

IZA DP No. 2276

Employee Training, Wage Dispersion and Equality in Britain

Filipe Almeida-Santos
Karen Mumford

August 2006

Employee Training, Wage Dispersion and Equality in Britain

Filipe Almeida-Santos

*University of York
and Universidade Católica Portuguesa*

Karen Mumford

*University of York
and IZA Bonn*

Discussion Paper No. 2276
August 2006

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
Email: iza@iza.org

Any opinions expressed here are those of the author(s) and not those of the institute. Research disseminated by IZA may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit company supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its research networks, research support, and visitors and doctoral programs. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ABSTRACT

Employee Training, Wage Dispersion and Equality in Britain^{*}

We use British household panel data to explore the wage returns to training incidence and intensity (duration) for 6924 employees. We find these returns differ greatly depending on the nature of the training (general or specific); who funds the training (employee or employer); and the skill levels of the recipient (white or blue collar). Using decomposition analysis, we further conclude that training is positively associated with wage dispersion in Britain and a virtuous circle of wage gains but only for white-collar employees.

JEL Classification: J24, J31, J41

Keywords: training, wage compression, performance

Corresponding author:

Karen Mumford
Department of Economics and Related Studies
University of York
York YO10 5DD
United Kingdom
E-mail: kam9@york.ac.uk

^{*} Almeida-Santos is grateful for funding from the Fundacao para a Ciencia e Tecnologia - Ministerio da Ciencia e Tecnologia (Portugal)

Training is a key factor in the economic performance of all countries. It is a major tool for increasing productivity and living standards (Ok and Tergeist, 2002). Concentrating training amongst workers who perform complex tasks and have high levels of formal education may create a virtuous circle for these high skill workers resulting in higher wages, further training opportunities, longer tenure and greater social status (Gershuny, 2005). In contrast, workers who are disadvantaged in the education process may be less likely to receive training, inducing a vicious circle for these low skill workers; further increasing their risk of unemployment and social exclusion (Keep et al, 2002). Simply ensuring equity of training opportunity may not, however, be sufficient to assure a reduction in wage inequality among workers if individuals with different characteristics obtain different benefits from the same training scheme. The British Government is increasingly concerned with the potentially contradictory implications of training policy for equity and efficiency, namely, redirecting training investment towards groups that receive less training or towards groups of workers where expected returns are larger (Department of Trade and Industry, 2005).

Economists have tended to concentrate on the efficiency issues. In the seminal Becker (1962 and 1964) competitive model, employees support the costs of their general training by accepting a wage below their potential current marginal product during the training period. They then reap the full return from their investments through higher wages after the training period, even if there is job turnover. The training level reached corresponds to the socially optimal condition, although underinvestment in general training may occur if workers face wage inflexibility or are liquidity constrained. Employees are predicted to invest wisely according to their own expected rates of return. Firms will not finance this general type of training with its probable negative poaching externalities.

Recent non-competitive models emphasise how market frictions may transform general training into de-facto specific training if the wage level is lower than marginal product in the post-training product (Stevens, 1994; Acemoglu and Pischke, 1998, 1999a, and

1999b). In such an environment, firms have an incentive to finance general training and to distribute these training opportunities amongst employees, thereby introducing issues of allocation. Furthermore, since the wage level is below marginal product and there is uncertainty concerning labour turnover, a negative poaching externality may occur, leading the firm to under invest and the equilibrium training level to be below the socially optimum level.

This paper concentrates on the relationship between training and wages. Our results may be seen as a further empirical investigation of the determinants of training (for both the firm and employee) and the potential returns from this training which helps to fill a gap in a still unresolved area of research (Pischke, 2001: 543, Leuven, 2002: 34). We seek to address three fundamental questions. Do different types of training have similar impacts on both wage levels and wage dispersion? Is general training a key tool for reversing wage inequality between high skill and low skill workers? And finally, in line with the recent imperfect competition models, is there a contribution from employer financed training to wage inequality in Britain?

In the process of seeking answers to these questions, it is important to estimate the individual employee's rates of wage return to training. Relevant empirical studies are not easy to locate; Frazis and Loewenstein (2005) recently conclude "we are aware of few studies that attempt to estimate rates of return to training". Often due to data constraints, most of the relevant studies that do exist estimate average returns for all training recipients, ignoring that the provision and returns to training across employees may differ according to gender, age, education level, occupation and sector of employment. Using longitudinal data on households and individuals (the British Household Panel Survey, BHPS), we can address many of these issues.

1. Modeling Wage Returns

The relationship between investment in training and wages has been explored decisively by Becker (1962 and 1964), Ben Porath (1967) and, of course, Mincer (1958, 1962, 1970 and 1974) with the development of the well known Mincer wage regression.

In subsequent years, authors have increased the number of explanatory variables included in the regression: initially with the introduction of tenure, as a proxy for specific training investment, and later with the addition of variables capturing individual, job and firm characteristics (for a recent review see Chiswick 2003). In this augmented framework, training may be considered as inherently heterogeneous and it is legitimate to expect the size of the wage returns to differ according to the nature and the type of the training program (Leuven, 2004: 19). Several limitations have been identified in this research area associated with methodological questions; with database quality; and with the mixed continuous-discrete nature of training variables. We will return to discuss some of these issues below.

Following in the tradition of the literature on training (see Melero, 2004; Booth and Bryan, 2006; and in particular Lowenstein and Spletzer, 1998), we estimate the wage return from different types of training using the following Mincer type wage regression:

$$\ln W_{ijt} = X_{ijt} \beta + Y_t \delta + T_{it} \alpha + \mu_i + \nu_{ij} + \varepsilon_{ijt} \quad (1)$$

Where $\ln W_{ijt}$ is the natural logarithm of the real (1998 prices) hourly wage of individual i in job j at time t ; X_{ijt} is a vector of individual, job and workplace characteristics; T_{ij} represents different measures of training accumulated by the worker and Y_t is a vector of year-specific dummy variables. Unobserved characteristics are decomposed into an individual fixed effect μ_i , an unobserved job match specific component ν_{ij} and a transitory shock ε_{ijt} . The individual effect μ_i is considered as an omitted measure of time invariant characteristics such as ability, motivation, and ambition or career commitment. The unobserved components (μ_i and ν_{ij}) become a problem for the consistency of estimates if they are in some way correlated with the regressors. Following Lowenstein and Spletzer (1998), we address this problem by estimating the model with fixed effects and approximating ν_{ij} with a binary variable accounting for employer change.

2. The Data

We use data from the British Household Panel Survey (BHPS) which is a nationally representative sample of private British households. The BHPS was launched in 1991. Each year, individual adult members of households are interviewed over a broad range of socioeconomic topics resulting in a rich and relevant data set. In 1992 and 1993 respondents were also asked for lifetime employment status and job histories which we also include in the analyses below.

The BHPS questionnaire was extended in (and continuously from) wave 8, conducted in 1998, to include information on the type, and the duration, of the three most recent training courses attended since September of the previous year; how these courses were financed; and where they took place.

Our sample is an unbalanced panel of employed and self-employed individuals in Britain, in the 18 to 65 age bracket (that are original, temporary or permanent BHPS sample members). We exclude those individuals working in Agriculture, Fishing Service, Mining and Quarrying sectors and those missing relevant training information. Our final sample contains 20,538 training observations over four years (1998 to 2001), from 6,924 individuals, a little over half of whom are men (52%). Information from previous waves of the BHPS is also included for these individuals. In total, we use BHPS data collected between 1991 and 2001, inclusively.

