FORMAL TRAINING, TEMPORARY CONTRACTS, PRODUCTIVITY AND WAGES IN SPAIN†

Alfonso Alba-Ramirez

I. INTRODUCTION

Much analysis has focused upon the individual's decision to invest in human capital and its consequent effects on earnings (Mincer, 1974; Lillard and Tan, 1986; Barron *et al.*, 1987 and Lynch, 1989). Yet, we know little about the determinants and effects of formal training when provided by employers and analysed from the perspective of firms.[1] Most developed countries have implemented household surveys to obtain information on schooling and earnings, and less frequently on job training. Besides, questions related to human capital investment are rarely included in establishment surveys. Consequently, the dearth of data can partly explain the absence of empirical research on the firm's decision to provide formal training and the effect that training may have on economic performance.

An important difference between a person's decision to invest in education and an organization's decision to invest in training is that the period of expected return is more uncertain for the organization than for the individual. Discouraged by such an uncertainty, some firms refrain from making any training commitment and rely on the educational system at large or on other firms in obtaining trained workers. Otherwise, the relationship between the employer and the trainee in bearing the costs and reaping the benefits of undertaking training becomes paramount.[2]

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[1] As an exception, Bartel (1989) analyses company-based training by using an econometric framework where the firm is the unit of analysis, while Bishop *et al.* (1985) analyse a firm-based data set containing training information only on the most recently hired employees.

[2] Becker (1962) and Oi (1962) stress the role of firm-specific elements in the relationship between the employer and the trainee. In this article, we refer to training as that provided through organized courses or programmes within the firm.

Two questions are relevant: First, are there appreciable differences between firms which provide training and firms which do not? Secondly, does training have a significant effect on productivity and wages? The first question can be investigated where the typical firm assesses the costs against the returns of training its workers. We observe an absence of training when the firm finds that providing it turns out to be virtually unprofitable. The second question addresses the core of the current debate on how countries can improve productivity and economic performance (Dertouzos *et al.*, 1989).

It is often pointed out that workers in entry-level jobs who receive training in the workplace, and senior employees who experience an environment of continuous learning, are more flexible in performing tasks that present frequent contingencies. Moreover, labour psychologists emphasize that peoples' better understanding of their jobs makes them more responsible and satisfied at work. In a world of fast-paced technological change, the necessity of training is deemed to be enhanced: multiple skills, teamwork, responsibility and cooperation on the workplace are increasingly gaining terrain in more advanced enterprises. Favourable task planning, adequate incentives and a satisfactory compensation system become some of the necessary complements to a motivated and productive labour force. These values in human resources development critically depend upon well-educated and trained employees.

In order to obain a quantitative response to the two questions posed, we use 1989 training data provided by medium- and large-sized firms in Spain. We first ascertain the characteristics of the firms which provide training, as opposed to those which do not. We then analyse the effect training has on labour productivity, as measured by sales as well as by value added per employee. Finally, we estimate wage equations to assess the relationship between training and firms' average wage. Our results indicate that larger, more capital-intensive and foreign-owned firms are the most likely to provide training. Moreover, firms undergoing technological change, employing workers in higher occupational categories, practising profit-sharing and more intensively using some forms of public employment-training programmes are also more likely to train their workers than are other firms. More importantly, we find evidence showing that the proportion of senior employees receiving training has a positive effect on labour productivity and wages.

In the following section, we develop the framework. In Section III, we explain some features of the relevant labour institutions in Spain. We offer a description of the data in Section IV. In Section V, we present estimations and discuss the results. Finally, in Section VI, we draw some conclusions.

II. CONCEPTUAL AND EMPIRICAL FRAMEWORK

What underlies a firm's decision to provide its employees with training? Among those which do, what determines the intensity of training provided? The problem can be formulated in terms of the typical profit-maximizing firm. Since training expenditures represent a cost for the firm, the amount of training per employee will be such that the marginal cost equals the marginal return, where the latter is the increase in the average product per worker for each unit of training provided by the firm. In a life-cycle approach, the equilibrium implies that the marginal return on a current expenditure in training equals the discounted sum of successive increases in the average product of labour over an employee's time with the firm. We should keep in mind, however, that measuring the firm's return to training through output excludes any observable improvement in its product quality. Such improved quality may not necessarily be reflected in the price of the product if the industry is highly competitive and the firm's goal is to gain an edge in the market.

The first issue to be considered is whether or not a company provides formal training. Indeed, for some firms we observe an absence of formal training. Thereafter, we can assess the intensity of existing training by examining the proportion of workers who receive training, firms' expenditures and/or other indicators of how much training is provided. Nevertheless, if training increases the quality of an employee's work performance, we might ask ourselves why it is that some firms do not train their workers. According to the model of profit maximization, one possible reason can be that, in the non-training firms, the average output per worker is highly unresponsive to expenditures in training. Another reason could be that it is cheaper for the firm to hire trained workers from other firms than to train newly hired workers. Moreover, informal on-the-job training may be a better substitute for formal training in these non-training firms.

