

FORMAL TRAINING, TEMPORARY CONTRACTS, PRODUCTIVITY  
AND WAGES IN SPAIN

Alfonso Alba-Ramírez\*

**Abstract**

This article investigates the determinants and effects of firm-based training in Spain. We focus on the following questions: (1) Are there appreciable differences between firms which provide training and firms which do not? (2) Does the proportion of workers who receive training have a significant effect on firms' productivity and wages? In seeking quantitative answers to these relatively unexplored questions, we use a sample of some six hundred medium- and large-sized firms. Our main results indicate that larger firms and those undergoing technological change are more likely to provide their work force with formal training. By estimating a production function, we also find evidence of the positive and significant effects of formal training on labor productivity and wages. However, when training is treated as an endogenous variable the specified production function or the wage equation, such positive effects are no longer significant.

---

**Key words**

Formal training; firms' productivity and wages; production function; technological change; temporary contracts; training and apprenticeship contracts.

\* Cynthia Costas-Centivany has been indispensable in editing this article. The author has greatly benefited from conversations with Lisa Lynch. He thanks participants at the NBER Labor Lunch for useful comments and suggestions. He gratefully acknowledges a grant from the Spanish Ministry of Education and Science, in cooperation with the Fulbright Commission, during the second year of his Post-Doctoral Fellowship at Harvard University and the National Bureau of Economic Research.

## I. Introduction

Much analysis has focused upon the individual's decision to invest in human capital and its consequent effects on earnings.<sup>1</sup> Yet, we know little about the determinants and effects of formal training, when provided by employers and analyzed from the perspective of firms.<sup>2</sup> While most developed countries have implemented household surveys to obtain information on schooling and earnings, and less frequently on job training, questions related to human capital investment are rarely included in establishment surveys. The dearth of data can partly explain the absence of empirical research on firm's decision to provide formal training and the effect of that training 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. Discouraged by such an uncertainty, some firms refrain from making any training commitment and opt to 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.<sup>3</sup>

Two questions are relevant: First, are there appreciable differences between firms which provide training and firms which do not? Second, does training have a significant effect on productivity and wages?<sup>4</sup> The first question can be illustrated 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

---

<sup>1</sup> See Mincer (1974), Lillard and Tan (1986), Barron et al. (1987) and Lynch (1989).

<sup>2</sup> Bartel (1989) is one exception which analyzes company-based training by using an econometric framework where the firm is the unit of analysis. Bishop et al. (1985) analyzes a firm-based data set containing training information only on the most recently hired employees.

<sup>3</sup> Becker (1962) and Oi (1962) stress the role of firm-specific elements in the relationship between the employer and the trainee.

<sup>4</sup> In this article, we refer to training as that provided through organized courses or programs within the firm.

second question addresses the core of the current debate on productivity and economic performance.<sup>5</sup>

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, labor psychologists emphasize that people's 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 shopfloor are increasingly gaining terrain in more advanced enterprises.<sup>6</sup> These same new values in human resources development critically depend upon well-educated and trained employees.

In order to obtain a quantitative response to the former two questions, 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 analyze the effect training has on labor productivity, as measured by sales as well as by value added per employee. Finally, we estimate wage equations to ascertain 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, practicing profit-sharing and more intensively using some forms of public employment-training programs 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 labor productivity and wages. However, when training is treated as an endogenous variable in our specified production function and wage equation, its positive effects on productivity and wages become insignificant.

---

<sup>5</sup> See, for instance, Dertouzos et al. (1989).

<sup>6</sup> Favorable task planning, adequate incentives and a satisfactory compensation system become some of the necessary complements to a motivated and productive labor force.

In the following section, we develop the framework. In section III, we explain some relevant features of the institutional context 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. 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 labor over employees' time with the firm.<sup>7</sup>

The first issue to be considered is whether or not the company provides formal training. Indeed, for some firms we observe the absence of formal training. Thereafter, we can assess the intensity of 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 employees' 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 could be that, in the non-training firms, the average output per worker is highly unresponsive to expenditures in training.<sup>8</sup>

We make a distinction between training received by junior employees (newly hired workers) and training received by senior employees (retraining).