Concise variable definitions and summary statistics are presented in Table 1. Means and standard deviations are presented in columns one and two for the full sample, and in columns three and four for those workers trained. Columns 5 to 8 (and columns 9 to 12) present analogous information for white collar (and blue collar) employees. We define the white-collar group of employees to be the: managerial, professional, associate professional and technical occupations. The blue-collar group consists of: clerical and secretarial, personal service, sales, craft and related, plant and machine operatives, and other semi-skilled and unskilled occupations.

2.1 *Training Measures*

The BHPS questionnaire asks individuals to choose one of the following five non-mutually exclusive options about "... the training schemes or courses [they] have been on since September ..." of the previous year:

- 1 - Was this training to help you get started in your current job?
- 2 - To increase your skills in your current job?
- 3 - To improve your skills in your current job?
- 4 - To prepare you for a job or jobs you might do in the future?
- 5 - To develop your skills generally?

Based on the answers to this question, we define three different categories of training for the construction of our dichotomous and continuous variables related to the incidence and intensity (duration) of training respectively. The first is the widest category including any of the five options and is defined simply as *training*. It consists of either specific and/or general training components, and is expected to improve the worker's skills either in their current job or in any other job.

We define the second category as *general training*. In this category, the interviewees have chosen the fourth and/or fifth options, and recognize that the training events include general components and may improve post training skills outside the actual job or workplace.

To construct our third category we include additional information concerning four non-mutually exclusive options for the financing of training. We define this third category as *employer-financed general training*, or simply *financed general training*, and construct a binary indicator variable that allows us to identify if the general training event (option 4 and/or 5 above) was also financed by the employer. This variable is set equal to one if trained workers recognize that fees were paid by the employer or if they respond that there were "no fees". As Booth and Bryan (2006; footnote 3) highlight, individuals may

reveal a certain economic naivety if they respond that nobody has covered direct or indirect training costs. In our sample, for more than 72% of courses attended in the employer workplace or in the employer training centre, the workers involved reported no fees.

The proportion of employees responding that they had received training in Britain was 32% during the period from 1998 to 2001 inclusively (column 1, panel 1 of Table 1). On average, and in contrast with the results obtained using British workplace data (Almeida-Santos and Mumford, 2005)¹, women have a higher rate of participation than do men (34% and 29% respectively). A similar training incidence (31%) has been found by Booth and Bryan (2005) using the BHPS database over a shorter time period (1998-2000).

Amongst the specific group of trained individuals, 91% of the courses attended include components that improved their general skills; however, only 74% of courses increased their general skills and were additionally financed by the employers. On average, trained workers participated in 2.1 training courses over the four years.

The average intensity (or duration) of the set of three training events attended per year was approximately 26.7 days. Not surprisingly, general training courses and financed general training events both tend to be of shorter duration. Women experience not only a higher training incidence but also a higher intensity. On average, women have 6 more days of training per year relative to their male counterparts.

2.2 Individual and Job Characteristics

Amongst the group of variables quantifying individual and demographic characteristics, are several measures of the individual's aptitude and opportunities which may be related to wages and training outcomes, such as: labour market work experience; highest formal

¹ Findings for other countries can be found in Almeida-Santos and Mumford (2004), Bassini and Brunello (2003), and Brunello (2001).

education level achieved; the possession of a vocational qualification; current job tenure; gender; and race.

Rather than using a proxy for potential lifetime work experience (such as the commonly used age minus years of schooling), we construct a continuous variable for the years of actual labor market work experience using the individual's employment history since first leaving full-time education (via combining information available in wave 2 (1992) and the subsequent waves of the BHPS).² We find that, in 71% of the cases, workers have more than 20 years of work experience and in only 5% of the cases do they have less than three years of work experience. In our sample, men typically have more work experience than women despite them being, on average, approximately the same age.

Table 1 also reveals that trained workers have more years of formal education and less years of tenure in their current job. Employees have on average 5 years of tenure in their current job. This value is not out of line with estimates of current job tenure in Britain found in other studies (Almeida-Santos and Mumford, 2005; Melero, 2004; Mumford and Smith, 2004). The relationship between current job tenure and training is, however, not clear theoretically. For example, employees with higher current job tenure may have a shorter expected future employment period (before retirement) for the employer to reap the return from training investment. On the other hand, long tenure may represent a higher quality match between firm and employee, and therefore a greater incentive to finance training.

It is important when investigating the relationship between training and wages to consider relationships that may otherwise limit the efficiency and/or consistency of training estimates. First, training accumulated in the current job should be distinctly measurable from training accumulated in previous jobs. This allows testing of the joint hypothesis of no depreciation and that training is transferable across employer. Furthermore, the measures of training incidence and intensity should ideally fully capture the amount of

² We follow Swaffield (2000) and adopt a linear spline instead of the common quadratic form.

training accumulated over the working life because it is the stock of human capital accumulated via training, and not just by the most recent flow, that affects wages.

We have data on the cumulated events of training acquired in the period 1998 to 2001. The stock of human capital accumulated before this period is captured by current job tenure and previous work experience at the beginning of the period. Using cumulated events allows for greater flexibility and reduces potential bias due to errors in self-reported training (Ariga and Brunello, 2006; Frazis and Loewenstein, 2005; and Melero, 2004). We use single time period lagged training measures as instruments, reducing the risk of bias if cumulated training events and wages are simultaneously determined, or if the measure of training is correlated with any omitted variable. We also consider alternative econometric specifications in order to test a range of hypotheses; both for the incidence and the intensity of training (discussed in more detail below).

A further complication when calculating the return to training is related to promotions. It is possible that employees are offered training prior to being promoted and before increasing their job responsibilities; this potential correlation between job-related training receipt and future promotions also needs to be addressed (Melero, 2004: page 14). The descriptive statistics in Table 1 indicate that individuals with longer working hours, current union membership, full time employment status, vocational qualifications, and who were promoted last year are more likely to be trained, especially in the case of women. We return to consider the relationship between training and promotion below.

Amongst the occupational groupings, managers and administrators; professional occupations; and associated professional and technical occupations are more likely to participate in a training program compared to those employed in sales; plant and machines operators; and other occupations. Suggesting that the likelihood to be trained may also increase with the task's complexity and the responsibility required for the job. To further explore this possibility, the sample is into white and blue-collar workers.

It is assumed that high skill workers are allocated to occupations where tasks are more complex and job responsibilities higher. White-collar workers usually enjoy faster wage growth, they are better educated, more able to perform intellectually complex work related tasks (Bishop, 1997) and consequently are predicted to generate a higher rate of return from training. In our sample, blue-collar workers receive fewer training events and have shorter training spells than do their white-collar counterparts (see Table 1).

2.3 Workplace and Market Characteristics

Whilst non-work attributes may have a significant impact on training and productivity, the work environment characteristics beyond the control of employees may also inhibit ability and motivation to perform activities (Clifton, 1997). Several measures are included in the empirical analyses as controls for some of these characteristics such as: region of residence; economic sector; firm type; and firm size. The definitions and summary statistics for these workplace and market characteristics are included in the lower panels (panels 2 and 3) of Table 1.

3. Results

Table 2 reports the instrumental variable estimates of our three training measures from the fixed effect model (FE/IV) for training incidence (upper panel) and intensity (lower panel). Though only the relevant wage returns are reported in Table 2, the independent variables include the individual-level control variables listed in Table 1 and discussed in section 3, such as age, marital status, gender, hours worked, union membership and education, plus the more aggregate level controls such as economic sector, workplace characteristics, and region. A full list of the controls is provided in the endnotes to Table 2 (and Table 3) and all results are available from the authors upon request.

