DOES TRAINING GENERALLY WORK? THE RETURNS TO IN-COMPANY TRAINING

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Using data from surveys of enterprises in Ireland in 1993 and 1996–97, the authors estimate the productivity effects of general training, specific training, and all types of training combined. Statistically significant positive effects on productivity are found both for all training and for general training, but not for specific training. The positive effect of general training remains when the researchers control for factors such as changes in work organization, corporate re-structuring, firm size, and the initial level of human capital in the enterprise. The impact of general training varies positively with the level of capital investment.

In recent years a number of researchers have sought to measure the effect of employer-provided training on productivity using firm-level data (Holzer et al. 1993; Bartel 1994; Black and Lynch 1996). Previously, such exercises were constrained by the lack of appropriate data. With the growth in firm-level data and the relaxation of this constraint, we are beginning to develop a deeper knowledge of the link between employer-provided training and productivity.

In this paper we add to this area of research by drawing on a new data set that allows us to analyze a particularly interesting dimension of the effect of employer-provided training. The data used are from a survey specifically designed to collect detailed information on firms' training practices, including a measure of days spent on specific and general training, following Becker's (1975) familiar distinction. Although the distinction between these types of training has been well developed in the theoretical literature, empirical studies that test it are extremely rare.[1] Also included is information on output, capital, and employment at two points in time. This allows

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The data used come from two surveys. To obtain the data from the 1993 survey, address requests to FAS (the Irish Training and Employment Authority). The data from the 1997 survey and the computer programs used to generate the results presented in the paper are available from either of the authors at the Economic and Social Research Institute, 4 Burlington Road, Dublin 4, Ireland.

[1]One recent exception is Loewenstein and Spletzer (1999).

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us to estimate the impact of general and specific training on productivity growth. In addition, we include as controls a range of variables indicating changes in corporate structure, organizational policies, and personnel policies. In sum, the data allow us to make both a novel contribution to the measurement of the impact of training and an important addition to the limited empirical work on general versus specific training.

Literature Review

A number of studies have looked at the effect of employer-provided training by analyzing the impact on wages using data on employees (for example, Booth 1991; Lynch 1992). Other studies, including some produced by the National Institute for Economic and Social Research (NIESR 1990), have adopted a case study approach and have looked at the relationship between training and productivity in a limited number of enterprises. Our approach is to use a firm-level dataset in a regression framework to estimate the impact of training on productivity. We restrict this brief review of the literature to studies of that type.

One of the earliest such studies, Holzer et al. (1993), arose out of a grant program run by the State of Michigan, through which grants were made available to manufacturing companies for the financing of training. By surveying companies that had applied for grants, the authors generated a data set with information on training inputs and companies' outputs. In addition, as they had information on the companies over a number of years, they were able to look at how productivity *changes* across firms were related to *changes* in training, thereby overcoming the familiar problem of time-invariant unobserved heterogeneity. Working with samples of between 171 and 250 firms, they found evidence of a direct link between training and productivity.

Bartel (1994) looked at the link between training and productivity using around 150 firms from another survey of employers, the Columbia Business School survey. Like Holzer et al., she found a positive effect of training on productivity.

This employer-based approach to estimating the training/productivity relationship was recently refined in a series of papers by Lisa Lynch and Sandra Black (Lynch and Black 1995; Black and Lynch 1996; Black and Lynch 1997). Their refinements were facilitated by a new data set that, as the authors put it, "was designed to overcome some of the limitations of previous studies and collect more precise data on human-capital inputs and establishment inputs" (Black and Lynch 1996:263). For our purposes, the results of greatest interest are found in their 1995 paper.[2] In that study, they estimated production functions for the manufacturing and non-manufacturing sectors in which they included dimensions of training along with the more usual arguments in production functions such as capital and labor. The results on training are interesting: the number of workers trained was not found to have a statistically significant effect on productivity, but this masked the effects of different dimensions of training, which did matter. In manufacturing, the higher the proportion of training that was off-the-job, the higher was productivity. In non-manufacturing, too, the type of training mattered for productivity; in particular, training in computer skills increased productivity.

Because the results presented in Black and Lynch's 1995 and 1996 papers are based on data from a single year, they suffer from the problem of unobserved heterogeneity, mentioned above.[3] In the 1997 paper, the authors attempted to overcome this problem by supplementing the original data with data from the Longitudinal Research Database (LRD) of the U.S. Bureau of the Census. They were able to match the companies with records in the LRD and thereby

[2]The same results are found in the 1996 paper, which is a published version of a section of the 1995 working paper.

[3]This is acknowledged by the authors; see p. 266 of the 1996 paper.

create a dataset with information over time. In re-estimating their earlier work, they now found no effect of training on productivity; however, they maintained that this was probably because the information on training was too weak for its effect to be captured in the extended estimation framework. What does emerge from this study is the interesting effects of workplace practices on productivity. In particular, greater involvement of workers in decision-making and the use of performance-related pay were found to generate higher productivity than did more traditional labor-management relations practices.[4]

General and Specific Training

As noted, our task in this paper is to estimate the effects of general and specific training on productivity growth. In this section, we discuss the concepts as proposed by Becker (1975); we also discuss briefly some recent insights that question the implications of Becker's original formulation. These developments do not relate directly to the task we undertake in our empirical work, but they provide context.

