

**AVERAGE EFFECT OF TRAINING PROGRAMS ON THE TIME  
NEEDED TO FIND A JOB. THE CASE OF THE TRAINING  
SCHOOLS PROGRAM IN THE SOUTH OF SPAIN  
(SEVILLE, 1997-1999)**

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**AVERAGE EFFECT OF TRAINING PROGRAMS ON THE TIME NEEDED  
TO FIND A JOB. THE CASE OF THE TRAINING SCHOOLS PROGRAM  
IN THE SOUTH OF SPAIN (SEVILLE, 1997-1999).**

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**Abstract:**

This paper estimates the average effect of a binary treatment on a scalar outcome. Such a treatment is the training schools program implemented in the South of Spain (Seville) between 1997 and 1999. Specifically, the paper estimates the average effect of this training program on the time needed to find a job.

Difficulty in accessing microdata has obstructed in Spain this type of evaluation, largely developed in France, Germany, United Kingdom and USA.

For our purpose, two methods based on the previous estimation of the propensity score are applied: weighting observations by the inverse of the propensity score and Heckman's "two-stage" estimator -Heckman (1979)-.

The average effect estimated by weighting observations by the inverse of a nonparametric estimate of the propensity score let us to conclude that, for treated, the time needed to find a job is reduced in 471 days.

With the second method authors conclude that the estimator of  $ATE_T (\hat{\alpha}_{ATE_T})$  takes a positive value -446 days -although minor than the previous one.

**Key words:** Training programs evaluation, public policies, propensity score, Heckman's two-stage estimator.

**JEL Code:** H30, C30

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## 1. INTRODUCTION<sup>1</sup>.

From Heckman, Clements and Smith (1997), it is generally accepted that social programs impact differently on individuals when they differ in characteristics. The individual's adequate assignment to the set of programs disposable, begins a crucial issue in political decisions.

After controlling by covariates and by knowing the average effect of a program on an appropriate outcome, the public decisor can decide which program would provoke the best impact on individuals by taking into account the program's average effect on subpopulations previously estimated. Social welfare can improve if public decisors follow an assignment rule which let them to determine which individuals must receive which treatment. Manski (2001) theorized this assuming the case of a finite set of rival treatments.

The aim of this paper is to estimate the average effect of a binary treatment on a scalar outcome. Such a treatment is the training schools program implemented in the South of Spain (Seville) between 1997 and 1999. Specifically, the paper estimates the average effect of this training program on the time needed to find a job.

We select the province of Seville as this is the zone with the most widely developed number of training policies until now. The evaluation is carried out by estimating the program's average effect over the individuals' ability of the sample to find a job, individuals being unemployed between 16 and 25 years old.

Following Hirano, Imbens and Ridder (2003), the paper estimates the average effect by using an estimator which weights observations by the inverse of nonparametric estimates of the propensity score. Heckman's two-stage estimator is also implemented to compare results. Difficulty in accessing microdata has obstructed in Spain this type of evaluation, largely developed in France, Germany, United Kingdom and USA. This paper contributes to the

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literature in the sense that no evaluation based of non experimental methods has been applied to this training program in Spain before.

Section 2 is destined to explain the training schools program evaluated and the database used. In section 3 the average treatment effect is considered and two estimators are described: the estimator which weights observations by the inverse of the propensity score -Hirano, Imbens and Ridder (2003)- and the Heckman's "two-stage" estimator -Heckman (1979, 1990) and Heckman and Vytlacil (2005)-. The variables included into the model are defined in section 4. All the empirical results are also contained in section 5. Section 6 concludes.

## **2. THE TRAINING SCHOOLS PROGRAM.**

### **2.1. THE CHARACTERISTICS OF THE PROGRAM EVALUATED**

The training schools program evaluated was designed as a nationwide experimental one implemented by the Spanish Department of Labor (more specifically, by the National Institute of Employment). Considering the first results of the program, the Spanish Department of Labor decided to convert it into a permanent program regulated by the Department Labor's order of march 29st - 1988. Finally, the Department Labor's order of august 3st - 1994 added this program into the set of the national policies of employment until now.