All the results presented in Table 2 (and Table 3) are based upon robust standard errors³. The overall test of the explanatory power of the regressors is clearly significant for all the

³ Serial correlation in the idiosyncratic errors of the linear panel-data model was tested for (Wooldridge, 1995). The null hypothesis is that there is no autocorrelation of first order from the regressions. According

regressions and whilst the goodness of fit measures are not high, they are comparable with those found in other studies of training (see Leuven, 2002). Overall, the parameter estimates are generally well defined and have the expected sign.

Several alternative functional forms were also considered, with training measures entering quadratically; as a logarithm; a cubic root; and incorporating interaction terms. However, neither robust results⁴ nor higher goodness of fit measures were obtained compared to the results reported in Table 2. (These additional results are available from the authors on request).

As discussed above, cumulated training events and wages may be simultaneously determined and/or correlated with omitted variables. The possible endogeneity of cumulated training events is considered via a Hausman test. The hypothesis that the cumulated training variables are exogenous is rejected⁵. The validity of using lagged cumulated training measures as instruments is considered with a Sargan test of over-identifying restrictions for a panel data fixed effects regression via instrumental variables estimated previously. The null hypothesis is not rejected⁶ and the single time period lagged training measures are accepted as valid instruments.

The relationship between training and wages may also vary across types of employees. To consider this possibility more fully, fixed effect wage regressions with instrumental variables are estimated for the full sample of employees (columns 1, 2 and 3 of Table 2) and for two separate worker groups: white-collar (columns 4, 5 and 6) and blue-collar

to the Wald test (1, 2782) and the critical values obtained using STATA9 namely 0.115, 0.120 and 0.118 respectively, the null hypothesis of no first order autocorrelation is not rejected.

⁴ The set of interaction terms considered in the model and found to be statistically insignificant are: training*years of school; training*female; training*tenure; training*tenure2; training*part-time; training*log hours; training*promoted and training*several occupation measures reveal. The inclusion of a quadratic term for training is statistically insignificant (at a level of 15%) and equal to zero.

⁵ Estimates were obtained with a fixed effect 2SLS model. The Hausman test statistics [$\chi^2(45)$] obtained are 227.76 for the widest category of training, 227.58 for general training and finally, 225.45 for financed general training.

⁶ The null hypothesis is that the instrumental variables are uncorrelated with idiosyncratic residuals in equation (1), and therefore they are valid instruments. This test results are 1.635, 2.581 and 0.792 respectively, which are smaller than the 5% critical value in the Chi-square distribution with one degree of freedom (3.84).

(columns 7, 8 and 9). Columns 1, 4 and 7 present the ‘base’ results for training incidence (upper panel) and training intensity (lower panel). Columns 2, 5 and 8 report the estimated wage return to cumulated training events when the promotion measure is included in the base model. In columns 3, 6 and 9 cumulated training measures (with both the current and the previous employer) are also added to the model.

3.1 *Training Incidence*

Beginning with the results for the full sample of employees (Table 2 columns 1, 2 and 3), the incidence of a training course (ignoring the components that the course may include) is associated with an increase of 0.96% in wages (column 1), whilst the wage return to general training is associated with an increase of 1.37% (or 1.32% if the general training course is financed by the employer).

Controlling for unobservable time invariant heterogeneity significantly reduces the training estimates. (The IV estimates from the pooled OLS model for the different cumulated training events are twice as high⁷.) As discussed above, the Hausman test rejects the hypothesis that the two sets of estimates are not significantly different, supporting a greater reliance on the more consistent fixed effect results.

Similar estimates of wage returns from training have been obtained by Lynch (1992a and 1992b) and Veum (1995) using the American National Longitudinal Survey of Youth Cohorts (NLSY); and Schöne (2004) using the Norwegian Survey of Organisations and Employees (NSOE)). Arulampalam *et al* (2006), using the European Community Household Panel Series (ECHP), conclude that “Britain, Denmark and Finland – are also amongst the countries with the lowest returns, of approximately one percent per event”.

Our estimated wage returns to training are, however, relatively low compared to those obtained by Booth and Bryan (2006) and Melero (2004) using the same database (BHPS) for the period of 1998 to 2000 and for the period of 1991 to 2002, respectively. There are

⁷ The IV estimates from the pooled OLS model are 0.0220 for cumulated training events, 0.0215 for cumulated general training events and 0.0256 for cumulated financed general training events. All of the IV estimates are statistically significant at a level of 1%.

some important differences between our approach and these earlier studies that may help to explain our lower estimates. In particular, we consider employees aged 18 to 65 (they included 16 to 65 year olds); we do not include employees in Mining and Quarrying; our sample period is longer; we control for the possible endogeneity of training events using instrumental variables (they use current period training); we control for a larger set of independent variables; and, perhaps most importantly, we use different definitions of training (for example, Booth and Bryan include induction training).

Returning to our results, as predicted by the classical model, specific and general training components included in the same training category are found to be associated with a lower wage return than are exclusively general training courses (either financed by employers or not). This point may be seen by comparing the estimates for both types of training events in columns 1, 4 and 7 of Table 2. The broadest measure of training is, however, not statistically significant (at a level of 15%) for either the full sample or the skill subgroups.

The estimates for training are robust to the inclusion of the promotion measure in the set of explanatory variables (column 2). Nevertheless, promotion has a significant and a positive relationship with wages. Employees can expect their wage to rise by 4% when they are promoted.

Dividing training events into those with the current or previous employer (column 3 of Table 2), training events (incidence) with the previous employer do not have a statistically significant relationship with current wages in the full sample estimates. This finding is consistent with the classical model if, for example, skills received from training have depreciated and/or training is not transferable. Further dividing training with previous employer into (i) general training and (ii) firm financed general training (reading down column 3 in panel 1), general training or firm financed general training with previous employers also do not have a systematic relationship with wages for the full sample of British employees.

Concentrating on white collar employees (column 5), the wage returns associated with training are similar in size to those found for the full sample with the exception of the larger returns from firm financed general training (1.62% compared to 1.32% for the full sample). Cumulated training events with specific and general components have an insignificant relationship with wages. In contrast, however, cumulated general training events and cumulated employer-financed general training events have a positive and significant relationship with wages.

For the blue-collar sample, the wage return related to employer-financed training is lower than for white-collar workers, although it is also statistically insignificant⁸ at a level of 15%. Similarly, cumulated training events with previous employers may appear to have a stronger association with wages than do training periods with the current employer (2.97% compared to 1.34% for general training and 3.03% compared to 1.46% for firm financed general training in the full sample), however, they are also statistically insignificant at a level of 15%. Other studies (Loewenstein and Spletzer, 1998; Booth and Bryan, 2005) have found the potential impact of training received in previous employment to be several times higher than training with the current employer, although they find this relationship to be statistically significant, perhaps because they do not control for endogeneity in cumulated training events.

To reiterate, for blue-collar workers, training events do not have a significant association with wages for any of the three training measures considered. This is also true for training events with the previous employer or with the current employer. The potential impact of training on productivity and wages apparently differs according to the occupation (white or blue collar) of the group of workers that participates in the training program. In the case of white-collar employees, general training (either financed or not) is positively associated with wage increases. This is clearly not the case for blue collar employees

⁸ This finding may be inconsistent with the predictions of recent non-competitive models but still consistent with classical human capital theory in the presence of long-term labour contracts (Lazear and Oyer, 2003).

who are not found to derive a significant wage benefit from participating in training events.

3.2 *Training Intensity*

The estimates of the fixed effects model with instrumental variables (FE/IV) for training intensity (duration) are reported in the lower panel of Table 2. The results for the full sample (columns 1 to 3) are consistent with those found for training intensity. All three of the training measures are associated with wage increases (column 1). Promotion is also positively related to wage increases (of 4%) but controlling for promotion does not change the estimates of the wage return from training. Furthermore, it is training with the current employer that is associated with wage growth. There is no significant evidence that training intensity with previous employers is related to wage rates for the full sample of British employees.