Becker (1975) defined general training as the type of training that raises productivity by equal amounts in the firm where it was provided and in other firms. In contrast, specific training only raises productivity in the firm providing it. Under certain conditions, these definitions imply that firms will not pay for general training. As an individual's productivity is raised in other firms, alternative wage offers will increase. To retain the employee, the employer who provided the general training must match those offers, and hence can capture no return to the training investment. The employer will thus shift all the costs of general training onto the employee, possibly through a reduced wage during the training period. In contrast, because *specific* training does not lead to increased productivity and higher wage offers elsewhere, the firm will be prepared to share the costs of providing it.

These hypothesized mechanisms have an additional implication if there are constraints on the employer's ability to offer an employee a lower wage during training. If, for example, a wage is attached to a particular job through an agreement with a union, the firm will not be able to shift the costs of training onto the employee. Such a situation leads to market failure in the provision of training—particularly general training, given the employer's need to shift all (not merely a portion) of the costs of such training.

In the years since Becker introduced the distinction between general and specific training, some doubts have been raised about its implications for who funds training. Bishop and Kang (1996) pointed out that the strong predictions of Becker's theory require that (i) labor markets are competitive, (ii) workers can finance general on-the-job training investments by borrowing at a fixed interest rate, and (iii) technically general skills can be cheaply signaled to other potential employers. They then developed a model in which these assumptions are relaxed and predictions emerge in which employers do share the costs of general training.[5] Their empirical analysis failed to support a prediction that follows from a rigid application of Becker's theory, namely, that general training would have greater effects on wage growth than on productivity growth. Similarly, Loewenstein and Spletzer (1999) did not find any systematic difference in the wage returns to general and specific training, which is consistent with employers sharing the costs and returns to general and specific training. They also found in their data that most of the training provided by employers was general in nature, which runs counter to the prediction of a lower provision of general training when shifting the

[4]The importance of workplace practices arises again in the paper by Ichniowski et al. (1995).

[5]Acemoglu and Pischke (1999) focused on wage compression as a factor leading to a sharing of general training costs.

full cost to employees is not possible.

The theoretical focus of these recent papers has been on the issue of who pays for general training; the empirical tests have tended to look at the relationship between training and wages. Here, we look at a different dimension of the general and specific training dichotomy: the relative productivity effects of the two categories of training. If general and specific training differ in their effects, this has implications for the wage changes of employees post-training.

Research Design and the Data Set

The analysis presented below draws on a data set that was generated in two waves. The first wave was a survey of enterprises conducted in Ireland in 1993 and reported in Fox (1995). The survey was part of an effort funded by the European Union to establish, for the first time, comparable data within the EU on the nature and extent of training in companies.[6] For each of the countries involved, broadly standardized questionnaires were designed to collect detailed information on the training practices.

In the case of Ireland, a nationally representative sample of 1,000 enterprises was randomly selected. The survey covered companies employing more than 10 people in manufacturing, construction, and private services. Interviews were conducted on site at each enterprise, and interviewers typically dealt with individuals responsible for training provision within the enterprise; in the case of small firms, this individual sometimes was also the chief executive. The focus of the questionnaire was on continuing vocational training, rather than initial training, and so apprentices and trainees are excluded in the responses.[7]

A total of 654 usable returns were obtained from this survey. The information obtained includes items such as the activity of each company, the number of employees, and the distribution of employees in the enterprise across five broad occupational categories. Among the numerous questions touching on various aspects of training, those that are of interest here asked if certain specific types of training were provided, such as on-site training, conferences, workshops, seminars, job rotations, exchanges, and self-learning.

Although the 1993 survey contained much information on training activities, it did not contain information that would allow us to estimate the effect of training on productivity growth. In order to generate the information required, we conducted a follow-up survey of the 654 companies in April and May 1997. This survey was initially carried out through postal questionnaires and posted reminders, but non-respondents were eventually phoned. Given that the sample that we were re-surveying was quite small, we sought to maximize the response rate by minimizing the amount of information sought. The main pieces of information sought were as follows: output in 1993 and 1995, as measured by the sales figures from the end-of-year accounts in each period (this in turn would be used to calculate productivity in the two periods); the value of fixed assets at the same two points in time, again from the end-of-year accounts; and the size of the work force in 1993 and 1995. We also asked if there had been changes in personnel policy, corporate organization, and corporate structure between 1993 and 1995; as such changes could have affected productivity growth, we thought it important to be able to control for them.[8]

Excluding 12 public authorities, the original survey consisted of 642 enterprises.

[6]For a full description of the EU survey, see Eurostat (1996).

[7]Trainees and apprentices were defined in the instructions as "employees whose wages/salaries are determined by the fact that they are being trained or are studying for a recognised qualification relevant to their trade or profession."