We make a distinction between training received by junior employees (newly hired workers) and training received by senior employees (retraining). This distinction is relevant for several reasons. First, the amount of training devoted to junior employees is associated with the firm's level of employment creation. Secondly, the effect of both types of training on productivity and wages may differ according to reasons for and nature of the training courses offered. Thirdly, training is concentrated among those workers who have been with the firm for a longer period of time (retraining). The firm's uncertainty with respect to reaping the benefits of training might be lower when training is directed at senior employees who have shown a longstanding commitment to the company. Fourthly, retraining can be a basic need of the firm in order to implement technological change and make use of its internal labour market.

Among factors affecting the responsiveness of a firm's output to the amount of training provided, we consider the following: (1) The size of the firm: it is well known that job turnover is lower among larger firms (Oi, 1983a), so that the employer can reap the benefits of training in the long term. It is also true that more training in larger firms leads to longer job tenure. Moreover, larger firms may regard training as a way to reduce monitoring costs. (2) Intensity of capital: since the complexity of tasks, i.e.

operation of machinery by workers, is greater among capital-intensive companies, these are expected to require a more qualified labour force. (3) Technological change: a new product and/or production process requires enhanced or new skills. The degree of success in implementing such technological change depends upon the adaptability of workers to deal with novelty in the workplace. (4) Formal education of employees: the effectiveness of training on work performance greatly depends upon the capacity of workers to learn and use that knowledge. This capacity is increased by workers' higher levels of formal education. Thus, a more educated worker makes more valuable the firm's investment in training. (5) Management: a well managed company has greater success in developing its human resources. Our only observable indicator with respect to the firm's management characteristics is ownership. (6) Characteristics of employment contracts: as we will explain in the following section, Spanish labour law offers a varied menu of employment arrangements, some of which contemplate or enforce the provision of training by the firm. (7) Product competition: a higher intensity of domestic competition and participation in international markets make it more likely that the firm offers training. (8) The degree of workers' commitment to the firm: this is assumed to relate to the degree of employees' participation in decision-making, and whether or not there is a profit-sharing agreement with the company.[3]

We will analyse these and other factors as they relate to firm-based training in two different ways: first, by using a probit model in which the outcome variable indicates whether or not the firm provided any training at all and whether or not a particular type of training was provided; second, by conducting a tobit analysis in which the dependent variable is either the proportion of junior employees or the proportion of senior employees who received training within the firm.

Training, Labour Productivity and Wages

To ascertain the effects of formal training on employees' productivity, we consider a Cobb–Douglas production function with two inputs: capital, K, and effective labour, L. Effective labour measures the increase in the quality of labour as a result of training:[4]

$$L = R\,e^{(at+br)} \tag{1}$$

[3] The turnover rate is another variable that affects firm-supported training: when a trained worker quits his job, it implies the loss of the investment by the firm, and impedes higher work efficiency resulting from additional training directed at the same worker. Although a high turnover rate thus discourages firm-supported training, it is also likely that specific training increases workers' long-term employment with the same firm. This two-way relationship between training and turnover advises against the inclusion of the turnover rate among the independent variables of the training equation.

[4] This methodology has been used to address the labour productivity effects of schooling (Griliches, 1970), research and development (Griliches and Mairesse, 1984), and training (Bartel, 1989). A Cobb–Douglas production function has proved to be useful, sometimes under the assumption of constant returns to scale.

where R is the number of workers employed, t and r are, respectively, the proportions of junior and senior employees receiving training, and a and b indicate the training effects on the quality of labour. So long as a and b are positive numbers, it is clear in equation (1) that more training leads to more effective labour. The production function can be written as

$$Q = AK^{\alpha}L^{\beta} \tag{2}$$

By substituting (1) into (2) results in

$$Q = AK^{\alpha}[R\,e^{(at+br)}]^{\beta} \tag{3}$$

Equation (3) can be expressed in terms of output per worker:

$$Q/R = AK^{\alpha}R^{\beta-1}\,e^{\beta at+\beta br} \tag{4}$$

By taking logarithms, the equation to be estimated becomes the following (error term omitted):

$$\ln(Q/R) = \ln A + \alpha \ln K + (\beta - 1)\ln R + \beta at + \beta br \tag{5}$$

This equation provides the basic framework that allows us to address the effect of formal training on labour productivity. In addition, we investigate how training is related to wages. Training is deemed to link wages with productivity. In fact, the lack of an objective measure over productivity has made the assessment of the effects of training on productivity possible only in terms of its effects on wages. By using data drawn from a cross-section sample of medium- and large-sized firms in Spain, we are able to compare the results of estimating the effects of training on both productivity and average wage.