Dividing the workers into white and blue collar, the results again reveal that training is only significantly related to wage changes for white-collar employees (columns 4 to 6). For these employees, the cumulated days of training (training intensity) has a significant and positive relationship with wages (0.08% in column 4), even after controlling for promotion (0.08% in column 5). An employee undergoing a training program (which includes general components) lasting for 20 days, with their current employer, may expect a wage increase of 1.6%, *ceteris paribus*. Training with previous employers is again found to have an insignificant association with wage, in contrast to cumulated training days with the current employer.

The intensity of general training events financed by the employer appears, however, to be insignificant for white-collar employees in contrast to the results found for training incidence (comparing the final 4 rows in panel 1 with the final 4 rows in panel 2).

For blue-collar workers (columns 7 to 9), consistent with the results for training incidence, training intensity does not have a statistically significant relationship with

wages, either for training courses attended with the current employer or with the previous employer.

To reiterate, our results indicate that wage returns differ according to the nature and the type of the training program and by the type of employee (white or blue-collar). Equal access to training programs will not reverse wage inequality in favor of low skilled employees if blue-collar employees do not derive a wage benefit from participating in training. Whilst, the nature of the components included in the training programme are related to differing wage returns for white-collar employees, there are nevertheless clear gains for them associated with training.

4. Training and Wage Dispersion between Groups

It appears that training may have a non negligible role in wage inequality amongst workers in Britain. We next evaluate the contribution of different types of training to wage dispersion during the time period of 1998 to 2001, giving special attention to the contribution of (a) general training and (b) general training that is financed by the employer.

4.1 Wage Gap Decomposition

Following Oaxaca and Ransom (1994), the mean wage gap can be written as:

$$\ln W_w - \ln W_b = \underbrace{(\bar{X}_w - \bar{X}_b)\hat{\beta}^*}_{\text{Explained Part (E)}} + \underbrace{\bar{X}_b(\hat{\beta}^* - \hat{\beta}_b)}_{\text{Un explained Part (U)}} + \underbrace{\bar{X}_w(\hat{\beta}_w - \hat{\beta}^*)}_{\text{Un explained Part (U)}} \quad (2)$$

Where W_w represents the wages of the white-collar group (advantaged group) and W_b represents the wages of the blue-collar group (disadvantaged group); $\ln(Q_{wb}+1)$ is the endowment component; $\ln(D_{wb}+1) = \ln(\delta_{w^*}+1)+\ln(\delta_{b^*}+1)$ is the remuneration or the discrimination component; δ_{w^*} and δ_{b^*} are respectively the blue collar wage disadvantage and white collar wage advantage associated with discrimination; and β^* is a set of benchmark coefficients equal to:

$$\beta^* = \Omega \hat{\beta}_w + (I - \Omega) \hat{\beta}_b \quad (3)$$

representing a matrix of relative weights of the estimated vector of coefficients and the identity matrix (I). Other choices have been suggested for the weighting matrix Ω (Oaxaca and Ransom (1994)); for example, Cotton (1988) sets $\Omega = \alpha_w I$ where α_w is the proportion of white collar employees; Reimers (1983) adopts $\Omega = I/2I$; and Neumark (1988) suggests $\Omega = (X'X)^{-1}(X'_w X_w)$ where $X'X = X'_w X_w + X'_b X_b$ and is equivalent to using the coefficients from the pooled sample of workers.

Table 3 reports the white-collar/blue-collar wage decompositions based on the results presented in Table 2 and the variable means presented in Table 1⁹. The estimated coefficients for those regressors that are time invariant were recovered, in a second stage, using an OLS estimation of the residuals of the FE/IV estimation over those time invariant regressors.

The gross wage differential¹⁰ across the time period is 70.2%. When the group of blue-collar workers is taken as the standard competitive ($\Omega = 0$) the portion of the measured wage gap due to coefficients differentials is smaller and the portion due to endowments differentials larger compared to using the white collar wage structure ($\Omega = I$). Even in this case, however, most of the wage differential is explained by measured productivity differentials across white and blue-collar workers.

It is clear from these results that training is associated positively with wage dispersion. The extent of this contribution varies according to the method of decomposition adopted: the method that adopts the blue-collar wage structure ($\Omega = 0$) predicts a smaller contribution from training relative to the white wage structure adoption. The type of training is itself of little relevance for wage dispersion: our widest category of training and general training contributes little more than 1 to 2.5% of the overall wage differentials. Cumulated general training events either financed by the employers or not reveal a much higher contribution.

⁹ Our results may be affected by an identification problem if the remuneration effect attributed to training is not invariant to the choice of the left-out group. Yun (2005) presents a simple solution for this problem by utilizing a “normalized” wage equation for binary variables. This solution is unfortunately not applicable in our case because the training variables measure cumulated events for the period 1998-2001.

¹⁰ The wage gap: $G = [\text{Exp}(0.532) - 1] * 100$

Table 3. Wage Gap Decompositions

		Training	General Training	Financed General Training
	Wage Gap <i>(ln G_{wb}+I)</i>	0.532	0.532	0.532
	$\hat{\beta}_w$ - estimated coefficient for training (white-collar group)	0.009	0.013	0.016
	$\hat{\beta}_b$ - estimated coefficient for training (blue-collar group)	0.002	0.004	0.001
$\Omega=1$	<i>Due to endowment</i> <i>(ln Q_{wb}+I)</i>	-0.064	-0.040	-0.037
	<i>Due to discrimination</i> <i>(ln D_{wb}+I)</i>	0.587	0.578	0.578
	<i>Overall Training contribution</i>	0.013	0.021	0.019
	<i>Endowment effect of Training</i>	(2.50%) 0.007	(4.04%) 0.011	(3.55%) 0.009
	<i>Discrimination effect of Training</i>	0.006	0.010	0.010
$\Omega=0.5$	<i>Due to endowment</i> <i>(ln Q_{wb}+I)</i>	-0.019	0.004	0.005
	<i>Due to discrimination</i> <i>(ln D_{wb}+I)</i>	0.542	0.533	0.536
	<i>Overall Training contribution</i>	0.013	0.021	0.019
	<i>Endowment effect of Training</i>	(2.50%) 0.004	(4.04%) 0.007	(3.55%) 0.005
	<i>Discrimination effect of Training</i>	0.009	0.014	0.014
$\Omega=0$	<i>Due to endowment</i> <i>(ln Q_{wb}+I)</i>	0.026	0.048	0.046
	<i>Due to discrimination</i> <i>(ln D_{wb}+I)</i>	0.497	0.489	0.495
	<i>Overall Training contribution</i>	0.007	0.021	0.019
	<i>Endowment effect of Training</i>	(1.32%) 0.002	(4.04%) 0.003	(3.55%) 0.001
	<i>Discrimination effect of Training</i>	0.012	0.018	0.018

Source: British Household Panel Survey, 1998 - 2001

The results do not suggest that training is a major tool for reversing wage inequality among workers. On the contrary, it seems that training is a contributor to the wage dispersion across high and low-skill workers, even if the training programme includes general components that may increase the employee's wage offers across firms¹¹. The

¹¹ A limitation with the original Oaxaca and Blinder (1973) approach is that the wage gap is measured at the mean, thereby ignoring potential differences in the form of the entire wage distribution (Dolton and Makepeace, 1987; Munroe, 1988). Several techniques have been developed to overcome this limitation. For example, the use of quantile regressions (Juhn, Murphy and Pierce, 1993) allow for the decomposition of the wage gap at different points of the wage distribution. We explored the relationship between wages and training (for all three of our training measures) using quantile regression techniques and did not find significant differences across the wage distribution. In our particular example, where we are interested in a comparison of high and low skill workers (rather than higher and lower waged workers) we believe that the Oaxaca and Blinder decomposition continues to be a valid and a pertinent approach.

implications of these findings may be further explored by concentrating analyses on the returns to training for workers within skill and age bands.

