656	-0.0611	-0.0626
	(0.0279)**	(0.0275)**	(0.0278)**	(0.0273)**	(0.0274)**	(0.0266)**
Capital-labor ratio 51-75%	-0.0189	-0.0233	-0.0183	-0.0247	-0.0170	-0.0195
	(0.0366)	(0.0347)	(0.0365)	(0.0349)	(0.0360)	(0.0338)
Log (employment size)	0.0257	0.0239	0.0262	0.0260	0.0277	0.0268
	(0.0098)***	(0.0099)**	(0.0095)***	(0.0093)***	(0.0095)***	(0.0091)***
Organization size >100,000	-0.1339	-0.1413	-0.1348	-0.1442	-0.1334	-0.1409
	(0.0360)***	(0.0367)***	(0.0363)***	(0.0372)***	(0.0360)***	(0.0362)***
Organization size 50,000-99,999	-0.0679	-0.0677	-0.0648	-0.0627	-0.0672	-0.0643
	(0.0234)***	(0.0235)***	(0.0230)***	(0.0230)***	(0.0232)***	(0.0230)***
Few competitors in industry	-0.0523	-0.0486	-0.0517	-0.0503	-0.0483	-0.0444
	(0.0350)	(0.0355)	(0.0350)	(0.0353)	(0.0350)	(0.0356)
Many competitors in industry	-0.0309	-0.0272	-0.0278	-0.0244	-0.0284	-0.0226
	(0.0304)	(0.0308)	(0.0306)	(0.0309)	(0.0307)	(0.0312)
Team working	0.0290	0.0308	0.0227	0.0253	0.0269	0.0277
	(0.0207)	(0.0209)	(0.0203)	(0.0204)	(0.0205)	(0.0206)
Quality circles	-0.0069	-0.0076	-0.0126	-0.0126	-0.0106	-0.0119
	(0.0184)	(0.0185)	(0.0188)	(0.0188)	(0.0185)	(0.0186)
Briefing groups	0.0206	0.0214	0.0190	0.0169	0.0202	0.0190
	(0.0191)	(0.0189)	(0.0189)	(0.0188)	(0.0190)	(0.0188)
Information disclosure	0.0029	0.0036	0.0048	0.0062	0.0082	0.0081
	(0.0249)	(0.0248)	(0.0244)	(0.0244)	(0.0244)	(0.0244)
Financial participation	0.0676	0.0698	0.0652	0.0645	0.0661	0.0665
	(0.0273)**	(0.0272)**	(0.0274)**	(0.0272)**	(0.0274)**	(0.0272)**
n	1100	1100	1100	1100	1100	1100
R^2	0.47	0.47	0.47	0.47	0.47	0.48

Robust standard errors in parentheses.
Notes: OLS estimation. Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Table 5: Determinants of Labor Productivity with Full Interactions