III. THE INSTITUTIONAL CONTEXT: TRAINING AND APPRENTICESHIP CONTRACTS

Unemployment in Spain began to rise in the mid-seventies and peaked in 1985, when almost 22 percent of the labour force was jobless. In the second half of the 1980s, employment steadily increased, notably through fixed-term (temporary) employment contracts. Spain's recent labour market developments highlight the institutional conditions in which firms have operated. By understanding those conditions, we can better assess their possible effects on company-based training.

Convinced that high unemployment was caused by rigid employment relationships and an exceedingly expensive labour force, the Spanish government established the Employment Promotion Programmes, in place by the end of 1984. Extensive economic measures were implemented: some were aimed at making labour more flexible through temporary and part-time contracts; others were intended to lower the costs of new hires by way of subsidies, reductions in firms' Social Security contributions and corporate income tax reliefs. While the measures to increase flexibility in hiring and firing applied to all workers, those accompanied by economic incentives were targeted for the benefit of specific groups: youth, long-term unemployed

adult workers, disabled persons and women in underrepresented occupations.

Two types of fixed-term contracts are particularly relevant to this work: training contracts and apprenticeship contracts. These types of contracts were contemplated under certain conditions in the Workers Statute of 1980. Since then the legislation has been modified several times. The description that follows is based on its status in 1988. These contracts were intended to ease the entry of youth into the labour market. They can be extended for a minimum of three months and a maximum of three years. The training contract (*contrato en prácticas*) is applicable only within the first four years following graduation from an academic or vocational institution. Its objective is primarily to place the worker in a job in which he or she can apply the professional training previously received. In 1988, one major restriction placed on eligibility for training contracts was that the worker must be a first-time job seeker, unemployed for at least two years. On the other hand, the apprenticeship contract (*contrato para la formación*) was conceived as a way to complement work with training. Only workers between ages 16 and 20 are eligible for apprenticeship contracts. The time devoted to training must be from one fourth to one half of the total time considered in the contract, and the worker is compensated only for hours of effective work.

The economic incentives for firms to implement these contracts are the following: (1) Training contracts reduce employers' contributions to the Social Security by 75 percent, and are proportionately subsidized in sums ranging from 120,000 ptas. to 280,000 ptas., depending on their initial duration. (2) Apprenticeship contracts lower the employers' Social Security contributions by 90 percent, or even 100 percent if the firm has fewer than 25 employees. Apprenticeship contracts are subsidized at 90 ptas. per training hour per worker when that training is provided by the employer through a program approved by the government employment office, INEM (National Institute of Employment).

IV. THE DATA

The data used in this study are drawn from a yearly survey carried out since 1979 by the Spanish Ministry of Economics and Finance, entitled 'Collective Bargaining in Large Firms' (hereinafter NCGE).[5] Its main objective is to follow the evolution of collective bargaining in medium- and large-sized firms in Spain. The NCGE survey includes companies with 200+ workers[6] and contains detailed information about their economic characteristics and industrial relations practices. The questionnaires are sent to the company executives who, in many cases, have developed computerized methods in responding to survey questions. In the last five years, the average number of companies to which yearly questionnaires were sent amounted to 2,000, and the average response rate per year has been higher than 30 percent.

The NCGE survey provides detailed information on economic sector, company ownership, percentage of output exported, sales, value added, value of the fixed capital stock, number of employees, average number of hours worked per employee, hires and dismissals throughout the year, professional categories and other variables regarding collective bargaining practices. Moreover, some aspects pertaining to the company's implementation of new technologies are reported.

In 1988, the NCGE survey for the first time incorporated questions on human resources practices. In 1989, those questions were refined and others, addressing technological changes within the firm, were added. The following questions related to training were asked of all the firms in 1989:

(1) How many workers in entry-level jobs have attended training courses in 1988?
(2) How many senior workers have attended training courses in 1988?[7]

Since the variable training refers to 1988, it measures gross investment in training and not the stock of trained workers. This latter variable is not available in the data. However, training in 1988 can be taken as a proxy for training on other years. We can check this assumption by using additional information contained in the data set. Namely, firms were asked about ongoing training in the year of the survey (1989). This allows us to compare firms' training activities in 1988 and 1989. About 58 percent of companies reported training in both years, and 39 percent indicated that they did not train their employees in either year. This result suggests that firms which train workers in a given year are more likely to do so on a regular basis.

The sample we use includes some six hundred firms. It is fairly representative of the non-agricultural firms having 200+ employees in Spain. This firm size segment comprised about 35 percent of the total non-agricultural employment in 1988. Our sample of firms employed a total of approximately 930,000 workers, representing almost 45 percent of the labour force employed by non-agricultural firms of 200+ employees. Other characteristics, like firm distribution by size, sector, ownership and geographical location, are close to those of firms with 200+ employees.