5. Wage Returns to Training within Groups

The white and blue-collar groups considered in Table 2 are further subdivided into three different age groups: lower than thirty; between thirty and forty five, and older than forty-five (i.e. $30 <$; $30-45$; and >45). Table 4 presents the IV/FE estimated wage returns from cumulated training events for these white-collar and blue-collar age groups. The models presented in Table 4 are directly comparable to those in Table 2 and are subjected to the same battery of diagnostic testing. Independent variables controlling for individual, job, workplace, and market characteristics are also included (see endnotes to Table 4).

A striking result is found when analysis is concentrated on the different age bands of white and blue-collar employees. Cumulated training events (incidence), independent of the nature of components that they may include, are not statistically significantly related to wages for either white or blue-collar workers who are younger than thirty.

Considering white-collar employees in more detail, general training (and especially financed general training) with the *previous* employer has a positive and statistically significant relationship with wages for white-collar workers older than 45 (at a level of 10%). Within the 30 to 45 year age band, however, cumulated training events with the *current* employer are found to be significantly related to wage increases for these employees. Implying that there is a peak age period (the 30 to 45 year band) during which white collar employees should seek training opportunities.

A possible explanation for these results may be that workers younger than 30 have lower expected tenure; they may have a lower quality employer job match and consequently have a higher probability of leaving. Analogously, older workers may also represent a high risk of short tenure to employers, limiting the opportunity of those who finance training to reap all the returns from such investment.

For blue-collar employees, only training events with previous employers are associated with wage growth and this is true only for those employees aged between 30 and 45 (at a level of 15%). It would appear that the returns for younger (below 30) blue collar employees from training are limited in the short run and that training expenditure during these years constitutes a relatively long term investment. The size of these relationships for these workers is, however, notable: cumulated training days with previous employers are associated with 11.21% wage growth; 12.84% if this training is general in nature; and 16.52% if the training was financed by the previous employer.

Turning to consider training intensity (duration) in the lower panel of Table 4, the results are similar for the white-collar employees. High skill (white-collar) workers, aged 30 to 45, typically obtain significant wage returns to cumulated training events with the current employer; whilst employees from the same skill group who are older than 45 typically gain from cumulated general training events with previous employers¹². Surprisingly, however, for white-collar employees who are less than 30 years old, cumulated training intensity with previous employer is now found to have a negative and a significant impact (at a level of 10%) on wage. It may be job turnover after training is treated as a negative signal of potential employment stability by future employees of young white-collar workers resulting in a wage penalty.

Point estimates for training duration are in most cases insignificant (at a level of 15%) for the group of blue-collar workers. The only exceptions are the point estimates obtained for general training for the 30 to 45 year age bracket (column 7 of Table 4).

Our results suggest the relationship between training (incidence and intensity), implied productivity level and wage is not uniform for high and low skill employees nor is it constant over the working life of an employee. Consequently, the impact of training

¹² The estimated wage return from cumulated training events with a prior employer is 0.04% and it is also highly significant (at levels of 1%).

policy may be distinct and/or have very different impacts with respect to the age and the occupation of the recipients.

6. Conclusion

We use British panel data from 1991 to 2002 to explore the wage returns to training (both incidence and intensity) undertaken by employees between 1998 and 2002. We find that (after controlling for individual, job, workplace, and market characteristics) the wage returns differ greatly depending on the nature of the training (general or specific); who funds the training (employee or employer); the skill levels of the recipient (white or blue collar); and the age of the employee.

In general, the estimated wage returns to training courses for British employees are typically small at less than 1%. Although, training courses that include general components are associated with a higher wage as are training courses undertaken with previous employers.

The relationship between training and wages, however, is found to differ according to the occupation (white or blue-collar) and the age of the group of workers that participates in the training programme. We find very limited wage returns from training (incidence or intensity) for blue collar employees aged between thirty and forty five years, and no significant returns for younger or older low-skill workers. This result contrasts with the range of positive returns found for high skill employees. White collar employees also have higher training incidence and intensity than blue collar workers, suggesting a virtuous circle between training and wage growth for white-collar employees (but not for blue-collar employees).

Using decomposition analysis, we further conclude that unequal remuneration to different skill groups from contributes positively to wage inequality across white and blue-collar employees in Britain. These results imply that merely promoting equal access to training

programmes will not be sufficient to reverse wage inequality in favor of low-skilled workers. Indeed, it may exacerbate wage inequality.

References

- Acemoglu, D. and Pischke, J.S. (1998). 'Why do firms train? Theory and evidence', *Quarterly Journal of Economics*, vol. 113(1), pp. 79-119.
- Acemoglu, D. and Pischke, J.S. (1999a). 'The structure of wages and investment in general training', *Journal of Political Economy*, vol. 107(3), pp. 539-572.
- Acemoglu, D. and Pischke, J.S. (1999b). 'Beyond Becker: Training in imperfect labor markets', *The Economic Journal* vol. 109, pp. F112-F142.
- Almeida-Santos, F. and Mumford, K. (2004). 'Employee training in Australia: Evidence from AWIRS', *Economic Record* vol. 80, pp. S53-S64.
- Almeida-Santos, F. and Mumford, K. (2005). 'Employee training and wage compression in Britain', *The Manchester School* vol. 73 (3), pp. 321-342.
- Ariga, K. and G. Brunello. (2006). Are the more educated receiving more training? Evidence from Thailand. *Industrial and Labor Relations Review*, vol. 59 (4), pp.
- Arulampalam, W. Booth, A. and Bryan, M. (2006). 'Are there Asymmetries in the effects of training on the conditional male wage distribution?' *Industrial and Labor Relations Review*, vol. 59 (4), pp.
- Bassanini, A. and Brunello, G. (2003). 'Is training more frequent when wage compression is higher? Evidence from the European Community Household Panel', *IZA, Discussion Paper* 839.
- Becker, G.S. (1962). 'Investment in human capital: A theoretical analysis', *Journal of Political Economy* vol. 70, pp. 9-49.
- Becker, G.S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education* (The University of Chicago Press, 3rd Edition, Chicago).
- Ben-Porath, Y. (1967). 'The production of human capital and the life cycle of earnings', *Journal of Political Economy*, no. 75, pp. 352-365.
- Bishop, J.H. (1997). 'What we know about employer-provided training? A review of the literature', *Research in Labor Economics* vol.16, pp. 19-87.
- Booth, A.L. and Bryan, M. L. (2005). 'Testing some predictions of human capital: New training evidence from Britain', *Review of Economics and Statistics* vol. 87(2), pp. 391-394.
- Booth, A.L. and Bryan, M. L. (2006). 'Who pays for general training? New evidence for British Men and Women', *Research in Labor Economics*, vol. , pp.