[8]We sought information from 1995 and not 1996 or 1997 to ensure we were looking at a period when the 1993 training was most likely to be having an effect.

Eliminating responses with incomplete data reduced the number of cases from the follow-up survey to 215; hence the response rate based on the 642 enterprises was 33.5%. In order to check for bias in the pattern of response, we compared responses in the second wave to those in the first. We found that the distribution of companies by sector and size category was very similar in both surveys. We also found that the mean values of the training measures were very similar in the two surveys, and not different at statistically significant levels. Some descriptive statistics on the firms that responded to the second survey can be found in Table 1 below.

Before proceeding with the analysis, it is worth saying a few words on the Irish economy, by way of establishing whether lessons learned from Irish data can be applied elsewhere. Ireland has been a member of the European Union since the early 1970s, and one effect has been a substantial opening of the economy. This openness can be seen in the level of exports relative to national income; in 1995 (the year to which our second survey relates), Ireland's exports of goods and services were valued at 87% of GNP. The openness can also be seen in the level of foreign ownership in the Irish economy; again in 1995, in terms of numbers employed, just under half of manufacturing activity in Ireland was in enterprises owned by non-Irish companies. Of foreign-owned enterprises, just over half were U.S.-owned. Such levels of openness, along with the high growth rates of recent years (estimated to be around 8% in 1998), suggest that Ireland is now a modern economy, well integrated into the economy of the EU and beyond. While it is likely that the scale of enterprises is smaller in Ireland than in the United States, it is interesting to note that the median size of the enterprises studied here (60 employees) is identical to the mean in the Holzer et al. (1993) study mentioned above. Finally, in an international comparison of the data from the EU survey discussed above, the proportion of enterprises in Ireland providing training was similar to that in Germany, France, and the United Kingdom. Hence, the level of training provision in Ireland appears to be similar to that in other developed economies (Schömann 1998).

The Estimation Framework

The framework on which our estimation is based follows Bartel (1994) and assumes that the relationship between output and inputs at the company level has a standard Cobb-Douglas structure.[9] The production function is shown in equation (1) below. Output is a function of two inputs, capital (K) and "effective labor" (EFFLAB), the latter consisting of the amount of labor services employed by the company.

$$(1) \qquad Q = AK^{\beta}\text{EFFLAB}^{\gamma},$$

where β and γ are numbers greater than zero, as is A.

Effective labor consists of the amount of labor employed (RPTLAB, or reported labor), and the stock of training that the work force has received, which we will call its human capital (HUMCAP). Human capital thus refers to the accumulated stock of skills and competencies of the work force; the training provided to employees in any year can thus be thought of as a "flow" variable, that is, the amount that is added to the stock over a period of time. The relationships among effective labor (EFFLAB), reported labor (RPTLAB), and human capital (HUMCAP) are as follows:

$$(2) \qquad \text{EFFLAB} = \text{RPTLAB}(1 + \lambda\text{HUMCAP})$$

According to equation (2), if human capital stock (HUMCAP) were equal to zero, effective labor (EFFLAB) and reported labor (RPTLAB) would be the same. However, as λ is a number greater than zero, if the stock of human capital is greater than zero, then effective labor is greater than reported labor.

Substituting equation (2) into equation (1), dividing through by reported labor (RPTLAB), and taking the logarithm of both

[9] Black and Lynch (1996, 1997) also used a Cobb-Douglas production function in their estimation.

sides, we arrive at equation (3), which is a model of productivity, estimable using linear techniques:

$$(3) \quad \ln(Q/\text{RPTLAB}) = \ln A + \beta \ln K + (\gamma - 1)\ln\text{RPTLAB} + \gamma\lambda\text{HUMCAP} + \varepsilon.^{10}$$

As the estimation of equation (3) could produce a biased estimate of the effect of training on productivity due to unobserved heterogeneity, we difference equation (3) to produce the following, which is the equation we estimate:

$$(4) \quad \ln(Q_t/\text{RPTLAB}_t) - \ln(Q_{t-1}/\text{RPTLAB}_{t-1}) = \beta(\ln K_t - \ln K_{t-1}) + (\gamma - 1)(\ln\text{RPTLAB}_t - \ln\text{RPTLAB}_{t-1}) + \gamma\lambda(\text{HUMCAP}_t - \text{HUMCAP}_{t-1}) + \varepsilon_t - \varepsilon_{t-1}.$$

This equation relates changes in productivity to a range of variables, including the change in the human capital stock; $(\text{HUMCAP}_t - \text{HUMCAP}_{t-1})$ is represented in the estimations reported below by the training provided by the companies in 1993. Equation (4) encapsulates the core concern in this study—in essence, whether training provided during 1993 brought about productivity growth between 1993 and 1995. The approach implies that we are estimating how the *level* of training in 1993 affected the *change* in productivity between 1993 and 1995. We believe this to be the correct approach and to be conceptually preferable to seeing how a *change* in training may be related to a *change* in productivity. To see why, consider two firms, one that initially provides no training and then increases its training input to 10 units of training per employee, and another that provides 100 units of training per employee every year. As the latter firm is adding more to human capital, even though it has not increased its flow of training, we would expect it to experience larger growth in productivity in subsequent years. Relating changes in training to changes in productivity would not provide an insight into the relationship of interest.[11]

Results

Before presenting the results of our estimation of equation (4), we will present some descriptive statistics on our sample of firms. These are contained in Table 1. It should be noted that our sample included some firms that had not undertaken any training in 1993.