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted training	0.9935	0.9315	0.0169	0.0154	0.2737	0.2545
	(0.2569)***	(0.2008)***	(0.0047)***	(0.0046)***	(0.0695)***	(0.0681)***
Union	-0.3220		-0.3325		-0.1849	
	(0.2043)		(0.1766)*		(0.1252)	
Pred. training * Union	0.0590		0.0035		0.0884	
	(0.1385)		(0.0041)		(0.0634)	
Single-table barg.		-1.0266		-0.9707		-0.2946
		(0.5273)*		(0.4290)**		(0.2635)
Joint barg.		-0.4318		-0.3779		-0.2049
		(0.2845)		(0.2922)		(0.1935)
Single union		-0.3153		-0.2788		-0.1946
		(0.1958)		(0.2037)		(0.1453)
Pred. training * Single-table barg.		-0.0312		0.0107		0.0579
		(0.1870)		(0.0082)		(0.1270)
Pred. training * Joint barg.		0.1869		0.0045		0.1254
		(0.1538)		(0.0069)		(0.0992)
Pred. training * Single union		0.1865		0.0046		0.1209
		(0.1444)		(0.0049)		(0.0780)
Establishment age	0.0019	0.0022	0.0015	0.0018	0.0009	0.0010
	(0.0013)	(0.0010)**	(0.0010)	(0.0010)*	(0.0010)	(0.0010)
% female workers	0.6775	0.6259	0.7713	0.7191	0.6777	0.6654
	(0.2776)**	(0.2309)***	(0.2251)***	(0.2278)***	(0.2288)***	(0.2306)***
% part-time workers at workplace	0.7630	0.6705	-0.3819	-0.4177	-0.3521	-0.3773
	(0.4877)	(0.3944)*	(0.2597)	(0.2608)	(0.2549)	(0.2575)
U.K.-owned	0.0701	0.0005	0.0593	0.0190	0.1498	0.1273
	(0.1408)	(0.1095)	(0.1073)	(0.1090)	(0.1082)	(0.1096)
Single establishment firm	0.4220	0.4073	0.3556	0.3439	0.2708	0.2635
	(0.1527)***	(0.1334)***	(0.1321)***	(0.1324)***	(0.1249)**	(0.1252)**
% manual workers at workplace	0.8405	0.7739	0.4474	0.4109	0.6214	0.5922
	(0.2620)***	(0.1866)***	(0.1494)***	(0.1493)***	(0.1644)***	(0.1655)***
Establishment employs shift workers	-0.1042	-0.0929	-0.0515	-0.0480	-0.1110	-0.1094
	(0.1195)	(0.0998)	(0.0986)	(0.0987)	(0.1007)	(0.1009)
Capital-labor ratio 0-25%	-0.0726	-0.0973	0.0622	0.0500	0.1445	0.1334
	(0.1816)	(0.1505)	(0.1417)	(0.1424)	(0.1368)	(0.1373)
Capital-labor ratio 26-50%	0.0364	0.0259	-0.1013	-0.0997	-0.1025	-0.1038
	(0.1675)	(0.1324)	(0.1344)	(0.1349)	(0.1338)	(0.1344)
Capital-labor ratio 51-75%	-0.4484	-0.4477	-0.1168	-0.1250	-0.1433	-0.1487
	(0.1980)**	(0.1616)***	(0.1366)	(0.1386)	(0.1373)	(0.1391)
Log (employment size)	-0.2547	-0.2236	-0.0538	-0.0335	-0.0166	-0.0053

	(1)	(2)	(3)	(4)	(5)	(6)
	(0.0806)***	(0.0569)***	(0.0348)	(0.0363)	(0.0340)	(0.0355)
Organization size >100,000	0.2129	0.1931	0.3194	0.3026	0.3702	0.3643
	(0.1840)	(0.1567)	(0.1508)**	(0.1528)**	(0.1507)**	(0.1525)**
Organization size 50,000-99,999	-0.0737	-0.0400	0.2277	0.2455	0.1309	0.1347
	(0.1477)	(0.1183)	(0.1104)**	(0.1111)**	(0.1099)	(0.1103)
Few competitors in industry	-0.2500	-0.2512	-0.1763	-0.1812	-0.0492	-0.0412
	(0.1741)	(0.1310)*	(0.1265)	(0.1283)	(0.1263)	(0.1280)
Many competitors in industry	-0.1168	-0.1370	-0.1092	-0.1220	-0.0970	-0.0934
	(0.1527)	(0.1170)	(0.1150)	(0.1168)	(0.1151)	(0.1167)
Team working	-0.0992	-0.0822	-0.0684	-0.0491	-0.0242	-0.0154
	(0.1247)	(0.1042)	(0.1075)	(0.1067)	(0.0995)	(0.0998)
Quality circles	-0.0247	0.0074	0.0052	0.0317	0.0063	0.0189
	(0.1165)	(0.0993)	(0.1014)	(0.1012)	(0.0991)	(0.0998)
Briefing groups	0.0306	0.0350	0.0168	0.0070	0.0580	0.0473
	(0.1018)	(0.0843)	(0.0836)	(0.0838)	(0.0841)	(0.0843)
Information disclosure	-0.6389	-0.6093	-0.2812	-0.2631	-0.2434	-0.2377
	(0.2023)***	(0.1599)***	(0.1269)**	(0.1264)**	(0.1220)**	(0.1221)*
Financial participation	0.0657	0.0570	0.3137	0.2941	0.2697	0.2638
	(0.1638)	(0.1310)	(0.1114)***	(0.1118)***	(0.1130)**	(0.1128)**
n	1100	1100	1100	1100	1100	1100

Robust standard errors in parentheses.