- Brunello, G. (2001). 'Is training more frequent when wage compression is higher? Evidence from 11 European countries', *PuRE publications*, The Research Institute of the Finnish Economy, Helsinki, Finland.
- Chiswick, B. (2003). 'Jacob Mincer, experience and the distribution of earnings', *Review of Economics and the Household* vol.1(4), pp. 343-362.
- Clifton, J. (1997). 'Constraining influences on the decision to participate in training: the importance of the non-work environment', *Cornell - Center for Advanced Human Resource Studies*, Working paper no. 97-25.
- Cotton, J. (1988). 'On the decomposition of wage differentials', *Review of Economics and Statistics* vol. 70, pp. 236-243.
- Dolton, P.J., and Makepeace, G.H. (1987). 'Marital status, child rearing and earnings: Differentials in the graduate labour market', *Economic Journal*, vol. 97, pp. 897-922.
- Department of Trade and Industry. (2005). 'Fairness at work. Chapter two. Business at Work', retrieved from <http://www.dti.gov.uk/er/fairness/part2.htm> on 21/12/2005.
- Frazis, H. and Loewenstein, M. A. (2005). 'Reexamining the returns to training: Functional form, magnitude and interpretation', *Journal of Human Resources*, vol. 40(2), pp. 435-452.
- Gershuny, J. (2005). 'Busyness as the badge of honor for the new super ordinate working class', *Social Research* vol. 72(2), pp.287-314 .
- Heckman, J. (1979). 'Sample selection bias as a specification error', *Econometrica*, vol. 47, pp. 153-163.
- Juhn, C. Murphy, K.M. and Pierce, B. (1993). 'Wage inequality and the rise in returns to skill,' *Journal of Political Economy*, vol. 101, pp. 410-442.
- Keep, E. Mayhew, K. and Corney, M. (2002). 'Review of the evidence on the rate of return to employers of investment in training and employer training measures', *SKOPE Research Paper N° 34*, (Summer), University of Warwick.
- Lazear, E. and Oyer, P. (2003). 'Internal and external labor markets: a personnel economics approach', *NBER Working Paper Series* no.10192.
- Leuven, E. (2002). 'The economics of training: A survey of the literature', mimeo, retrieved from <http://www.fee.uva.nl/scholar/mdw/leuven/reviewart.pdf>.
- Leuven, E. (2004). 'A review of the wage returns to private sector training', *EC-OECD Seminar on Human Capital and Labour Market Performance*, Brussels.

- Lynch, L. M. (1992a). 'Differential effects of post-school training on early career mobility', *NBER Working Paper Series* no. 4034.
- Lynch, L. M. (1992b). 'Private sector training and the earning of young workers', *American Economic Review*, vol. 82(1), pp. 299-312;
- Loewenstein, M.A. and Spletzer, J.R. (1998). 'Dividing the costs and returns to general training', *Journal of Labor Economics* vol. 16 (1), pp. 142-171.
- Melero, E. (2004). 'Evidence on training and career paths: human capital, information and incentives', *IZA Discussion Paper*, no. 1377.
- Mincer, J. (1958). 'Investment in human capital and personal income distribution', *Journal of Political Economy*, vol. 66(4), pp. 281-302;
- Mincer, J. (1962). 'On-the-job training: Costs, returns and some implications', *Journal of Political Economy*, vol. 70(5) Part2, pp. S50-S79;
- Mincer, J. (1970). 'The distribution of labor incomes: A Survey with special reference to human capital approach', *The Journal of Economic Literature*, vol. VII, (March), pp. 1-26.
- Mincer, J. (1974). *Schooling, Experience and Earnings*, New York, Columbia University Press.
- Mumford, K. and Smith, P.N. (2004). 'Job tenure in Britain: Employee characteristics versus workplace effects', *Economica*, vol. 71, pp. 275-298.
- Munroe, A. (1988). 'The measurement of racial and other forms of discrimination.' *University of Stirling. Discussion Paper in Economics*, no. 148.
- Neumark, D. (1988). 'Employer's discriminatory behavior and the estimation of wage discrimination', *Journal of Human Resources*, vol. 23(3), pp. 279-295.
- Neuman, S. and Oaxaca, R. L. (1998). 'Estimating labor market discrimination with selectivity-corrected wage equations: Methodological considerations and an illustration from Israel', *CEPR Discussion Papers* no. 1915,
- Oaxaca, R. L. (1973). 'Male-female wage differentials in urban labor markets', *International Economic Review*, vol. 14(3), pp. 693-709.
- Oaxaca, R. L. and Ransom, M. R. (1994). 'On discrimination and the decomposition of wage differentials', *Journal of Econometrics*, vol. 61, pp. 5-24.
- Ok, W. and Tergeist, P. (2002). 'Supporting economic growth through continuous education and training – Some preliminary results', Papers presented at the meeting of National Economic Research Organisations, OECD headquarters, Paris.

- Pischke, J.S. (2001). 'Continuous training in Germany', *Journal of Population Economics* vol. 14, pp. 523-548.
- Reimers, C. (1983). 'Labor market discrimination against Hispanic and black men', *Review of Economics and Statistics*, vol. 65, pp. 570-579.
- Schöne, P. (2004). 'Why is the return to training so high?', *Labour*, vol. 18(3), pp.363-378.
- Stevens, M. (1994). 'A theoretical model of on-the-job-training with imperfect competition', *Oxford Economic Papers* vol. 46, pp. 537-563.
- Swaffield, J. (2000). 'Gender, motivation, experience and wages', *London School of Economics, CEP Discussion Paper*, no. 457.
- Veum, J. R. (1995). 'Sources of training and their impact on wages', *Industrial and Labor Relations Review*, vol. 48(4), pp. 812-826.
- Wooldridge, J.M. (1995). 'Selection corrections for panel data models under conditional mean independence assumptions', *Journal of Econometrics*, vol. 68, pp. 115-132.
- Yun, M.S. (2005). 'A simple solution to the identification problem in detailed wage decompositions', *Economic Inquiry*, vol. 43 (4), pp. 766-772.

Table 1 Variable Definitions and Means

	ALL				WHITE-COLLAR				BLUE-COLLAR			
	Mean	Std Dev	With Training		Mean	Std Dev	With Training		Mean	Std Dev	With Training	
			Mean	Std Dev			Mean	Std Dev			Mean	Std Dev
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
<i>(1) Individual employee characteristics</i>												
Less than 3 years of experience	0.05	0.23	0.06	0.24	0.04	0.20	0.05	0.21	0.06	0.24	0.07	0.26
3 and less than 8 years of experience	0.07	0.26	0.09	0.28	0.06	0.24	0.07	0.26	0.08	0.27	0.10	0.30
8 and less than 15 years of experience	0.09	0.29	0.10	0.30	0.09	0.29	0.10	0.30	0.09	0.29	0.10	0.30
15 and less than 20 years of experience	0.07	0.26	0.08	0.27	0.08	0.27	0.09	0.28	0.07	0.25	0.07	0.26
More than 20 years of experience	0.71	0.45	0.67	0.47	0.72	0.45	0.69	0.46	0.70	0.46	0.66	0.47
Age	38.54	11.56	37.17	11.01	39.56	10.80	38.61	10.44	37.90	11.96	35.84	11.34
Married	0.57	0.49	0.55	0.50	0.59	0.49	0.57	0.50	0.56	0.50	0.53	0.50
Female	0.48	0.50	0.52	0.50	0.46	0.50	0.52	0.50	0.50	0.50	0.53	0.50
White	0.96	0.18	0.96	0.19	0.96	0.19	0.96	0.19	0.97	0.18	0.97	0.18
having a children under 18	0.40	0.49	0.39	0.49	0.37	0.48	0.35	0.48	0.42	0.49	0.42	0.49
Years of school	10.68	3.15	11.49	2.84	12.27	2.90	12.62	2.67	9.69	2.89	10.44	2.59
Years of tenure	4.94	6.18	3.99	5.29	4.62	5.80	3.89	5.08	5.14	6.41	4.07	5.48
Log Hours	3.49	0.40	3.53	0.35	3.57	0.31	3.57	0.29	3.44	0.44	3.49	0.39
Temporary job	0.06	0.24	0.05	0.22	0.06	0.24	0.05	0.22	0.06	0.24	0.05	0.23
Part time	0.19	0.39	0.16	0.36	0.13	0.33	0.12	0.32	0.23	0.42	0.19	0.40
Have a Vocational Qualification	0.39	0.49	0.40	0.49	0.39	0.49	0.39	0.49	0.38	0.49	0.42	0.49
Trained in previous 12 months	0.31	0.46	1.00	0.00	0.39	0.49	1.00	0.00	0.26	0.44	1.00	0.00
Number of training course – cumulated events 98-01	0.66	1.51	2.11	2.05	0.93	1.86	2.36	2.32	0.50	1.21	1.88	1.73
Participated in a general training course in the last year	0.28	0.45	0.91	0.29	0.36	0.48	0.91	0.29	0.24	0.43	0.91	0.29
Participated in a general training courses financed by employer in the last year	0.23	0.42	0.74	0.44	0.30	0.46	0.76	0.43	0.19	0.39	0.72	0.45
Number of general training course -cumulated events 98-01	1.51	3.06	3.73	4.22	2.17	3.83	4.39	4.89	1.10	2.37	3.12	3.37
Number of general training course financed by the employer – cumulated events 98-01	1.09	1.77	2.64	2.10	1.49	2.08	2.96	2.29	0.84	1.49	2.34	1.86
Days of training in previous 12 months	0.89	1.61	2.17	2.06	1.24	1.91	2.46	2.23	0.68	1.36	1.90	1.84
Days of training in a course with general components in the last year	6.67	30.17	21.28	50.92	7.88	31.84	20.01	48.29	5.92	29.06	22.46	53.24
Days of training in a course with general components financed by the employer in the last year	6.09	29.14	19.42	49.50	7.10	30.27	18.02	46.15	5.46	28.40	20.72	52.40