---

<sup>7</sup> Measuring the firms's return to training through output excludes any observable improvement in its product quality. Such improved quality may not necessarily be reflected in price if the industry is highly competitive and the firm's goal is to gain an edge in the market.

<sup>8</sup> Moreover, informal on-the-job training may be a better substitute for formal training in these firms.

This distinction is relevant for several reasons. First, the amount of training devoted to junior employees is associated with firms' level of employment creation. Second, the effect of both types of training on productivity and wages may differ in correlation with reasons for and nature of the training courses offered. Third, the majority of employees who receive training is concentrated among those workers who have been with the firm for a longer period of time (retraining).<sup>9</sup> Four, retraining can be a basic need of the firm in order to implement technological change and make use of its internal labor market.

Among factors affecting the responsiveness of output to the amount of training, we consider the following: (1) The size of the firm: it is well known that job turnover is lower among larger firms,<sup>10</sup> 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.<sup>11</sup> 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 labor 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. A more educated worker thus makes more valuable the firm's investment in training. (5) Management: a well managed company has greater success in

---

<sup>9</sup> The firm's uncertainty with respect to reaping the benefits of training might be lower when training is directed to senior employees who have shown a longstanding commitment to the company.

<sup>10</sup> See Oi (1983a).

<sup>11</sup> The negative effect of turnover on firm-supported training is twofold: It implies the loss of the investment by the firm, and impedes higher work efficiency as a result of further training received by the same worker.

developing its human resources.<sup>12</sup> (6) Characteristics of employment contracts: as we will describe in the following section, Spanish labor law offers an interesting menu of employment arrangements, some of which contemplate or enforce the provision of training by the firm. (7) Product competition: the intensity of domestic competition, and whether or not the firm competes in international markets. (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. (9) Turnover rate: high turnover rates discourage the company from investing in training. It is also likely that specific training is an incentive for workers' long-term employment with the same firm.

We will analyze 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 applying 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, Labor 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 labor,  $L$ . Effective labor measures the increase in the quality of labor as a result of training:<sup>13</sup>

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

---

<sup>12</sup> Our only observable indicator with respect to the firm's management characteristics is ownership.

<sup>13</sup> This methodology has been used to address the labor productivity effect 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 labor. So long as  $a$  and  $b$  are positive numbers, it is clear in equation [1] that more training leads to more effective labor. The production function can be written as

$$(2) \quad Q = AK^\alpha L^\beta$$

By substituting [1] into [2] results in

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

Equation [3] can be expressed in terms of output per worker:

$$(4) \quad Q/R = AK^\alpha R^{\beta-1} e^{\beta at + \beta br}$$

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

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

This equation provides the basic framework that allows us to address the effect of formal training on labor productivity. In addition, we investigate how training is related to wages. Training is deemed to link wages with productivity. In fact, the lack of a objective measure over productivity has made the assessment of the effect of training on productivity possible only in terms of its effect 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 effect of training on both productivity and average wage.

### III. Institutional Context: Training and Apprenticeship Contracts

Unemployment in Spain began to rise in the mid-seventies and peaked in 1985, when almost 22% of the labor force were jobless. Since then, employment

has steadily increased, notably through fixed-term (temporary) employment contracts. Spain's recent labor market developments highlight the institutional conditions in which firms have operated over the last five years. By understanding those conditions, we better assess their possible effects on company-based training.

Convinced that high unemployment was caused by rigid employment relationships and an exceedingly expensive labor force, by the end of 1984 the Spanish government established the Employment Promotion Programs. Extensive economic measures were implemented: some were aimed at making labor more flexible through temporary and part-time contracts. Other measures were intended to lower the costs of new hires by way of subsidies, reductions in 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.

In the status of the legislation as of 1988, two types of fixed-term contracts are particularly relevant to this work: training contracts and apprenticeship contracts.<sup>14</sup> These contracts were intended to ease the entry of youth into the labor market. They can be extended for a minimum of three months and a maximum of three years. The training contract (*contrato en prácticas*) is only applicable 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.<sup>15</sup> On the other hand, the apprenticeship contract (*contrato para la formación*) was conceived as a way to complement work with training. Only workers between 16 and 20 years are eligible for apprenticeship

---

<sup>14</sup> These types of contracts were already contemplated in the Workers Statute of 1980, but under more limited conditions. Since the legislation has been modified several times, the description that follows is based on its status in 1988.