Notes: Probit estimation. Predicted training is based on training incidence (columns (1) and (2)); training intensity (columns (3) and (4)); and training duration (columns (5) and (6)). Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Table 6: Determinants of Financial Performance with Full Interactions

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted training	1.0439	0.9548	0.0182	0.0156	0.3370	0.3014
	(0.2653)***	(0.2048)***	(0.0048)***	(0.0048)***	(0.0709)***	(0.0697)***
Union	-0.0441		-0.1130		0.0535	
	(0.1979)		(0.1773)		(0.1261)	
Pred. training * Union	-0.0922		0.0000		-0.0367	
	(0.1360)		(0.0042)		(0.0646)	
Single-table barg.		-0.6672		-1.5644		-0.4822
		(0.5451)		(0.4687)***		(0.2739)*
Joint barg.		0.0319		0.1630		0.3401
		(0.3007)		(0.3041)		(0.2003)*
Single union		-0.0267		-0.0303		0.0373
		(0.1926)		(0.2032)		(0.1442)
Pred. training * Single-table barg.		-0.2106		0.0217		0.1316
		(0.1949)		(0.0092)**		(0.1336)
Pred. training * Joint barg.		0.0957		-0.0005		-0.0463
		(0.1746)		(0.0074)		(0.1079)
Pred. training * Single union		-0.0275		-0.0006		-0.0257
		(0.1446)		(0.0050)		(0.0777)
Establishment age	-0.0013	-0.0010	-0.0018	-0.0015	-0.0024	-0.0023
	(0.0013)	(0.0010)	(0.0010)*	(0.0010)	(0.0010)**	(0.0010)**
U.K.-owned	0.2029	0.1225	0.1916	0.1293	0.2804	0.2369
	(0.1390)	(0.1137)	(0.1112)*	(0.1134)	(0.1122)**	(0.1140)**
Single establishment firm	0.3453	0.3325	0.2676	0.2530	0.2023	0.1995
	(0.1577)**	(0.1363)**	(0.1353)**	(0.1355)*	(0.1279)	(0.1282)
% female workers	0.5699	0.4943	0.6823	0.5792	0.5520	0.4928
	(0.2749)**	(0.2442)**	(0.2389)***	(0.2414)**	(0.2428)**	(0.2444)**
% part-time workers at workplace	0.9049	0.7964	-0.2407	-0.2579	-0.1499	-0.1574
	(0.4870)*	(0.4081)*	(0.2716)	(0.2731)	(0.2669)	(0.2696)
% manual workers at workplace	0.7420	0.6278	0.3680	0.2961	0.5621	0.4939
	(0.2758)***	(0.1926)***	(0.1540)**	(0.1546)*	(0.1694)***	(0.1711)***
Establishment employs shift workers	-0.2477	-0.2243	-0.1944	-0.1832	-0.2602	-0.2457
	(0.1171)**	(0.1032)**	(0.1017)*	(0.1021)*	(0.1042)**	(0.1047)**
Capital-labor ratio 0-25%	-0.0537	-0.0798	0.0831	0.0663	0.1581	0.1473
	(0.1884)	(0.1559)	(0.1472)	(0.1484)	(0.1425)	(0.1433)
Capital-labor ratio 26-50%	0.1717	0.1496	0.0380	0.0418	0.0347	0.0381
	(0.1785)	(0.1391)	(0.1402)	(0.1412)	(0.1399)	(0.1406)
Capital-labor ratio 51-75%	-0.2158	-0.2354	0.1129	0.0703	0.0801	0.0533
	(0.1980)	(0.1682)	(0.1448)	(0.1471)	(0.1457)	(0.1475)
Log (employment size)	-0.1287	-0.0988	0.0604	0.0770	0.0994	0.1009