Table 1 (Cont.)

	ALL				WHITE-COLLAR				BLUE-COLLAR			
	Mean	Std Dev	With Training		Mean	Std Dev	With Training		Mean	Std Dev	With Training	
			Mean	Std Dev			Mean	Std Dev			Mean	Std Dev
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Union member	0.26	0.44	0.33	0.47	0.28	0.45	0.36	0.48	0.25	0.43	0.30	0.46
Changed employer in the last year- either for a better job or was dismissed	0.04	0.20	0.04	0.20	0.04	0.19	0.04	0.19	0.04	0.20	0.05	0.22
Promoted in the last year	0.03	0.18	0.05	0.23	0.05	0.22	0.07	0.26	0.02	0.14	0.04	0.19
<i>Occupations</i>												
Managers and Administrators	0.16	0.36	0.17	0.37	0.41	0.49	0.35	0.48	0.00	0.00	0.00	0.00
Professional Occupations	0.11	0.31	0.15	0.36	0.28	0.45	0.32	0.47	0.00	0.00	0.00	0.00
Assoc. Prof and Technic Occup	0.12	0.32	0.16	0.37	0.31	0.46	0.33	0.47	0.00	0.00	0.00	0.00
Cleric and Secret. Occup	0.17	0.38	0.17	0.38	0.00	0.00	0.00	0.00	0.28	0.45	0.34	0.47
Craft and Related Occup	0.12	0.32	0.09	0.28	0.00	0.00	0.00	0.00	0.19	0.39	0.17	0.37
Personal and Protect. Serv. Occup	0.10	0.30	0.11	0.32	0.00	0.00	0.00	0.00	0.17	0.37	0.22	0.41
Sales Occup	0.07	0.26	0.05	0.21	0.00	0.00	0.00	0.00	0.11	0.32	0.09	0.29
Plants and Machines Operat.	0.09	0.28	0.06	0.23	0.00	0.00	0.00	0.00	0.14	0.35	0.11	0.31
Other Occup.	0.07	0.25	0.04	0.20	0.00	0.00	0.00	0.00	0.11	0.31	0.08	0.27
<i>(2) Workplace characteristics</i>												
<i>Economic Sectors</i>												
Manufacturing	0.12	0.33	0.12	0.33	0.10	0.31	0.10	0.29	0.13	0.34	0.14	0.35
Electricity, gas and water	0.03	0.16	0.02	0.14	0.01	0.11	0.01	0.11	0.04	0.19	0.03	0.16
Construction	0.06	0.23	0.03	0.18	0.03	0.18	0.02	0.15	0.07	0.25	0.05	0.21
Wholesale and retail trade	0.06	0.23	0.04	0.19	0.03	0.16	0.02	0.15	0.08	0.26	0.05	0.22
Hotels and restaurants	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Transport, storage and communication	0.09	0.29	0.06	0.25	0.06	0.25	0.05	0.22	0.11	0.32	0.08	0.27
Financial intermediation	0.09	0.29	0.07	0.26	0.06	0.25	0.05	0.21	0.11	0.31	0.10	0.30
Real state, renting and business activities	0.03	0.17	0.02	0.12	0.01	0.10	0.01	0.07	0.04	0.20	0.02	0.15
Public Administration and Defense	0.04	0.20	0.04	0.20	0.03	0.17	0.03	0.18	0.05	0.22	0.05	0.23
Education	0.15	0.35	0.16	0.37	0.21	0.41	0.20	0.40	0.11	0.31	0.12	0.32
Health and Social Work	0.01	0.08	0.01	0.08	0.01	0.09	0.01	0.09	0.00	0.07	0.01	0.07
Other Community, Social and Personal service .	0.17	0.37	0.22	0.41	0.22	0.41	0.25	0.43	0.13	0.34	0.18	0.39
Private Households with employed persons	0.15	0.36	0.20	0.40	0.20	0.40	0.25	0.43	0.12	0.32	0.16	0.36
Extra-territorial organizations and bodies	0.01	0.10	0.01	0.09	0.01	0.07	0.00	0.06	0.01	0.11	0.01	0.11

Table 1 (Cont.)

	ALL				WHITE-COLLAR				BLUE-COLLAR			
			With Training				With Training				With Training	
	Mean (1)	Std Dev (2)	Mean (3)	Std Dev (4)	Mean (1)	Std Dev (2)	Mean (3)	Std Dev (4)	Mean (1)	Std Dev (2)	Mean (3)	Std Dev (4)
<i>Regions</i>												
London	0.10	0.30	0.10	0.30	0.12	0.33	0.11	0.32	0.08	0.27	0.09	0.28
<i>Type of Organizations</i>												
Public organization	0.25	0.43	0.33	0.47	0.33	0.47	0.39	0.49	0.21	0.40	0.28	0.45
Private organization	0.72	0.45	0.62	0.48	0.62	0.49	0.55	0.50	0.77	0.42	0.69	0.46
Non-profitable organization	0.03	0.18	0.05	0.21	0.06	0.23	0.07	0.25	0.02	0.14	0.03	0.16
<i>Size</i>												
fewer than 25 employees	0.34	0.47	0.30	0.46	0.31	0.46	0.28	0.45	0.35	0.48	0.31	0.46
25-49 employees at the establish	0.14	0.35	0.14	0.35	0.14	0.34	0.14	0.35	0.15	0.35	0.15	0.35
50-99 employees at the establish.	0.12	0.32	0.12	0.33	0.11	0.32	0.12	0.33	0.12	0.32	0.12	0.33
100-199 employees at the establish.	0.10	0.31	0.10	0.29	0.11	0.31	0.09	0.29	0.10	0.30	0.10	0.30
200-499 employees at the establish.	0.13	0.33	0.13	0.34	0.12	0.32	0.13	0.33	0.13	0.34	0.14	0.34
500-999 employees at the establish.	0.07	0.25	0.07	0.26	0.07	0.26	0.08	0.27	0.06	0.25	0.07	0.26
1000+ employees at the establish.	0.11	0.31	0.13	0.34	0.14	0.34	0.15	0.36	0.09	0.28	0.12	0.32
<i>Real Wage and Wage Compression measures</i>												
log real (1998 prices) wage	3.47	0.57	3.57	0.55	3.82	0.51	3.83	0.49	3.26	0.50	3.34	0.50
Number of employees	6,924		3,593		3,136		1,769		4,939		2,168	
Number of observations	20,538		6,436		7,869		3,099		12,669		3,337	