<sup>15</sup> 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.



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%, and are proportionately subsidized in sums ranging from 120,000 pts. (\$1,200) to 280,000 pts. (\$2,800), depending on their initial duration. (2) Apprenticeship contracts lower the employers' contributions to the Social Security by 90%, or even 100% if the firm has fewer than 25 employees. Apprenticeship contracts are subsidized at 90 pts. 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. Data

The data we use in this study are drawn from a yearly survey carried out since 1977 by the Spanish Ministry of Economics and Finance, entitled "Collective Bargaining in the Large Firms" (hereinafter NCGE).<sup>16</sup> 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<sup>17</sup> 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%.

---

<sup>16</sup> I thank Antonio García de Blas, Luis Albentosa, Valeriano Muñoz and Julio Sánchez, of the Director General's Office of Political Economy, for their help in providing these data.

<sup>17</sup> Due to employment adjustments, about 5% of the firms in the sample had fewer than 200 employees in 1988. Approximately 53% of the firms had fewer than 500 workers, 24% had more than 1,000, 4% had more than 5,000, and only six firms exceeded 20,000 employees. The largest company employed 64,148 workers in 1988.

The NCGE survey provides detailed information on economic sector, company ownership, percentage of output exported, sales, value added, stock value of fixed capital, number of employees, average number of hours worked per employee, year-round hires and dismissals, 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 incorporated questions pertaining to human resources practices for the first time. 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?<sup>18</sup>

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% of the total non-agricultural employment in 1988. Our sample of firms employed a total of approximately 930,000 workers, representing almost 45% of the labor force employed by non-agricultural firms having 200+ employees. Other characteristics, like firm distribution by size, sectors, 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 establishments. 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 labor force.

---

<sup>18</sup> Two other questions were also included in the 1989 questionnaire: (a) How many hours per worker were devoted to training in 1988? (b) What was the cost of training courses attended by workers in 1988? The firms' difficulty in answering these questions, reflected in the frequency of missing values, induced us to set them aside for future analysis.

## 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% of the companies in our sample provided formal training in 1988, and the average percentage of workers involved amounted to 15.9%, 83% of whom were senior employees (see Appendix).

### Probability of Firm-Based Training

Table 1 displays the results of estimating the 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 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).<sup>19</sup>

The results reflected in Table 1 support the hypothesis indicated in section II.<sup>20</sup> Namely, larger, more capital-intensive and foreign companies are

---

<sup>19</sup> Junior and senior employee proportions are taken over each firm's total number of employees.

<sup>20</sup> Our discussion in section II has served as a guide in 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 the 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 (capital ownership is defined by existing control of 50% or more of capital); (6) characteristics of labor contracts: fraction of temporary contracts existing as of 7/31/88, fraction of newly hired temporary workers, and fractions of those newly temporary workers who have training and apprenticeship contracts as referred to in 1988; (7) competition: fraction of output exported. (8) workers' commitment: fraction of employees covered by a profit-sharing agreement; (9) turnover rate: hires plus dismissals over size of the firm;

more likely to provide training. Furthermore, companies experiencing technological change, exporting a greater proportion of output, having more employees in higher occupations and practicing some form of profit-sharing are indicated to be more likely to train their labor force.<sup>21</sup> 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.<sup>22</sup>

Also, by estimating tobit models, we are able to highlight some differences between the factors which determine the type of training provided. The capital-labor ratio, the distribution of employees by occupations and the proportion of sharing-profit employees within the company are very significant in explaining the proportion of senior employees who received training. The same variables are insignificant in explaining the proportion of junior employees who received training.<sup>23</sup> The previous 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 to younger workers. Nonetheless, we suggest a more

---

(10) finally, nine economic sectors are considered.

<sup>21</sup> 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.

<sup>22</sup> Note that, in all the regression, 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.

<sup>23</sup> Only 2% 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%. 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% and the percentage of temporary contracts within those company payrolls is about 12% (see Appendix).

probing analysis to reach further conclusions on this particular an important issue.