	(1)	(2)	(3)	(4)	(5)	(6)
	(0.0839)	(0.0582)*	(0.0363)*	(0.0379)**	(0.0358)***	(0.0374)***
Organization size >100,000	0.3076	0.2660	0.4097	0.3377	0.4699	0.4068
	(0.1765)*	(0.1660)	(0.1597)**	(0.1622)**	(0.1598)***	(0.1616)**
Organization size 50,000-99,999	-0.3152	-0.2758	-0.0305	-0.0029	-0.1204	-0.1072
	(0.1542)**	(0.1221)**	(0.1132)	(0.1142)	(0.1131)	(0.1137)
Few competitors in industry	-0.3678	-0.3361	-0.2891	-0.2781	-0.1643	-0.1449
	(0.1607)**	(0.1406)**	(0.1361)**	(0.1378)**	(0.1362)	(0.1379)
Many competitors in industry	-0.2931	-0.2873	-0.2787	-0.2807	-0.2707	-0.2587
	(0.1466)**	(0.1265)**	(0.1241)**	(0.1260)**	(0.1243)**	(0.1258)**
Team working	-0.2731	-0.2333	-0.2427	-0.1949	-0.2087	-0.1699
	(0.1237)**	(0.1076)**	(0.1109)**	(0.1102)*	(0.1027)**	(0.1030)*
Quality circles	-0.3087	-0.2725	-0.2815	-0.2364	-0.2909	-0.2634
	(0.1161)***	(0.1035)***	(0.1056)***	(0.1056)**	(0.1033)***	(0.1042)**
Briefing groups	-0.0948	-0.0890	-0.1105	-0.1209	-0.0593	-0.0671
	(0.1016)	(0.0875)	(0.0868)	(0.0872)	(0.0875)	(0.0876)
Information disclosure	-0.5428	-0.4989	-0.1810	-0.1561	-0.1487	-0.1378
	(0.2015)***	(0.1631)***	(0.1293)	(0.1289)	(0.1246)	(0.1247)
Financial participation	0.1440	0.1622	0.3925	0.3803	0.3449	0.3546
	(0.1623)	(0.1373)	(0.1170)***	(0.1181)***	(0.1190)***	(0.1192)***
n	1069	1069	1069	1069	1069	1069

Robust standard errors in parentheses.

Notes: Probit estimation. Predicted training is based on training incidence (columns (1) and (2)); training intensity (columns (3) and (4)); and training duration (columns (5) and (6)). Constant term and 8 industry-sector dummies included. *, **, *** denote significance at 0.10, 0.05, and 0.01 levels, respectively.

Appendix Table 1: Selected Production Function Estimates of the Effect of Training on Productivity

Study	Data	Methodology	Training Measure	Other Controls	Findings
1. Black and Lynch (1996)	Educational Quality of the Workforce (EQW) National Employers Survey firm data for 1993 (n=1,346).	Cobb-Douglas framework. Dependent variables is log sales.	Total number of workers trained in 1993; the percentage of formal training off-the-job; and dummy variables for 3 training activities (computer, teamwork, and supervisor training).	Multiple establishment enterprise; age distribution of capital stock; labor quality; tenure structure of workforce; use of TQM or benchmarking; exporter; capacity utilization; union status; R&D; grades or communication skills important in recruitment.	Numbers of workers trained currently or in 1990 has no effect on productivity in 1993. For manufacturing, the greater the proportion of time spent in formal off-the-job training, the greater productivity. For non-manufacturing, content of training is more important, especially computer training. TQM and benchmarking statistically insignificant throughout, but union effect positive in non-manufacturing.
2. Barrett and O'Connell (2001)	Firm-level data for 1993 and 1997 (n=215)	Cobb-Douglas production function framework. Changes in sales per unit of reported labor, 1993-97, regressed on changes in labor, investment, training investments in 1993.	Employer-provided specific and general training. Three measure: trainees/total employment; training days/total employment; training expenditure/payroll.	Corporate restructuring; personnel and organizational policies; seven industry dummies; large firm dummy.	Training incidence and training intensity but not training expenditure are positively related to labor productivity. General training but not specific training positively associated with labor productivity Corporate and personnel innovations are unrelated to productivity.
3. Holzer, Block, Cheatham and Knott (1993)	1990 survey of firms that applied for a training grant under the MJOB program, 1988-89 (n=395).	Training and output regressions, where the dependent variables are first differences. Output proxied by scrap rate.	Annual hours of training per employee.	Grant receipt; log of sales, employment, and wages; union membership; worker participation; incentive pay; grievance procedures; training purpose.	Training grants increase training in year of receipt. Positive effects of grants and training and changes in training on the output measure. But results highly sensitive to addition of controls.
4. Bartel (1984)	495 (manufacturing Compustat II business lines in 1986, matched to Census of Manufacturers data.	Cobb-Douglas framework. Dependent variables: log labor productivity in 1986 and percent change in labor productivity 1983-96.	Training index based on the presence of training programs for each of seven employee groups, plus percentage of employee groups that had a training program implemented after 1983 for first difference estimate.	Age of business; percent unionized; personnel policies (formal job design, formal performance appraisal, employee involvement/ quality circles); two-digit industry dummies.	Formal training is insignificant in levels equation, and is unaffected by inclusion of human resource policies. But new training is pro-productive in the first difference estimate. This is not the case for new human resource policies. Union coefficient estimate is no longer statistically significant. Indication that businesses operating below their expected productivity levels in 1983 implemented these new training programs.
5. Zwick (2002)	IAB Establishment Panel. Cross sections for 1998 and 1999 and longitudinal data	Cobb-Douglas production function approach. Cross section estimates of effect of training in 1997 on labor productivity levels in	Training incidence (share of firms offering training); training intensity (number of trainees divided by	Share of qualified employees; exporter; works council; state of the art technical equipment; investment in information	In cross section, (lagged) effects of training intensity – actual and predicted – are positively associated with labor productivity. Formal external training courses positive and statistically significant throughout. Negative