Productivity at each point in time is measured as output divided by total employment. On average between 1993 and 1995, the sample reported productivity growth of 3.4%.[12]

The training variables are derived from the series of detailed questions relating to the number of employees in training, the number of days spent in training, and the cost of training, including an estimate of the cost of time forgone by employees while training. We constructed three measures of total training volume: (1) the ratio of total persons trained to total employment; (2) the ratio of total days of training to total employment; and (3) the ratio of total expenditure on training to total payroll.

We were also able to distinguish between days spent on general *versus* specific training from a series of questions in which the training managers were asked to provide a breakdown of the total number of days of training into these two broad types. Under the heading "General Training Courses," defined in the instructions accompanying

[10]Although RL appears on both sides of the equation, it is valid to estimate how productivity responds to changes in labor inputs. This is done by Bartel (1994). In addition, estimations in which the dependent variable is a function of an independent variable can be found in studies of macroeconomic convergence and systems of consumer demand.

[11]Bishop and Kang (1996) also adopted this level/change approach.

[12]Output is measured as sales in the accounting years 1993 and 1995; again, this is similar to the measure used by Black and Lynch (1996, 1997). An effort was made in the follow-up survey to collect information on value added across firms, but the information turned out to be too weak to be used in the estimations.

Table 1. Summary Statistics of Principal Variables. (N = 215)

Variable	*Minimum*	*Maximum*	*Mean*	*Std. Dev.*
Dependent Variable:				
Proportionate Change in Productivity	−0.746	1.359	0.034	0.321
Training Variables:				
Trainees/Employees	0.000	1.000	0.394	0.349
Training Days/Employees	0.000	30.867	1.917	3.081
Training Expenditure/Payroll	0.000	22.514	1.844	2.967
General Training Days/Employees	0.000	27.333	0.832	2.123
Specific Training Days/Employees	0.000	13.559	0.948	1.854
Enterprise Variables:				
Investment	−0.790	2.495	0.148	0.377
Change in Employment	−0.700	2.273	0.128	0.329
Personnel Policies	0.000	3.000	0.405	0.791
Corporate Innovation	0.000	6.000	0.605	1.122
Corporate Restructuring	0.000	1.000	0.228	0.420
Labor Cost/Employees in 1993	5,604	58,327	21,321	9,450
Number of Employees in 1993	10	5,269	170.91	451.68
Sector:				
Catering	0.000	1.000	0.074	0.263
Construction	0.000	1.000	0.051	0.221
Distribution	0.000	1.000	0.186	0.390
Finance	0.000	1.000	0.033	0.178
Manufacturing	0.000	1.000	0.581	0.494
Transport	0.000	1.000	0.019	0.135
Other Sector	0.000	1.000	0.056	0.230

Note: The values for Payroll/Employees are in U.S. dollars, based on an exchange rate of IR£ = U.S.$ 1.50.

the questionnaire as training that provided "broad skills and knowledge," the respondents were asked to record the number of days spent in each of seven categories of "general" training: Management and Organizational Techniques; Human Resources Management; Job and Environmental Safety; Data Processing; Accounts/Finance; Marketing, Sales, and Customer Services; and Languages. Under the heading of training "specific to company's activity," defined in the instructions as training that is "directly related to the operation of the company," the respondents were asked to record the same information for four categories of "specific" training: Operation and Maintenance of Automated Systems and New Technology; Quality; Development of New Materials, Products, and Services; and Other (Including Production Techniques). A residual class of "other training" was also provided, in addition to the general and specific options. We measured General Training Days per Employee as the ratio of training days entered under the General Training heading to total employment, and Specific Training Days per Employee as the ratio of training days under the Specific Training heading to total employment.

We would argue that relying on training managers to apply the general/specific distinction to their own training activities represents a more satisfactory way of capturing this theoretically important distinction than relying on an ex-post coding of data based, for example, on information about the content or location of training. It might be thought that the use of categories under the general and specific headings could have reduced the accuracy with which general and specific training is recorded, but a

consideration of the categories shows that this is unlikely. The activities listed under general training are comprehensive and seem likely to provide skills that could be used outside the current employer, such as data processing and human resource management. As mentioned, the guide to the questionnaire explicitly defines general training as that which provides "broad skills and knowledge," so we are confident that the training recorded under "general" fits the Becker notion. In the section where the respondents are asked to place specific training, the four categories include an "other" category. For this reason, any form of training that was "directly related to the operation of the company," as opposed to offering "broad skills and knowledge," and which did not fit into one of the first three categories of specific training was likely to be placed under "other" forms of specific training. Finally, the existence in that section of the questionnaire of the residual category, "other" than general or specific, allows the respondent to deal with any ambiguities such as a situation in which a training activity is thought to be general in nature but is listed under the specific heading. Out of an average of 1.917 days of training per employee, 0.137 (7.1%) fall into this residual category.