Although Spanish employment is mainly concentrated among small firms, it is difficult to obtain information from these, often economically at risk,

[5] I thank Antonio García de Blas, Luis Albentosa, Valeriano Muñoz and Julio Sánchez, of the Ministry of Economics and Finance, for their help in providing these data.

[6] Due to employment adjustments, about 5 percent of the firms in the sample had fewer than 200 employees in 1988. Approximately 53 percent of the firms had fewer than 500 workers, 24 percent had more than 1,000, 4 percent had more than 5,000, and only six firms exceeded 20,000 employees. The largest company employed 64,148 workers in 1988.

[7] Two other questions were also included in the 1989 questionnaire: (a) How many hours per worker were devoted to training in 1988?, and (b) What was the cost of training courses attended by workers in 1988? The firms' difficulties in answering these questions, reflected in the frequency of missing values, induced us to set them aside for future analysis.

establishments. However, the availability of data on larger firms permits us to improve our understanding of the primary source of economic leadership. Needless to say, medium- and large-sized firms tend to employ an important proportion of the Spanish labour force.

V. ESTIMATION AND RESULTS

In this section we offer empirical evidence in addressing three questions as they relate to formal training provided by medium- and large-sized firms in Spain: (1) What determines firm-based training? (2) Does training have a significant effect on average output per worker? (3) Does training affect the average wage within the company?

We note that approximately 59 percent of the companies in our sample provided formal training in 1988, and the average percentage of workers involved amounted to 15.9 percent, 83 percent of whom were senior employees (see Appendix).

Probability of Firm-Based Training

Table 1 displays the results of estimated effects of a number of factors on the probability of firm-based training. The first three columns present estimates of a probit model. The dependent variable takes on the value one if any firm-based formal training existed in 1988 (column 1), if any junior employees received training in 1988 (column 2), and if any senior employees received training in the referred year (column 3). Zero applies otherwise. The fourth and fifth columns present the results of a tobit model in which the dependent variable is defined as the proportion of junior employees who have received training (column 4) and likewise for senior employees (column 5). Both proportions are taken over each firm's total number of employees.

Our discussion in Section II has served as a guide for choosing the explanatory variables included in the regressions. They can be described as follows: (1) size of the firm: log number of employees; (2) intensity of capital: value of fixed capital stock per employee; (3) technological change: a dummy which takes on one if the firm has launched a new product or implemented a new production process; (4) occupational distribution of employees: fraction of high-level managers, fraction of medium- and lower-level managers and fraction of clerical workers; (5) management: we identify managerial characteristics by private, public or foreign ownership (ownership is defined by existing control of 50 percent or more of capital); (6) characteristics of labour contracts: fraction of temporary contracts existing as of 7/31/88, fraction of newly hired temporary workers, and fraction of those newly hired temporary workers who have training and apprenticeship contracts in 1988; (7) competition: fraction of output exported. (8) workers' commitment: fraction of employees covered by a profit-sharing agreement; and (9) finally, sectoral differences: nine economic sectors are considered.

The results reflected in Table 1 support the hypothesis indicated in Section II. Namely, larger, more capital-intensive and foreign companies are more likely to provide training. Furthermore, companies experiencing technological change, exporting a greater proportion of output, having more employees in higher occupations and practising some form of profit-sharing are more likely to train their labour force.[8] An interesting finding, although not surprising, is that those firms which have hired a relatively greater number of temporary workers under training contracts are more likely to have provided their employees with training regardless of the dependent variable definition. When the dependent variable in the tobit model is defined as the proportion of junior employees who have received training, the proportion of fixed-term contracts among the firm's total number of employees and the proportion of apprenticeship contracts among newly hired workers obtain positive and significant coefficients. Note that, in all the regressions, we have controlled for the relative weight of fixed-term employment contracts among firms' overall employment and among newly hired workers. By newly hired workers, we refer to those who have been hired throughout 1988.

By estimating tobit models, we are able to highlight some differences between the factors which determine the type of training provided. The capital-labour ratio, the distribution of employees by occupations and the proportion of profit-sharing employees within the company are very significant in explaining the proportion of senior employees who received training. The same variables are insignificant, however, in explaining the proportion of junior employees who received training. It is to be noted that, in this sample of medium- and large-sized firms, the percentage of temporary contracts among newly hired workers is 64 percent and the percentage of temporary contracts within those compay payrolls is about 12 percent. Only 2 percent of newly hired workers with a temporary contract are of the apprenticeship variety; whereas, the proportion of training contracts among newly hired temporary workers amounts to 17 percent (see Appendix).

These results are consistent with the hypotheses advanced in Section II. Furthermore, such results indicate that the public employment-training policy has been effective in fostering firms' provision of training by firms to younger workers. Nevertheless, we suggest a more probing analysis to reach further conclusions on this particular and important issue.