### The Effect of Training on Labor Productivity and Wages

Equation [5] constitutes the basic specification of the production function to be estimated. We first attempted its estimation by using the ordinary least-square methodology. The results are presented in Table 2. We have considered two measures for the firm's 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 according to any type of employee training. The variable capital (K) is the value of the fixed capital stock, and the variable labor (R) is the number of employees.

The results recorded in Table 2 show strong support for a positive effect of training on labor 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:  $\alpha = .26$  and  $\beta = -.31 + 1 = .69$ . 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 of number of employees plus one; meaning that b, the effect of this type of training on the quality of labor, is approximately one.

The high estimated coefficient of the variable reflecting the firm's training provided to senior employees suggests the existence of bias in the estimated effect of training on the firm's productivity. A primary cause for 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% level, diminishing from .77 to .29 where the dependent variable is log value added. This result is not surprising, as 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.<sup>24</sup> 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 the productivity effects of differences in the labor force quality which are not attributable to training.<sup>25</sup>

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 effect of training on productivity. This can happen if training is measured with error and/or if training is determined simultaneously with other independent variables, i.e., the occupational structure or labor force formal education. The firm's decision to invest in training and the selection of workers to receive training are likely to be related to its employees' education and occupational distribution. In such a case we cannot treat training as an exogenous variable and apply the OLS method.

---

<sup>24</sup> Note that the constant returns to scale of our estimated production function are enhanced when these additional variables are included in the regression.

<sup>25</sup> It is likely that training is linked to workers' promotion. By receiving training some employees have higher chances of ascending along 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-graduated and most medium- and lower-level managers possess three years of formal post-secondary education.

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 as to more effectively apply their new skills. Furthermore, training can affect the occupational distribution of employees if those receiving training are promoted to higher-ranked occupations. We undertake this crucial problem by treating the proportion of senior employees who have received training as an endogenous variable. The fully specified production function is estimated by using the two-stage least-square methodology. The instrument for the proportion of senior employees trained is whether or not the firm underwent technological change throughout 1988. This variable is highly correlated with firm's provision of training and assumed to be independent of the error term in the production function.

Columns 2 and 4 of Table 3 reflect the instrumental variable estimates. As expected, the effect of training on productivity becomes insignificant. If our IV results, based on a sample of medium- and large-sized firms in Spain, are correct, we can conclude that there is not an exogenous training effect on labor productivity when it is measured by value added.

A possible reason for the former results is that we are unable to capture the effect of training on labor 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 labor productivity. Reliance on conventional measures thus tends to understate the impact of firm-specific training on total labor productivity."

The NCGE survey contains detailed information on wages, allowing us to analyze further the effect of firm-based training on labor productivity. We can do so if labor 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 hour

wage paid by the firm.<sup>26</sup> The coefficient for the proportion of senior employees who received formal training is positive and significant as to both specifications.

Other results indicate that the following characteristics or circumstances 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 Laborer Commissions (CCOO) or those of the General Union of Workers (UGT) are a majority at the bargaining table.<sup>27</sup>

Once again, our estimates of formal training effects on the average wage paid by the firm can be biased if training is correlated with the wage equation error term. This 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 effect of formal training on employees. The observed effect of formal training on average wage can be a consequence of the correlation between ability/general human capital and formal training/wages. To deal with this problem, we again resort to the instrumental variable methodology.

Columns 3 and 4 of Table 4 present the results of re-estimating the wage equations by two-stage least square. As done previously, we instrument the proportion of senior employees who received training by a dummy variable which

---

<sup>26</sup> 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 twelve). 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.

<sup>27</sup> 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 bargaining table (negotiation commission) is formed under the works council agreement. It is composed of twelve to fifteen members.



indicates whether or not the firm experienced some form of technological change in 1988.

The IV methodology applied leads to an insignificant coefficient for the training variable in both wage equations. Thus, no exogenous training effect is found on the average wage paid by the firm considering a sample of medium- and large-sized firms in Spain.

## 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 labor productivity and wages in these firms. Company provided training has special relevance in Spain, particularly when the country faces the imminent European Single Market and productivity growth stands as a key aspect in improving the Spanish economy's competitiveness.