Study	Data	Method	Training measure	Other variables	Results
	for 1997-1999.	1998 and 1999. Instru-mental variables to model selection into training and training intensity. Fixed effects panel estimation using Black and Lynch (2001) two-step procedure with and without selectivity correction.	number of employees; and training type (formal external courses, formal internal courses, training on the job, seminars and talks, job rotation, self-induced learning, and quality circles).	technology; legal form of firm; employee participation; teamwork; units with own costs and results accounting; stringent hiring rules/incentive payments.	effect of training on-the-job. Selection term is negative. Panel estimates indicate that training intensity, formal external and internal courses, and self-induced learning have a positive and significant effect on productivity. Allowing for selection increases the training intensity coefficient estimate and those of formal training courses.
6. Black and Lynch (2001)	EQW National Employers Survey data matched to longitudinal Research Database, 1987-93 (n=638)	Cobb-Douglas approach. Dependent variable: sales per production worker. Cross-section estimation for 1993. Panel analysis for 1988-93 involves a two-step procedure using both the within estimator and a GMM estimator for the production function to generate in a first step the firm-specific time-invariant residual. In a second step this residual is regressed on the training measure and other workplace practices.	Log number of employees trained.	Workplace practices are the main focus of the study. They include TQM, benchmarking, number of managerial tiers, employees per supervisor, proportion of workers in self-manager teams. Training viewed as one such high-performance work system. Other arguments: technology (e.g. capital vintage); worker characteristics; employee voice (incl. union); profit sharing; and recruitment strategies.	Training measure statistically insignificant in cross section and panel estimation. Unionization insignificant other than in combination with TQM. Mixed effects of high performance work systems, other than benchmarking. Pro-productive voice restricted to workers meeting regularly in groups.
7. Dearden, Reed, and Van Reenen (2000)	Panel of 94 British Industries, 1985-96. Labor Force Survey (LFS) data aggregated by three-digit industry. Annual Census of Production data for capital, labor, and output. Main analysis focuses on production sector.	Panel estimates of Cobb-Douglas production function using GMM techniques. Subsidiary wage regression analysis.	Training data from LFS: the proportion of workers un an industry who received training in a given 4-week period. Flow data connected into a training stock in some estimations. Also a distinction divider between off-the-job and on-the-job training.	Hours worked: labor turnover; gender; proxies for human capital (education, occupation, age, and tenure); R&D intensity; proportion of small firms; and regional composition.	In simple OLS regressions the large positive impact of training on productivity falls dramatically with controls added. Fixed effects estimation yields highly significant (and increased) point estimates of training effect (incl. logged training). GMM results for manufacturing with exogenous training are similar to fixed effects results. With allowance for endogeneity, training effect increases markedly and remains higher in dynamic specifications. Results by type of training suggest off-the-job training has bigger productivity effect. Stock measure yields more precise point estimates. Training effect on productivity greater their effects on wages.