The Effect of Training on Labour Productivity and Wages

Equation (5) constitutes the basic specification of the production function to be estimated by using the ordinary least-squares methodology. The results are presented in Table 2. We have considered two measures for the firm's

[8] We also ran OLS regressions in which the dependent variables represented the proportions of workers who were trained. The results were similar to those obtained with the probit and tobit models.

TABLE 1
The Determinants of Firm-Based Training

	Probit			*Tobit*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log number of employees	0.30891 (4.51)	0.23290 (3.97)	0.25621 (3.94)	0.01791 (2.58)	0.07012 (5.94)
Log stock fixed capit. per employee	0.05045 (0.94)	0.06985 (1.27)	0.06150 (1.15)	0.00828 (1.19)	0.03651 (3.20)
= 1 if foreign owned company	0.41726 (2.76)	0.15587 (1.07)	0.42458 (2.87)	0.02853 (1.59)	0.05051 (1.65)
= 1 if public owned company	0.33800 (1.59)	−0.14658 (−0.73)	0.49585 (2.38)	−0.01770 (−0.70)	0.10424 (2.59)
= 1 if technological change took place	0.73642 (5.55)	0.60560 (4.97)	0.76089 (5.83)	0.06880 (4.59)	0.14813 (5.75)
Fraction of output exported	0.66308 (2.00)	0.20461 (0.66)	0.37332 (1.15)	0.00154 (0.04)	0.07930 (1.22)
Fraction of temporary employees	0.24039 (0.51)	0.74432 (1.59)	−0.18138 (−0.38)	0.15863 (2.70)	−0.02830 (−0.27)
Temporary employees/ newly hired workers	−0.05269 (−0.25)	0.04994 (0.22)	0.04143 (0.19)	0.00472 (0.16)	0.03651 (0.80)
Training contracts/ newly hired temporary workers	0.58774 (2.31)	0.49037 (2.10)	0.62686 (2.53)	0.08068 (2.82)	0.11497 (2.39)
Apprenticeship contracts/newly hired temporary workers	−0.06126 (−0.09)	0.67821 (1.11)	−1.43973 (−1.80)	0.17771 (2.40)	−0.25538 (−1.43)
Fraction of high-level managers	2.64113 (3.69)	1.54776 (2.58)	1.82976 (2.88)	0.23002 (3.24)	0.30196 (2.48)
Fraction of medium- and lower-level managers	1.35824 (3.11)	0.81004 (1.91)	1.59518 (3.71)	0.08004 (1.51)	0.40269 (4.56)
Fraction of clerical workers	1.52907 (2.13)	0.77580 (1.18)	1.79481 (2.52)	0.11656 (1.47)	0.50411 (3.76)
Fraction of employees sharing profits	0.66853 (2.67)	0.29359 (1.45)	0.76302 (3.10)	0.02635 (1.17)	0.08658 (2.22)
Constant	−3.51826 (−5.01)	−3.64761 (−5.10)	−3.33415 (−4.79)	−0.41425 (−4.53)	−1.01791 (−7.00)
Sigma-square				0.01846 (9.35)	0.06565 (12.06)
N	595	595	595	595	595
Log likelihood	−304.6	−326.0	−309.2	−44.7	−162.3

Notes:
1. The dependent variables are: (1) = 1 if any employees trained and zero otherwise; (2) = 1 if any junior employees trained and zero otherwise; (3) = 1 if any senior employees trained and zero otherwise; (4) proportion of junior employees trained; (5) proportion of senior employees trained.
2. All equations include 8 sector dummies.
3. *t*-statistics are in parentheses.

TABLE 2
The Effects of Training on Labour Productivity: OLS Estimates

	Log sales per employee		*Log value added per employee*	
Dependent variable:	*(1)*	*(2)*	*(3)*	*(4)*
= 1 if existence of firm-based training		0.28343 (4.20)		0.23114 (3.68)
Proportion of junior employees who received formal training	0.34210 (0.79)		0.27962 (0.69)	
Proportion of senior employees who received formal training	0.80526 (4.97)		0.77384 (5.13)	
Log number of employees	−0.30748 (−7.39)	−0.30244 (−7.22)	−0.25359 (−6.58)	−0.24613 (−6.30)
Log stock of fixed capital value	0.25832 (10.67)	0.26859 (11.13)	0.26037 (11.53)	0.27275 (12.06)
Constant	7.59104 (29.39)	7.35826 (29.43)	6.23892 (25.97)	5.98391 (25.65)
N	596	596	587	587
R-square	0.23	0.22	0.27	0.25

Note: *t*-statistics are in parentheses.

output per employee: sales per employee and value added per employee. Two variables are deemed to reflect the intensity of training: the proportions of junior employees and of senior employees who, respectively, participated in training courses, as reported by the company. Alternatively, we use a dummy to indicate the existence or not of firm-based training of any type. The variable capital (K) is value of the fixed capital stock, and the variable labour (R) is number of employees.