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 provide and do not provide formal training. When estimating the effect of formal training on labor productivity and firm's average wage, no conclusive findings can be reported. Nevertheless, the evidence points to the absence of training effect on either productivity or wages when a simultaneity bias is taken into account. Thus, we have raised more questions than answers. A promising avenue for future research consists of investigating the relationship between firm-based training and workers' general human capital. Our 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 means of a conventional production function methodology.

A question remains: are companies in Spain providing the adequate amount of training for their employees? This study has taken some initial steps toward exploring possible responses to this crucial question. Although we cannot report a robust relationship between formal training and productivity, we stress the importance of workers' general skills in driving firms' tendency

to provide formal training. The relationship between workers' general skills and firm-provided specific training makes it difficult to disentangle the exogenous training effect on labor productivity and wages.

### References

Bartel, Ann P. 1989. "Formal Employee Training Programs and Their Impact on Labor Productivity: Evidence From a Human Resources Survey." NBER Working Paper No. 3026.

Barron, John M., Dan A. Black and Mark A. Loewenstein. 1987. "Employer Size: The Implications for Search, Training, Capital Investment, Starting Wages, and Wage Growth." Journal of Labor Economics 5 (1): 76-89.

Becker, Gary S. 1962. Human Capital, 2nd ed. Chicago: Chicago University Press, 1975.

Bishop, John, Kevin Hollenbeck, Suk Kang and Richard Willke. 1985. Training and Human Capital Formation. Columbus: National Center for Research in Vocational Education, Ohio State University.

Dertouzos, Michael L., Richard Lester and Robert M. Solow. 1989. Made in America. Regaining the Productive Edge. Cambridge: MIT Press.

Griliches, Zvi. 1970. "Education, Income, and Human Capital." W. Lee Hansen (ed.) Studies in Income and Wealth, NBER, vol. 35. New York: Columbia University Press.

Griliches, Zvi and Jacques Mairesse. 1984. "Productivity and R & D at the Firm Level." Zvi Griliches (ed.) R & D, Patents, and Productivity, NBER. Chicago: The University of Chicago Press.

Lillard, Lee and Hong Tan. 1986. "Private Sector Training: Who Gets It and What are Its Effects?" Rand Monograph R-3331-DOL/RC.

Lynch, M. Lisa. 1989. "Private Sector Training and Its Impact on the Earnings of Young Workers." NBER Working Paper No. 2872.

Mincer, Jacob. 1974. Schooling, Experience and Earnings. New York: Columbia University Press.

Oi, Walter. 1962. "Labor as a Quasi-Fixed Factor of Production." Journal of Political Economy, December.

Oi, Walter. 1983a. "Heterogeneous Firms and the Organization of Production." Economic Inquiry, 21: 147-71.

Oi, Walter. 1983b. "The Fixed Employment Costs of Specialized Labor." Jack E. Triplett (ed.) The Measurement of Labor Cost. Chicago: The University of Chicago Press.