Investment was calculated by subtracting the value of fixed assets in 1993 from that in 1995. Change in employment is the percentage change in total employment between 1993 and 1995.

Our corporate change variables are derived from a series of questions asking whether each of a series of policies had been implemented between 1993 and 1995. The questions relating to personnel policies asked about Performance-Related Pay, Productivity-Related Bonus Schemes, Performance Appraisal, Team Working, and "Other" personnel policies. Corporate innovation policies included Total Quality Management, World Class Manufacturing, Continuous Improvement/Kaizen, Business Process Re-Engineering, Change Management, Benchmarking, and "Other" high performance work systems. We created two scales—Personnel Policies and Corporate Innovation—by simply adding the dichotomous scores of each of the constituent items. A reliability analysis suggested that we could generate better scales by dropping the "other" categories from the two scales; these yielded a six-item Corporate Innovation scale with a Kuder-Richardson (KR20) score of .6, and a four-item Personnel Policy scale with a KR20 score of .45 with means of .4 and .6, respectively.[13] These reliability scores are somewhat low, so we tested the sensitivity of our model estimates to this "bundling" of corporate innovation and personnel policies by estimating separate models in which we specified each of the dichotomous items constituting each scale.

Table 1 also includes summary information on average labor cost[14] in the enterprises in 1993 and on the size of the enterprises, in terms of number of employees, again in 1993. To provide further insight into the dataset, we provide a correlation matrix in the Appendix.

In Table 2, we present the results of estimating equation (4) using three measures of training, without distinguishing between general and specific training. Given our primary interest in the effect of training, the results on this variable are most noteworthy. In two of the three models, training is seen to have a positive and statistically significant effect on productivity growth. The absence of apparent significance in the expenditure version may be related to measurement error; Fox (1995), in his write-up on the original survey, commented that this measure of training produced the most uncertain responses. Hence, we can say that we are finding the same effect as Holzer et al. (1993) and Bartel (1994). The coefficients of both investment and change in employment are measured with statistical precision, as can

[13]The Kuder-Richardson formula 20 score is more appropriate to estimate the reliability of scales composed of dichotomously scored items than the more familiar Cronbach's *alpha* for scales based on interval level data (Carmines and Zeller 1979).

[14]Labor cost is made up of wages/salaries, bonuses, social security, and pension contributions.

Table 2. OLS Models of Proportionate Change in Labor Productivity, 1993–1995. (N = 215)

Training Variable:	*Model (1) No. of Trainees/ Total Employment*		*Model (2) Training Days/ Total Employment*		*Model (3) Training Expenditure/ Total Employment*	
Indep. Var.	*Coefficient*	*t-Value*	*Coefficient*	*t-Value*	*Coefficient*	*t-Value*
Constant	–0.038	–0.458	–0.015	–0.194	–0.004	–0.055
Training	0.099*	1.828	0.014**	2.247	0.005	0.807
Chg. in Employment	–0.558***	–9.963	–0.556***	–9.985	–0.560***	–9.744
Investment	0.222***	4.458	0.209***	4.177	0.215***	4.223
Catering	0.024	0.233	0.016	0.155	0.013	0.127
Construction	0.090	0.792	0.074	0.660	0.069	0.604
Distribution	0.078	0.881	0.072	0.814	0.069	0.766
Finance	0.046	0.364	0.074	0.588	0.068	0.539
Manufacturing	0.087	1.074	0.076	0.948	0.087	1.064
Transport	–0.063	–0.416	–0.066	–0.434	–0.067	–0.432
Adjusted R^2	0.329		0.334		0.320	

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level (two-tailed tests).

be seen from their t-values across all specifications, and have plausible signs. Extra capital should increase labor productivity, so the positive investment coefficient is as expected. Employment increases would be expected to reduce productivity through either a diminishing returns effect or lower productivity of new hires, so the negative coefficient on employment change is also as expected. In general, the sectors do not seem to differ from the reference category ("other sectors") in terms of productivity growth; an exception to this will be seen in later equations, where the productivity growth rate of manufacturing is shown to exceed that of non-manufacturing at a statistically significant level.[15]

In Table 3, we present the results of the analysis when the training days variable is broken up into the general and specific training. The most interesting finding here is the differential effects of different types of training: the effect of general training is positive and statistically significant, while specific training has no statistically significant impact on productivity growth. It will be recalled that Black and Lynch (1996) also failed to find a statistically significant effect for some types of training. However, they did find that off-the-job training had a positive and statistically significant effect on productivity in manufacturing. Given that the bulk of off-the-job training is more likely to be general in nature, their findings are broadly consistent with ours.

In order to check the robustness of our models, we conducted sensitivity analyses in which we re-estimated Model (4) after dropping cases with outlying values. One particular concern was the substantial dispersion and skewness of the training variables. We excluded 15% of cases from the two extremes of the distribution of the total training days variable and 2 cases in which productivity gains in excess of 1 were reported. In no case did these re-estimations lead to any change in the pattern of results reported for the full viable sample.