The results recorded in Table 2 show strong support for a positive effect of training on labour productivity, although such an effect takes place only through the proportion of senior employees who received formal training. The coefficients for the proportion of junior employees who received formal training are insignificant (columns 1 and 3 of Table 2). Furthermore, there is clear evidence of constant returns to scale in the estimated production function: $\alpha = 0.26$ and $\beta = -0.31 + 1.00 = 0.69$. The same results hold when the dependent variable is taken as log value added. Also, it is to be noted that the coefficients for the proportions of senior employees who received training are very close to the coefficients for the log number of employees plus one; meaning that b, the effect of this type of training on the quality of labour, is approximately unity. This result implies that the higher the proportion of workers receiving training the more effective will be successive increases in training.[9]

The high estimated coefficient of the variable reflecting the firm's training provided to senior employees suggests the existence of bias in the estimated effects of training on the firm's productivity. A primary cause of bias can be the omission of relevant variables in the determination of firms' output.

Table 3 presents the results of estimating the specified production function controlling for other variables that may affect productivity. When we control for other variables, the coefficient for the proportion of senior employees who received training remains positive but significant only at a 10 percent level, diminishing from 0.77 to 0.30 where the dependent variable is log value added. This result is not surprising, given the variables added up in equation (5) are highly correlated with the percentage of workers attending training courses, as seen in Table 1.

Some results with regard to the added variables are worthy of mention. We find that foreign-owned firms and, above all, those with more employees in high occupational categories have higher average productivity than comparable firms.[10] The three categories reflecting the occupational distribution of employees, namely, the fraction of employees in high-level management, medium-lower-level management and clerical occupations (fraction of production workers omitted), are included in the regressions to control for productivity effects of differences in the labour force quality not attributable to training. It is likely that training is linked to firms' promotion of workers. By receiving training some employees have higher chances of ascending their career ladder. In the NCGE, however, the occupational classification is partly based on employees' formal education. Specifically, employees occupying high-level managerial positions are university graduates, while most medium- and lower-level managers possess three years of formal post-secondary education.

Another important source of bias can be the following: if the error term is correlated with the training variables, we obtain inconsistent estimates for the effects of training on productivity. This can happen if training is measured with error and/or if training is determined simultaneously with other independent variables, e.g., the occupational structure or formal education of labour force. The firm's decision to invest in training and the selection of workers to receive training are likely to be related to employees' education level and occupational distribution. In such case, we cannot treat training as an exogenous variable and apply the OLS estimation method.

In fact, the firm's benefit from training is enhanced when training is aimed at the employees who have a greater capacity to learn and are so strategically placed in the company that they apply their new skills more effectively.

[9] Note that the elasticity of L with respect to t in expression (1) is bt.

[10] That the constant returns to scale of our estimated production function are more apparent when these additional variables are included in the regression.

TABLE 3
The Effects of Training on Labour Productivity: OLS Estimates

Dependent variable:	*Log sales per employee*	*Log value added per employee*
Proportion of junior employees who received formal training	−0.09602 (−0.25)	−0.01356 (−0.03)
Proportion of senior employees who received formal training	0.24598 (1.66)	0.30106 (2.01)
Log number of employees	−0.25151 (−6.60)	−0.21996 (−5.73)
Log stock of fixed capital value	0.24153 (10.28)	0.23430 (9.87)
Log average hours worked during the year	1.46032 (2.55)	1.42532 (2.48)
Rate of capacity utilization	0.29560 (1.98)	0.40551 (2.72)
= 1 if foreign owned company	0.14223 (2.10)	0.16101 (2.37)
= 1 if public owned company	−0.09544 (−1.04)	−0.06854 (−0.74)
= 1 if technological change took place	0.03756 (0.65)	−0.06694 (−1.15)
Fraction of output exported	0.19535 (1.40)	0.10857 (0.77)
Fraction of temporary employees	−0.26760 (−1.24)	−0.38028 (−1.75)
Temporary contracts/ newly hired workers	0.22808 (2.40)	−0.29933 (3.14)
Training contracts/ newly hired temporary workers	−0.17792 (−1.62)	0.16507 (1.47)
Apprenticeship contracts/newly hired temporary workers	−0.54900 (−1.87)	−0.26172 (−0.89)
Fraction of high-level managers	1.20128 (4.30)	1.02311 (3.52)
Fraction of medium- and lower-level managers	1.18102 (6.18)	0.59654 (3.07)
Fraction of clerical workers	1.16701 (3.89)	0.76652 (2.51)
Constant	−4.00574 (−0.94)	−4.58766 (−1.07)
N	593	584
R-square	0.494	0.438

Notes:
1. All equations include 8 sector dummies.
2. *t*-statistics are in parentheses.