Table 1  
Determinants of Firm-Based Training

	Probit			Tobit	
	(1)	(2)	(3)	(4)	(5)
Log number of employees	.30758 (4.48)	.23240 (3.96)	.25558 (3.93)	.01808 (2.60)	.07000 (5.93)
Log stock fixed capit. per employee	.05244 (0.98)	.07082 (1.29)	.06301 (1.18)	.08162 (1.18)	.03672 (3.22)
=1 if foreign owned company	.43778 (2.88)	.17031 (1.16)	.44175 (2.97)	.02835 (1.57)	.05269 (1.71)
=1 if public owned company	.32704 (1.52)	-.16508 (-0.81)	.48086 (2.30)	-.02203 (-0.86)	.10492 (2.57)
=1 if technological change took place	.73159 (5.50)	.59961 (4.92)	.75752 (5.80)	.06879 (4.60)	.14824 (5.75)
Fraction of output exported	.68645 (2.06)	.21352 (0.69)	.39290 (1.21)	.00169 (0.04)	.08186 (1.26)
Fraction of temporary employees	.41062 (0.79)	.82147 (1.57)	-.04161 (-0.08)	.14717 (2.24)	.01097 (0.09)
Temporary employees/newly hired workers	-.17523 (-0.87)	-.06782 (-0.33)	-.08296 (-0.41)	-.00607 (-0.23)	.01908 (0.44)
Training contracts/newly hired temporary workers	.59269 (2.32)	.50540 (2.15)	.63503 (2.54)	.08318 (2.90)	.11355 (2.34)
Apprenticeship contracts/newly hired temporary workers	-.04526 (-0.07)	.70510 (1.15)	-1.41997 (-1.77)	.18142 (2.44)	-.25538 (-1.43)
Fraction of high-level managers	2.61210 (3.65)	1.53652 (2.56)	1.80667 (2.85)	.22930 (3.22)	.30173 (2.47)
Fraction of medium- and lower-level managers	1.31771 (3.00)	.78546 (1.85)	1.56199 (3.61)	.07872 (1.48)	.40076 (4.52)
Fraction of clerical workers	1.57185 (2.18)	.79697 (1.22)	1.83512 (2.57)	.11758 (1.49)	.51094 (3.81)
Fraction of employees sharing profits	.67083 (2.74)	.33479 (1.77)	.75871 (3.12)	.02635 (1.17)	.08742 (2.23)

Table 1 (continued)  
Determinants of Firm-Based Training

	Probit			Tobit	
	(1)	(2)	(3)	(4)	(5)
Turnover rate	-.06154 (-0.44)	-.00697 (-0.04)	-.03950 (-0.28)	.00981 (0.55)	-.01686 (-0.50)
Constant	-3.45936 (-4.93)	-3.59227 (-5.03)	-3.27114 (-4.71)	-.40811 (-4.48)	-1.00709 (-6.94)
Sigma-square				.01842 (9.35)	.06566 (12.05)
N	595	595	595	595	595
Log likelihood	-303.8	-325.5	-308.8	-44.5	-162.4

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 Effect of Training on Labor Productivity  
OLS Estimates

Dependent Variable:	Log Sales per Employee		Log Value Added per Employee	
	(1)	(2)	(3)	(4)
=1 if existence of firm-based training		.28343 (4.20)		.23114 (3.68)
Proportion of junior employees who received formal training	.34210 (0.79)		.27962 (0.69)	
Proportion of senior employees who received formal training	.80526 (4.97)		.77384 (5.13)	
Log number of employees	-.30748 (-7.39)	-.30244 (-7.22)	-.25359 (-6.58)	-.24613 (-6.30)
Log stock of fixed capital value	.25832 (10.67)	.26859 (11.13)	.26037 (11.53)	.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	.23	.22	.27	.25

Note: t-statistics are in parentheses.

Table 3  
The Effect of Training on Labor Productivity  
OLS and IV Estimates

Dependent Variable:	Log Sales per Employee		Log Value Added per Employee	
	OLS	IV	OLS	IV
Proportion of junior employees who received formal training	-.06443 (-0.17)	-.32833 (-0.59)	-.05282 (-0.13)	.41172 (0.70)
Proportion of senior employees who received formal training	.26560 (1.81)	.87091 (0.94)	.27913 (1.89)	-.75713 (-0.77)
Log number of employees	-.24846 (-6.53)	-.26958 (-5.39)	-.22286 (-5.81)	-.18717 (-3.59)
Log stock of fixed capital value	.24061 (10.26)	.23209 (8.58)	.23653 (9.97)	.25103 (8.89)
Log average hours worked during the year	1.45384 (2.54)	1.40821 (2.41)	1.44709 (2.52)	1.53577 (2.54)
Rate of capacity utilization	.29028 (1.95)	.31288 (2.02)	.42294 (2.84)	.38574 (2.42)
=1 if foreign owned company	.14776 (2.19)	.15071 (2.19)	.16124 (2.38)	.15576 (2.19)
=1 if public owned company	-.10119 (-1.10)	-.13244 (-1.26)	-.07112 (-0.76)	-.01619 (-0.14)
Fraction of output exported	.19850 (1.42)	.16839 (1.13)	.11470 (0.82)	.16837 (1.09)
Fraction of temporary employees	-.23947 (-1.11)	-.21245 (-0.96)	-.35872 (-1.65)	-.40759 (-1.77)
Temporary contracts/newly hired workers	.19226 (2.13)	.17777 (1.89)	.25290 (2.79)	.27499 (2.84)
Training contracts/newly hired temporary workers	-.17353 (-1.58)	-.19625 (-1.68)	.17027 (1.52)	.21749 (1.74)