Appendix Table 2: Descriptive Statistics for Matched Employee-Employer Sample

	Mean	*SD*
Log hourly pay	1.841	0.534
During the last 12 months, how much training have you had, either paid for or organized by your employer?		
Training incidence (1=any, 0=none)	0.509	0.500
Training duration (days of training)	2.863	4.321
Training (<1 day)	0.094	0.291
Training (1-2 days)	0.131	0.337
Training (2-4 days)	0.191	0.393
Training (5-9 days)	0.090	0.286
Training (>10 days)	0.085	0.279
Union recognition	0.508	0.500
Multiple unions, single-table bargaining	0.175	0.380
Multiple unions, joint bargaining	0.098	0.297
Single union	0.235	0.424
Female	0.417	0.493
Tenure	79.100	66.468
Tenure^2	10674.600	13291.700
Single status	0.250	0.433
Minority ethnicity	0.042	0.201
Education level: GCSE	0.400	0.490
Education level: A-level	0.161	0.368
Education level: BA	0.196	0.397
Children as dependents (1=any, 0=none)	0.381	0.486
Disabled	0.053	0.224
Age: <20 years	0.088	0.283
Age: 20-24 years	0.143	0.350
Age: 25-29 years	0.280	0.449
Age: 30-39 years	0.233	0.423
Age: 40-49 years	0.202	0.401
Occupation: Manager/Senior Administrator	0.124	0.330
Occupation: Professional	0.107	0.309
Occupation: Technical/Associate Professional	0.083	0.276
Occupation: Clerical/Secretarial	0.197	0.398
Occupation: Craft/Skilled Service	0.109	0.311

Occupation: Personal/Protective Services	0.028	0.164
Occupation: Sales	0.112	0.315
Occupation: Operative/Assembly	0.126	0.332
Establishment age	29.509	37.038
U.K.-owned	0.713	0.452
Single establishment firm	0.183	0.387
% female workers	0.404	0.265
% part-time workers at workplace	0.186	0.260
% manual workers at workplace	0.268	0.319
Establishment employs shift workers	0.462	0.499
Capital-labor ratio 0-25%	0.306	0.461
Capital-labor ratio 26-50%	0.302	0.459
Capital-labor ratio 51-75%	0.208	0.406
Log (employment size)	4.813	1.181
Organization size >100,000	0.134	0.340
Organization size 50,000-99,999	0.392	0.488
Few competitors in industry	0.262	0.440
Many competitors in industry	0.473	0.499
Team working	0.662	0.473
Quality circles	0.493	0.500
Briefing groups	0.509	0.500
Information disclosure	0.856	0.351
Financial participation	0.306	0.461
n	*17092*	

Appendix Table 3: Descriptive Statistics for Workplace-Level Sample

	Mean	SD
Financial performance ('better than average'=1, 0 otherwise)	0.59	0.49
Labor productivity ('better than average'=1, 0 otherwise)	0.51	0.50
Log annual median wage	9.50	0.32
What proportion of experienced employees have had formal off-the-job training over the past 12 months?		
Training incidence (>0%=1, 0%=1)	0.82	0.38
Training intensity (100%)	0.09	0.29
Training intensity (80-99%)	0.23	0.42
Training intensity (60-79%)	0.30	0.46
Training intensity (40-59%)	0.11	0.31
Training intensity (20-39%)	0.08	0.26
Training intensity (1-19%)	0.05	0.22
Training duration (proportion trained * number of days)	41.85	36.71
Union recognition	0.42	0.49
Multiple unions, single table bargaining	0.11	0.31
Multiple unions, joint bargaining	0.09	0.29
Single union	0.23	0.42
Establishment age	28.31	40.92
U.K.-owned	0.77	0.42
Single establishment firm	0.21	0.41
% female workers at workplace	0.42	0.27
% part-time workers at workplace	0.25	0.30
% manual workers at workplace	0.31	0.33
Establishment employs shift workers	0.46	0.50
Capital-labor ratio 0-25%	0.33	0.47
Capital-labor ratio 26-50%	0.33	0.47
Capital-labor ratio 51-75%	0.19	0.39
Log (employment size)	4.65	1.25
Organization size >100,000	0.16	0.37
Organization size 50,000-99,999	0.33	0.47
Few competitors in industry	0.26	0.44
Many competitors in industry	0.55	0.50
Team working	0.62	0.48
Quality circles	0.46	0.50
Briefing groups	0.50	0.50
Information disclosure	0.38	0.49
Financial participation	0.02	0.13
Experience required to do job >1 month	0.71	0.46
Job security guarantees	0.27	0.44
Targets set for training	0.40	0.49
n	*1100*	