Furthermore, training can affect the occupational distribution of employees if those trained are promoted to higher-ranked occupations. A way to tackle this crucial problem consists of treating the proportion of senior employees who have received training as an endogenous variable. Having the appropriate instruments, the production function can be estimated by using the two-stage least-square methodology. Although we tried several possibilities, none was satisfactory in terms of having instruments that were independent of the error term in the production function.

To what extent are we able to capture the effect of training on labour productivity with aggregate measures for both training and productivity? As Oi (1983b) points out, '... firm-specific dimensions of workers' value to their employers are largely neglected in conventional measures of labour productivity. Reliance on conventional measures thus tends to understate the impact of firm-specific training on total labour productivity'.

The NCGE survey contains detailed information on wages, allowing us to further analyse the effects of firm-based training on labour productivity. We can do so if labour productivity and wages are highly correlated across firms, and thus the average wage is a better indicator of workers' value to their employers than sales or value added per employee.

Columns 1 and 2 of Table 4 present the results of estimating wage equations which are different from one another only with regard to the definition of the dependent variable: average annual wage and average hourly wage paid by the firm.[11] The coefficient for the proportion of senior employees who received formal training is positive and significant for both of these specifications.

Other results indicate that the following characteristics are associated with higher paying firms: larger, more capital-intensive, higher rates of capacity utilization and a greater fraction of fixed-term contracts among newly hired workers. Furthermore, the following variables obtain a negative and significant coefficient: fraction of fixed-term contracts within firms' payrolls, fraction of apprenticeship contracts among newly hired temporary workers and dummies indicating that the representatives of the Labourer Commissions (CCOO) or those of the General Union of Workers (UGT) are a majority at the bargaining table. CCOO and UGT are the two major unions in Spain. Their representatives and those of other worker organizations constitute the works councils in firms employing 50 + workers. With respect to employees, the negotiation commission is formed under the works council agreement, and it is composed of 12 to 15 members.

The estimates of formal training effects on the average wage paid by firms can be biased if training is correlated with the wage equation error term. This

[11] The NCGE survey reports the annual wage bill, the average number of hours worked during the year and the average number of employees (the sum of the number of employees at the end of each month divided by 12). In equation (1), the average wage is the annual wage bill divided by the average number of employees. In equation (2), the wage measure is the average wage per hour, i.e., the annual wage bill divided by the total hours worked during the year.

TABLE 4

The Effects of Training on Wages: OLS Estimates

Dependent variable: log average wage

	(1)	(2)
Proportion of junior employees who received formal training	0.20881	0.22558
	(1.51)	(1.61)
Proportion of senior employees who received formal training	0.16693	0.15989
	(3.12)	(2.95)
Log number of employees	0.01444	0.02152
	(1.43)	(2.10)
Log stock of fixed capital per employee	0.04234	0.04063
	(4.92)	(4.66)
Rate of capacity utilization	0.15185	0.14033
	(2.81)	(2.56)
= 1 if foreign owned company	0.04141	0.03608
	(1.66)	(1.42)
= 1 if public owned company	0.01733	0.03930
	(0.52)	(1.16)
Fraction of temporary contracts	−0.27084	−0.34262
	(−3.52)	(−4.40)
Temporary contracts/newly hired workers	0.06333	0.06322
	(1.92)	(1.90)
Training contracts/newly hired temporary workers	0.05823	0.04622
	(1.46)	(1.14)
Apprenticeship contracts/newly hired temporary workers	−0.32465	−0.32003
	(−2.92)	(−2.84)
Fraction of high-level managers	0.92242	0.86103
	(9.12)	(8.40)
Fraction of medium-and lower-level managers	0.52925	0.51301
	(7.62)	(7.30)
Fraction of clerical workers	−0.17798	−0.18777
	(−1.62)	(−1.69)
Fraction of workers sharing profit	0.04409	0.05626
	(1.23)	(1.55)
= 1 if CCOO holding majority at bargaining table	−0.05488	−0.05370
	(−2.65)	(−2.56)
= 1 if UGT holding majority at bargaining table	−0.07889	−0.07984
	(−3.42)	(−3.41)
Constant	7.26434	6.77257
	(61.41)	(56.54)
N	594	594
R-square	0.55	0.56

Notes:

1. See note 11 in text for an explanation of how the two dependent variables have been calculated.
2. All equations include 8 sector dummies.
3. *t*-statistics are in parentheses.

may happen if higher wages are paid to workers who are more able and/or possess more general skills. These workers are the most likely to receive formal training within the firm because ability and general human capital are characteristics which heighten the desired effects of formal training on employees. The observed effects of formal training on average wage can be a consequence of the correlation between ability/general human capital and formal training/wages. Again, we are unable to deal with this problem given the lack of adequate instrumental variables.