The finding that specific training had no

[15]Huselid and Becker (1996) pointed out that the use of differenced equations in a panel data context can lead to measurement error. In order to broaden the analysis, we also estimated equations in which we related the level of productivity in 1993 to the level of training in 1993. No statistically significant coefficients for training emerged. Given that some firms may have undertaken training in 1993 because their productivity was particularly low, this lack of significance may not be surprising.

Table 3. OLS Models of Proportionate Change in Labor Productivity, 1993–1995, Differentiating General and Specific Training Days per Employee. (N = 215)

	Model (4)		*Model (5)*		*Model (6)*	
Indep. Var.	*Coefficient*	*t-Value*	*Coefficient*	*t-Value*	*Coefficient*	*t-Value*
Constant	–0.025	–0.321	–0.009	–0.709	–0.007	–0.088
General Training Days	0.034***	4.083	0.035***	3.931	0.033***	3.902
Specific Training Days	–0.016	–1.623	–0.016	–1.652	–0.017	–1.649
Chg. in Employment	–0.538***	–9.900	–0.551***	- 9.954	–0.554***	–10.032
Investment	0.212***	4.366	0.219***	4.443	0.212***	4.318
Catering	0.015	0.153	0.015	0.149	0.010	0.104
Construction	0.088	0.812	0.090	0.820	0.125	1.141
Distribution	0.077	0.896	0.086	0.987	0.100	1.155
Finance	0.084	0.115	0.916	0.862	0.136	1.025
Manufacturing	0.106	1.346	0.115*	1.724	0.134*	1.685
Transport	–0.061	–0.045	–0.301	–0.171	–0.054	–0.369
Large Firm		–0.040	–1.100		–0.046	–1.216
Corporate Restructuring		–0.062	–1.373		–0.062	–1.343
Corporate Innovation		0.011	0.641			
Total Quality Mgt.					–0.076	–1.275
World Class Mfg.					0.010	0.143
Continuous Improvement					–0.009	–0.130
Business Process Re-engineering					0.070	0.974
Change Mgt.					–0.031	–0.497
Benchmarking					0.070	0.944
Other Org. Policies					–0.094	–1.402
Personnel Policies		0.010	0.415			
Productivity Bonus					–0.183*	–2.507
Performance-Related Pay					0.107	1.436
Performance Appraisal					0.048	0.781
Teamworking					0.063	0.996
Other Personnel					–0.050	–0.612
Adjusted R^2	0.370		0.369		0.383	

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level (two-tailed tests).

effect on productivity growth is somewhat surprising. It could be argued that companies are more likely to understate the amount of specific training undertaken by them if such training is given on a more informal basis than general training. If this is the case, then we would expect the coefficient on specific training to suffer from upward bias; hence, this argument cannot explain why specific training is not observed to increase productivity.

Another possible interpretation of the non-significant productivity effect of specific training is that it represents a part of the normal operational expenses of a company, related perhaps to personnel turnover. It will be recalled from the discussion of the data above that although "trainees and apprentices" were excluded from the survey, incoming staff who did not fit the definition as set out in the instructions (see footnote 8) would have been included. Higher spending on specific training may then have arisen in an environment of high staff turnover, in an effort to maintain productivity levels. In contrast, general training may have represented an additional investment above and beyond normal operating requirements and so enhanced company performance.

As we do not have data on gross inflows and outflows of employees, we are not in a position to determine whether the provision of specific training is more highly cor-

related than general training with staff turnover. Looking at the correlation matrix in the Appendix, however, we can see that neither general nor specific training has a statistically significant correlation with net employment change, which casts doubt on the turnover argument. In order to test this somewhat more formally, we ran a model in which we interacted specific training with employment change. The interaction was not statistically significant, leading us again to conclude, with fair confidence, that the non-significance of specific training is not related to turnover.

The finding of a statistically significant effect of general training prompted us to ask whether general training was capturing the effects of other omitted variables that could have had effects on productivity growth over the 1993–95 period. In particular, it seemed possible that firms offering training that is general in nature may also employ a range of other policies that increase productivity. In addition, it could have been that large firms were more likely than smaller firms to be in a position to offer general training and to achieve productivity growth. In order to test for these possibilities, we included a series of variables measuring aspects of corporate organization. We included a dummy variable for large firms, where a large firm was taken to be one in which total employment exceeded the median, that is, 60 employees. We also included a dummy variable indicating whether a firm underwent some form of corporate restructuring during the 1993–95 period. Such re-structuring may have had a positive effect on productivity growth if the new management was in some sense "better" than the old; alternatively, a negative effect could be observed if a takeover or merger had a disruptive effect on the running of the enterprise.

In order to take account of the potential impact of the implementation of high-performance work practices, we included variables measuring the extent to which various corporate strategies and personnel polices had been introduced between 1993 and 1995. In Model (5) we include the two additive scales measuring the implementation of Corporate Innovations and new Personnel Policies as described above. Combining corporate innovations and personnel policies into bundles of policies entails some loss of information. For that reason, and also in view of the somewhat low reliability scores of the two scores, we instead control for each of these policies and programs as separate variables in Model (6).