Table 2 Wage effects of training incidence using different specifications (FE/IV)

Dependent Variable: Log of real hourly wage	All			White-Collar			Blue-Collar		
Training Incidence	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Training_t (cumulated events)</i>	0.0096***	0.0099***	—	0.0089	0.0091	—	0.0017	0.0019	—
<i>Promoted</i>	—	0.0390****	0.0392***	—	0.0362**	0.0368**	—	0.0372*	0.0374*
<i>Training_{t-1} in the current employer (cumulated events)</i>	—	—	0.0088**	—	—	0.0089	—	—	0.0020
<i>Training in the previous employer (cumulated events)</i>	—	—	0.0256	—	—	0.0348	—	—	0.0186
<i>General Training_{t-1} (cumulated events)</i>	0.0137****	0.0140****	—	0.0129**	0.0133**	—	0.0037	0.0038	—
<i>Promoted</i>	—	0.0397****	0.0393****	—	0.0370**	0.0375**	—	0.0374*	0.0375*
<i>General Training_{t-1} in the current employer (cumulated events)</i>	—	—	0.0134****	—	—	0.0135**	—	—	0.0040
<i>General Training in the previous employer (cumulated events)</i>	—	—	0.0297	—	—	0.0346	—	—	0.0297
<i>Financed General Training_{t-1} (cumulated events)</i>	0.0132***	0.0136***	—	0.0159***	0.0162***	—	0.0010	0.0011	—
<i>Promoted</i>	—	0.0388****	0.0390****	—	0.0370**	0.0373**	—	0.0371*	0.0373*
<i>Finance General Training_{t-1} in the current employer (cumulated events)</i>	—	—	0.0146****	—	—	0.0165***	—	—	0.0041
<i>Finance General Training in the previous employer (cumulated events)</i>	—	—	0.0303	—	—	0.0330	—	—	0.0393
Training Intensity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Training (cumulated events)</i>	0.0009****	0.0009****	—	0.0008**	0.0008*	—	0.0004	0.0004	—
<i>Promoted</i>	—	0.0387****	0.0392****	—	0.0363**	0.0373**	—	0.0358*	0.0353*
<i>Training in the current employer (cumulated events)</i>	—	—	0.0010****	—	—	0.0010**	—	—	0.0006
<i>Training in the previous employer (cumulated events)</i>	—	—	0.0002	—	—	0.0003	—	—	0.0002
<i>General Training (cumulated events)</i>	0.0010****	0.0011****	—	0.0008*	0.0008*	—	0.0006	0.0006	—
<i>Promoted</i>	—	0.0386****	0.0392****	—	0.0368**	0.0378**	—	0.0348*	0.0341*
<i>General Training in the current employer (cumulated events)</i>	—	—	0.0011****	—	—	0.0009*	—	—	0.0008
<i>General Training in the previous employer (cumulated events)</i>	—	—	0.0003	—	—	0.0003	—	—	0.0004
<i>Financed General Training (cumulated events)</i>	0.0007*	0.0007*	—	0.0005	0.0004	—	0.0004	0.0004	—
<i>Promoted</i>	—	0.0382****	0.0384****	—	0.0354**	0.0357**	—	0.0362*	0.0358*
<i>Finance General Training in the current employer (cumulated events)</i>	—	—	0.0009***	—	—	0.0007	—	—	0.0006
<i>Finance General Training in the previous employer (cumulated events)</i>	—	—	0.0003	—	—	0.0004	—	—	0.0011

Source: British Household Panel Survey, 1998 - 2001.

Notes: Each entry in columns (1) to (9) contains marginal effects. *Statistically significant * at 85%, ** at 90%, *** at 95%, and **** at 99%. All results presented are based upon robust standard errors. Controls are also introduced for: experience, age, marital status, gender, race, having children, years of school, tenure, hours worked, having temporary job, having a part time job, having vocational qualifications, being a union member, have left the employer, year, occupation, economic sector, region, type and size of workplaces.

Table 4 Wage effects of training incidence and training intensity among groups of workers

FE/IV	White-collar				Blue-collar			
	<i>All</i>	<30	[30-45]	>45	<i>All</i>	<30	[30-45]	>45
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log of real hourly wage								
Training INCIDENCE								
Training (cumulated events)	0.0091	0.0112	0.0138*	0.0073	0.0019	-0.0186	-0.0004	0.0079
Training in the current employer (cumulated events)	0.0089	0.0067	0.0134*	0.0118	0.0020	0.0031	-0.0022	0.0052
Training in the previous employer (cumulated events)	0.0348	0.0482	0.0265	0.0731*	0.0186	-0.0848	0.1121*	0.0420
General Training (cumulated events)	0.0133**	0.0060	0.0201***	0.0077	0.0038	-0.0135	-0.0021	0.0139
General Training in the current employer (cumulated events)	0.0135**	0.0041	0.0206***	0.0136	0.0040	0.0074	-0.0044	0.0112
General Training in the previous employer (cumulated events)	0.0346	0.0471	0.0262	0.0731*	0.0297	-0.0602	0.1284*	0.0405
Financed General Training (cumulated events)	0.0162***	0.0255	0.0211***	0.0109	0.0011	-0.0182	-0.0006	0.0131
Financed General Training in the current employer (cumulated events)	0.0165***	0.0233	0.0211***	0.0177	0.0041	0.0098	0.0015	0.0080
Financed General Training in the previous employer (cumulated events)	0.0330	0.0761	0.0223	0.0910**	0.0393	-0.0897	0.1652*	0.0337
Training INTENSITY								
Training	0.0008*	-0.0003	0.0008*	0.0024	0.0004	-0.0007	0.0012	0.0003
Training in the current employer (cumulated days)	0.0010**	0.0001	0.0008*	0.0028	0.0006	-0.0009	0.0014	-0.0005
Training in the previous employer (cumulated days)	0.0003	-0.0005**	-0.0017	0.0004****	0.0002	0.0002	0.0010	0.0012
General Training	0.0008*	-0.0004	0.0008*	0.0020	0.0006	-0.0007	0.0013	0.0005
General Training in the current employer (cumulated days)	0.0009*	0.0000	0.0008*	0.0023	0.0008	-0.0011	0.0015*	-0.0004
General Training in the previous employer (cumulated days)	0.0003	-0.0005**	-0.0020	0.0004****	0.0004	0.0003	0.0305***	0.0012
Financed General Training	0.0004	-0.0005	0.0019***	-0.0004	0.0004	-0.0006	0.0011	0.0010
Financed General Training in the current employer (cumulated days)	0.0007	-0.0002	0.0020***	-0.0003	0.0006	0.0000	0.0013	-0.0041
Financed General Training in the previous employer (cumulated days)	0.0004	-0.0005**	-0.0002	0.0004****	0.0011	0.0026	0.0243	0.0011
observations	7869	1646	3768	2455	12669	3760	5232	3677

Source: British Household Panel Survey, 1998 - 2001.

Notes: Each entry in columns (1) to (8) contains marginal effects.

*Statistically significant * at 85%, ** at 90%, *** at 95%, and **** at 99%. All results presented are based upon robust standard errors.

Controls are also introduced for: experience, age, marital status, gender, race, having children, years of school, tenure, hours worked, having temporary job, having a part time job, having vocational qualifications, being a union member, have left the employer, year, occupation, economic sector, region, type and size of workplaces, and promotion.