VI. CONCLUSIONS

This study has sought to highlight some central issues related to firm-based training in Spain, namely, what determines the existence of training among medium- and large-sized firms and how training affects labour productivity and wages in these firms. Company-provided training has special relevance in Spain, particularly in the context of the European Single Market, where productivity growth stands as a key aspect in improving the performance of the Spanish economy. Unfortunately, the lack of similar studies prevents us from comparing our results with those obtainable for other countries.

To summarize, we found noticeable differences between firms which do and those which do not provide formal training. By using the least squares method, we estimated the effects of formal training on labour productivity and on firm's average wage. In both cases, we obtained positive and significant training effects.

A promising avenue for future research consists of investigating the relationship between firm-based training and workers' general human capital. This work suggests that there are significant links between occupational structure, productivity and wages, making it difficult to estimate the relationship between formal training, productivity and wages by a conventional production function methodology.

A question remains: are companies in Spain providing the optimal amount of training for their employees? This study has taken some initial steps toward exploring this crucial question. Although we cannot report an exogenous relationship between formal training and productivity, our results stress the importance of workers' general skills in motivating firms' to provide formal training. The relationship between workers' general skills and firm-provided specific training makes it difficult to disentangle the exogenous training effects on labour productivity and wages.

Universidad Carlos III de Madrid

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APPENDIX 1

Means and Standard Deviations of the Sample

Variables	*All firms* Mean (SD)	*Training* Mean (SD)	*No training* Mean (SD)
= 1 if firm-based training exists	0.58910	1	0
Proportion of junior employees who received formal training	0.02697 (0.073)	0.04578 (0.090)	0
Proportion of senior employees who received formal training	0.13185 (0.215)	0.22382 (0.241)	0
Log sales per employee	9.46715 (0.863)	9.63013 (0.846)	9.23194 (0.835)
Log value added per employee	8.48488 (0.813)	8.63771 (0.797)	8.26293 (0.787)
Log (wage bill/number of employees)	7.88206 (0.332)	7.97136 (0.294)	7.75387 (0.341)
Log (wage bill/total hours worked)	7.35662 (0.339)	7.44779 (0.305)	7.22521 (0.342)
Log number of employees	6.41559 (1.06)	6.68102 (1.14)	6.03504 (0.809)
Log stock of fixed capital	14.46090 (1.86)	14.93173 (1.76)	13.78444 (1.79)
Log (stock of fixed capital/number of employees)	8.04817 (1.33)	8.25509 (1.19)	7.75088 (1.46)
Rate of capacity utilization	0.84306 (0.183)	0.84476 (0.180)	0.84064 (0.189)
Log hours worked during the year	7.43431 (0.050)	7.43144 (0.31092)	7.43844 (0.16465)
= 1 if 50% + foreign owned company = 0 otherwise	0.25082	0.31092	0.16465
= 1 if 50% + public owned company = 0 otherwise	0.15841	0.19047	0.11244
= 1 if technological change (new product or production process was introduced) = 0 otherwise	0.33828	0.44537	0.18473
Fraction of output exported	0.13150 (0.205)	0.14067 (0.214)	0.11835 (0.191)

APPENDIX 1 — CONTINUED

Variables	*All firms* Mean (SD)	*Training* Mean (SD)	*No training* Mean (SD)
Fraction of temporary contracts	0.11620 (0.140)	0.11090 (0.118)	0.12372 (0.166)
Temporary contracts/ newly hired workers	0.63943 (0.317)	0.61816 (0.295)	0.66994 (0.346)
Training contracts/ newly hired temporary workers	0.16700 (0.252)	0.20784 (0.266)	0.10843 (0.218)
Apprenticeship contracts/newly hired temporary workers	0.01899 (0.089)	0.01532 (0.071)	0.02425 (0.100)
Fraction of high-level managers	0.08814 (0.104)	0.10834 (0.118)	0.05951 (0.071)
Fraction of medium- and lower-level managers	0.28623 (0.208)	0.32594 (0.213)	0.22992 (0.188)
Fraction of clerical workers	0.08659 (0.106)	0.09648 (0.116)	0.07257 (0.090)
Fraction of production workers	0.53902 (0.290)	0.46922 (0.292)	0.63798 (0.257)
Fraction of workers sharing profit	0.16666 0.09249	0.19887 0.13151	0.12048 0.03654
= 1 if CCOO holding majority at bargaining table	0.34488	0.35294	0.33333
= 1 if UGT holding majority at bargaining table	0.22937	0.19887	0.27309
Energy and water	0.05280	0.05882	0.04417
Mining and chemical ind.	0.16501	0.17927	0.14457
Engineering	0.21122	0.22689	0.18875
Other manufacturing ind.	0.22937	0.17647	0.30522
Construction	0.02970	0.01960	0.04417
Trade, hotel and repair	0.06765	0.05322	0.08835
Transport and communications	0.07095	0.06722	0.07630
Finance and insurance	0.15346	0.20448	0.08032
Other services	0.01980	0.01400	0.02811

Note: All the variables concern the year 1988.