Table 3 (continued)  
The Effect of Training on Labor Productivity  
OLS and IV Estimates

Dependent Variable:	Log Sales per Employee		Log Value Added per Employee	
	OLS	IV	OLS	IV
Apprenticeship contracts/newly hired temporary workers	-.55202 (-1.88)	-.50673 (-1.66)	-.26797 (-0.91)	-.34420 (-1.09)
Fraction of high-level managers	1.22154 (4.36)	1.18117 (4.06)	1.04254 (3.57)	1.11261 (3.57)
Fraction of medium- and lower-level managers	1.18443 (6.18)	1.08409 (4.40)	.61041 (3.13)	.79111 (2.99)
Fraction of clerical workers	1.18841 (3.96)	.99613 (2.37)	.77333 (2.53)	1.10936 (2.48)
Constant	-3.92803 (-0.92)	-3.37787 (-0.77)	-4.74940 (-1.11)	-5.76984 (-1.27)
N	593	593	584	584
R-square	.49	.48	.43	.38

Notes: 1. The instrument for the proportion of senior employees who received training is whether or not the firm underwent technological change throughout 1988.  
2. All equations include 8 sector dummies.  
3. t-statistics are in parentheses.

Table 4  
The Effect of Training on Wages  
OLS and IV Estimates

Dependent Variable: Log Average Wage

	OLS		IV	
	(1)	(2)	(3)	(4)
Proportion of junior employees who received formal training	.20881 (1.51)	.22558 (1.61)	.16443 (0.79)	.28903 (0.81)
Proportion of senior employees who received formal training	.16693 (3.12)	.15989 (2.95)	.26789 (0.76)	.16883 (0.80)
Log number of employees	.01444 (1.43)	.02152 (2.10)	.00969 (0.50)	.01545 (0.79)
Log stock of fixed capital per employee	.04234 (4.92)	.04063 (4.66)	.04096 (4.16)	.03888 (3.89)
Rate of capacity utilization	.15185 (2.81)	.14033 (2.56)	.15512 (2.80)	.14452 (2.57)
=1 if foreign owned company	.04141 (1.66)	.03608 (1.42)	.04158 (1.66)	.03630 (1.42)
=1 if public owned company	.01733 (0.52)	.03930 (1.16)	.01212 (0.32)	.03264 (0.85)
Fraction of temporary contracts	-.27084 (-3.52)	-.34262 (-4.40)	-.26595 (-3.36)	-.33635 (-4.20)
Temporary contracts/ newly hired workers	.06333 (1.92)	.06322 (1.90)	.06095 (1.79)	.06017 (1.74)
Training contracts/ newly hired temporary workers	.05823 (1.46)	.04622 (1.14)	.05393 (1.26)	.04071 (0.94)
Apprenticeship contracts/newly hired temporary workers	-.32465 (-2.92)	-.32003 (-2.84)	-.31970 (-2.84)	-.31370 (-2.74)

Table 4 (continued)  
The Effect of Training on Wages  
OLS and IV Estimates

Dependent Variable: Log Average Wage

	OLS		IV	
	(1)	(2)	(3)	(4)
Fraction of high-level managers	.92242 (9.12)	.86103 (8.40)	.91527 (8.77)	.85188 (8.04)
Fraction of medium- and lower-level managers	.52925 (7.62)	.51301 (7.30)	.51298 (5.75)	.49219 (5.44)
Fraction of clerical workers	-.17798 (-1.62)	-.18777 (-1.69)	-.20914 (-1.36)	-.22763 (-1.46)
Fraction of workers sharing profit	.04409 (1.23)	.05626 (1.55)	.03820 (0.92)	.04873 (1.16)
=1 if CCOO holding majority at bargaining table	-.05488 (-2.65)	-.05370 (-2.56)	-.05344 (-2.50)	-.05187 (-2.39)
=1 if UGT holding majority at bargaining table	-.07889 (-3.42)	-.07984 (-3.41)	-.07907 (-3.41)	-.08008 (-3.40)
Constant	7.26434 (61.41)	6.77257 (56.54)	7.29875 (43.65)	6.81657 (40.19)
N	594	594	594	594
R-square	.55	.56	.54	.55