Our concern that the general training variables might be picking up the effects of other company policies is dispelled by the results of Models (5) and (6). The coefficients of the general training variable change little when this new set of variables is introduced. Model (5) shows no discernible impact on productivity of corporate innovation, the introduction of new personnel policies, or the two in combination. These results contrast with Huselid's (1996). The lack of statistical significance here, however, may be related to a timing issue, in the sense that the period of observation may be too short for any positive effect of these policies to be felt. In addition, our measures are weak in the sense that they only indicate the presence of the policies and do not capture information on, for example, number of employees covered. When we examine the impact of the range of individual corporate strategies and personnel policies, the positive effect of general training is maintained, and the only personnel policy to have a statistically significant effect on productivity is the introduction of pay-related productivity bonuses, which has a *negative* productivity effect. This negative coefficient may reflect lower rates of productivity in firms resorting to productivity bonuses.[16] In both equations, the

[16]We also (a) measured personnel and innovation scales as simple dummies reflecting whether *any* of the constituent policies had been implemented, and (b) amalgamated the two scales into a single additive measure of corporate policy innovation (which generated a scale with a Kuder-Richardson reliability score of .65). The results from these trials were no more statistically significant than were the effects reported in Table 3.

Table 4. OLS Models of the Proportionate Change in Labor Productivity, 1993–1995, with the Addition of Interactions and an Average Labor Cost Control. (N = 215)

	Model (7)	
Indep. Var.	*Coefficient*	*t-Value*
Constant	−0.004	−0.041
General Training Days	0.027**	2.161
Specific Training Days	−0.015	−1.569
Change in Employment	−0.649***	−10.356
Investment	0.088	1.457
Chg. in Employment * General Training	0.022	1.542
Investment * General Training	0.063**	2.566
Labor Cost/Employee	0.001	0.240
Catering	−0.007	−0.073
Construction	0.056	0.525
Distribution	0.077	0.920
Finance	0.070	0.593
Manufacturing	0.098	1.288
Transport	−0.076	−0.530
Adjusted R^2	0.416	

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level (two-tailed tests).

effects of firm size and corporate restructuring were negative and non-significant.

At this juncture it is useful to recall that our principal rationale for exploring the effects of the range of organizational indicators was to ascertain whether the positive effect of general training on productivity growth might be due to other omitted factors that could have stimulated productivity growth. Controlling for organizational factors, we found that the effects of general training remain robust.

An additional line of inquiry into this general training effect was motivated in the following manner. We showed that the companies included in our survey increased both employment and capital assets by about 14% over the 1993–95 period (Table 1). In each of the estimated models, capital investment has a strong positive effect on productivity while the effect of increases in employment is negative. This led us to ask whether our findings of a positive effect of general training were concentrated among firms with an expansion strategy based on increased capital investment rather than employment growth. Thus, for example, if general training mostly took place in companies with high levels of capital investment, then the existence of a strong interaction might produce a positive effect of general training. To investigate this possibility more formally, we specified a series of interaction terms between general or specific training days with both investment and employment.

At this point, we also include a measure of the level of human capital in the enterprises in 1993. It can be argued that there is likely to be a complementarity between enterprise-provided training and education, in the sense that training will be more effective when given to employees with higher initial levels of education. Once again, if general training is more likely to be given in firms where the employees are more highly educated, this association could be driving our results. To test for this possibility, we include labor cost per employee as an explanatory variable, on the assumption that higher average labor costs reflect higher levels of human capital. We report the results in Table 4.

In model (7) the interaction between change in capital and general training is positive and statistically significant; neither labor cost per employee nor the general training/change in employment interaction is significant. The coefficient for general training is reduced, as is its statistical significance, but it still remains significantly different from zero at the 5% confidence level. The impact of capital investment is now seen to be statistically equal to zero; this indicates that the positive effect of investment is strongly related to accompanying general training. The payroll per employee variable has little impact on the model; we ran an additional model in which it was interacted with general training, but again the coefficient on the interaction was not statistically significant. Hence, we are once again left with the conclusion that general training promotes productivity growth more strongly than does specific training.

Discussion and Conclusions

Our primary purpose in this paper has been to apply the familiar theoretical distinction between general and specific training to the empirical task of estimating the returns to in-company training. Using a firm-level data set, we first estimated the effect of all training on productivity growth and found a positive and statistically significant effect. The fact that the data distinguished between general *versus* specific training provided us with an opportunity to test for differential effects of the two types of training on productivity growth. We find that specific training has no statistically significant effect on productivity growth, but general training has a statistically significant positive effect—one that remains when we control for other workplace policies and corporate re-structuring, for firm size and existing level of human capital, and for interactions between general training and investment and employment growth.