- Notes: 1. See note 26 in text for an explanation on how the two dependent variables have been calculated.  
2. The instrument for the proportion of senior employees who received training is whether or not the firm underwent technological change throughout 1988.  
3. All equations include 8 sector dummies.  
4. t-statistics are in parentheses.

Appendix 1  
Means and Standard Deviations of the Sample

Variables	All Firms	Training	No Training
	Mean (S.D)	Mean (S.D)	Mean (S.D)
=1 if firm-based training exists	.58910 (.492)	1	0
Proportion of junior employees who received formal training	.02697 (.073)	.04578 (.090)	0
Proportion of senior employees who received formal training	.13185 (.215)	.22382 (.241)	0
Log sales per employee	9.46715 (.863)	9.63013 (.846)	9.23194 (.835)
Log value added per employee	8.48488 (.813)	8.63771 (.797)	8.26293 (.787)
Log (wage bill/number of employees)	7.88206 (.332)	7.97136 (.294)	7.75387 (.341)
Log (wage bill/total hours worked)	7.35662 (.339)	7.44779 (.305)	7.22521 (.342)
Log number of employees	6.41559 (1.06)	6.68102 (1.14)	6.03504 (.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	.84306 (.183)	.84476 (.180)	.84064 (.189)
Log hours worked during the year	7.43431 (.050)	7.43144 (.050)	7.43844 (.051)
=1 if 50%+ foreign owned company =0 otherwise	.25082	.31092	.16465

Appendix 1 (continued)  
Means and Standard Deviations of the Sample

Variables	All Firms	Training	No Training
	Mean (S.D)	Mean (S.D)	Mean (S.D)
=1 if 50%+ public owned company =0 otherwise	.15841	.19047	.11244
=1 if technological change (new product or production process was introduced) =0 otherwise	.33828	.44537	.18473
Fraction of output exported	.13150 (.205)	.14067 (.214)	.11835 (.191)
Fraction of temporary contracts	.11620 (.140)	.11090 (.118)	.12372 (.166)
Temporary contracts/ newly hired workers	.63943 (.317)	.61816 (.295)	.66994 (.346)
Training contracts/ newly hired temporary workers	.16700 (.252)	.20784 (.266)	.10843 (.218)
Apprenticeship contracts/newly hired temporary workers	.01899 (.089)	.01532 (.071)	.02425 (.110)
Fraction of high-level managers	.08814 (.104)	.10834 (.118)	.05951 (.071)
Fraction of medium- and lower-level managers	.28623 (.208)	.32594 (.213)	.22992 (.188)
Fraction of clerical workers	.08659 (.106)	.09648 (.116)	.07257 (.090)
Fraction of production workers	.53902 (.290)	.46922 (.292)	.63798 (.257)
Fraction of workers sharing profit	.16666	.19887	.12048
	.09249	.13151	.03654

Appendix 1 (continued)  
Means and Standard Deviations of the Sample

Variables	All Firms	Training	No Training
	Mean (S.D)	Mean (S.D)	Mean (S.D)
Turnover rate = Hires + dismissal/ firm size	.39688 (.534)	.36093 (.402)	.44842 (.678)
=1 if CCOO holding majority at bargaining table	.34488	.35294	.33333
=1 if UGT holding majority at bargaining table	.22937	.19887	.27309
Energy and Water	.05280	.05882	.04417
Mining and Chemical Ind.	.16501	.17927	.14457
Engineering	.21122	.22689	.18875
Other Manufacturing Ind.	.22937	.17647	.30522
Construction	.02970	.01960	.04417
Trade, Hotel and Repair	.06765	.05322	.08835
Transport and Communications	.07095	.06722	.07630
Finance and Insurance	.15346	.20448	.08032
Other Services	.01980	.01400	.02811

Note: All the variables concern the year 1988.