What can we conclude from these results? Our interpretation of why general training has a stronger impact than specific training on productivity growth draws on Becker's insight into differences between the incentives for general training and those for specific training, but also focuses on employee responses to different types of training. If we accept that general training can be of value to the employee outside the present employment, and assume that employees are aware of this, then it seems reasonable to suggest that they react differently to the provision of the more valuable form of training.

First, let us regard training as a production activity with human capital as the output. The output stems not simply from the employer's investment in training, but from a joint effort by employer and employee. The employer can provide the classes or the demonstrations, but the extent to which such activities are turned into human capital depends on the extent to which the employee devotes effort to learning and applying the new skills. Different kinds of training can create differing incentives for employees to exert effort in training. Because of its transferability, general training provides the additional benefit of enhanced employability. Should the employee be laid off or wish to leave the current employer, the general training acquired can be used elsewhere while specific training cannot. In this way, as long as there is a positive probability of separation from the current employer, even a risk-neutral employee will gain a greater expected benefit from general training. As such, employees are likely to devote greater effort to general training than to specific training; and an investment in any quantum of general training will produce more human capital than an investment in the equivalent quantum of specific training. This in turn leads to higher productivity effects of general training.

Our second interpretation of the relative impact of general and specific training also focuses on employee responses to training but derives from the efficiency wage literature and the literature on psychological contracts. Akerlof (1982) proposed the idea that firms may pay employees above the going wage and that this payment is essentially a gift. Employees respond by offering a gift in return, consisting of increased effort. We would argue that general training can be viewed as a gift from the employer to the employee. Employees who receive general training realize that it is useful outside the firm and are thus more likely to regard it as a gift. They increase their effort in exchange, leading to increased productivity.

If workers perceive general training as a gift, they may also view it as a signal of commitment on the part of the employer. In the terminology of Rousseau (1995), the provision of general training forms part of the psychological contract between the employer and the employee. The employee interprets the provision of general training as an unwritten sign from the employer about the nature of their relationship. The employee may thus interpret the provision of general training to mean that the employer sees the employee as being a core member of the organization, meaning that

his or her position is more permanent than others'. The employer's lack of concern about the portability of the general training may be viewed by the employee as signaling confidence that the employee will remain with the firm. By sending such a signal and fostering a sense of belonging to the organization, the employer can earn the employee's loyalty. This is almost the contractual equivalent of a self-fulfilling prophecy in the sense that the employees' belief in attachment to the organization leads them to remain with the organization, and their feeling like "insiders" leads them to exert more effort and to raise productivity. This view of general training is at odds with the Becker approach, which sees general training as increasing the likelihood that an individual will leave a firm. Our interpretation regards the employment relationship as more complex and of longer duration than the spot labor market assumed in Becker's model.

Even where the employer engages in transactional rather than long-term relational contracts (we again make use of Rousseau's 1995 terminology), provision of general training may still engender a productivity-enhancing response from the employee. While the employer is not contracting to offer the employee long-term employment, the employee can see that subsequent employability will be enhanced by general training, and responds to the employer's gesture by exerting more effort in a way that may not arise if a more functional approach were taken to what is still essentially a transactional relationship. In this way, the employer can enjoy the benefits of a flexible work force while at the same time reducing the costs associated with employees who feel disconnected from the organization.

A number of important implications flow from these results. As with the work of Sandra Black and Lisa Lynch, we have shown that different dimensions of training can have different effects. While they, and others, looked at the distinction between on-the-job and off-the-job training, the results here show that when we are assessing effects on productivity growth, the crucial distinction may be that between general and specific training. Our proposed explanations point to the need for a clearer understanding of precisely how training is translated into productivity increases. As regards the work that looks at the relationship between training and wages, differing productivity effects of general and specific training have clear implications for wages post-training. For this reason, our findings should be factored into models that examine wages pre- and post-training when trying to establish if employers share training costs.

Appendix

Correlation Matrix

	Productivity Change	Training Days/ Employees	General Training Days/ Employees	Specific Training Days/ Employees	Investment	Change in Employ.	Personnel Policies	Corporate Innovation	Corporate Reorg.	Labor Cost/ Employees	Large Firm
Productivity Change	1										
Training Days/ Employees	0.14**	1									
General Training Days	0.24***	0.78***	1.000								
Specific Training Days	-0.06	0.70***	0.15**	1.000							
Investment	0.16**	0.13*	0.09	0.08	1.000						
Chg. in Employ.	-0.53***	0.05	-0.01	0.09	0.15**	1.000					
Personnel Policies	-0.04	0.04	0.03	0.02	0.02	0.14**	1.000				
Corporate Innovation	0.01	0.06	0.01	0.07	-0.05	0.04	0.33***	1.000			
Corp. Reorganization	0.00	-0.06	-0.05	-0.02	0.10	-0.08	0.17**	0.20***	1.000		
Labor Cost/ Employees	0.09	0.09	0.10	0.05	-0.17**	-0.13**	-0.03	0.20***	0.10	1.000	
Large Firm	-0.06	0.03	-0.03	0.04	-0.08	-0.04	0.04	0.14	0.10	0.28***	1.000

Note: Only the training days per employee measure is shown.

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