The training schools organizes its activities into two steps; the first one gives a theoretical education to the unemployed and the second one offers a professional stage.

In order to judge the interest of this public training program, three parameters have been considered. The first is the number of participants. After the experimental period, the average number of participants had a range of between 45000 and 50000 young unemployed for every year. Compared to the whole of Spain, Seville is the zone with the largest number of implemented projects since 1985. This justifies the geographical focus of the paper.

Secondly, the size of the public funds absorbed as *Table 1* shows.

Thirdly, the EU authorities supported this training program allowing the use of the European Social Fund to finance it.

Table 1 shows the total budget for joint employment actions between the Spanish Department of Labor and the European Social Fund for the period 2000-2006. This allows us to form an idea of the importance that the European Social Fund has as co-financer of the training programs, given that its participation in these joint budget actions is 60'32%.

**Table 1**

Joint budget actions between the Spanish Department of Labor and the European Social Fund (2000-2006)	
TOTAL <b>9.540.537.406</b> Euros	
<b>ESF</b> <b>5.768.208.916</b> Euros <b>60'46 %</b>	<b>SDL</b> <b>3.772.328.490</b> Euros <b>39'54 %</b>

Source: INEM (National Institute of Employment)

## 2.2. THE “BASEVAFOR 96-03” DATABASE.

The “BASEVAFOR 96-03” database<sup>2</sup> has been constructed from individuals who have participated in the training programs carried out in the south of Spain (Seville) between 1996 and 2003<sup>3</sup>. We have selected those individuals who have finished the training program in 1999, the last year in which information was available when we started the evaluation<sup>4</sup>. Depending on the length of the program (1 or 2 years), programs finishing in 1999 started in either 1997 or 1998.

<sup>2</sup> The individual data came from the official employment agency (INEM).

<sup>3</sup> This time limit is due to the fact that it includes information related to the training programs that finished in 1999, meaning the program started in either 1997 or 1998. In some cases additional information of the individuals has been referred to from 1996. On other hand, as we refer to programs finished during 1999, the information relative to the response variable extends until 2002, to which some information of the individuals of 2003 is added.

<sup>4</sup> The requirements of the individuals were to be between the ages of 16 and 25 years, be unemployed and have signed up to the unemployment office, and have the minimum requirements to begin a training contract.

The total of individuals was 1528 and from that figure, according to Dehejia and Wahba (1999), we have selected a sample of 150. The selected individuals make up the participant group in our investigation. Similarly we have selected 75 individuals<sup>5</sup> to be the control group. The controls have similar characteristics to the participants<sup>6</sup>.

The “BASEVAFOR 96-03” includes two types of data related not only to participants but also with the controls. Firstly, “BASEVAFOR 96-03” gives us information about the periods of employment and unemployment of individuals, including data related to the number of times the individual has applied for a job. We will use this type of information to construct Y. Secondly, “BASEVAFOR 96-03” contains information related to the covariates considered; sex, age and resident zone.

### **3. THE MODEL CHARACTERISTICS.**

#### **3.1. THE AVERAGE TREATMENT EFFECT.**

The development of public policy evaluation has benefited from the use of causal inference<sup>7</sup>. One of the results is the Potential Outcome Model –POM-, which allows us to compare participants and non participants in public programs<sup>8</sup>. A prolific development of the POM with regard to training programs evaluation comes thanks to Roy (1951) and Rubin<sup>9</sup> (1974, 1978). This paper supports the Roy-Rubin Causal Model (RRM).

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<sup>5</sup> We maintain the ratio 2/1 which was used in the evaluation of the JTPA study. The National Job Training Partnership Act (JTPA) Study was commissioned by the U.S. Department of Labor in 1986 to measure the benefits and cost of selected employment and training programs for economically disadvantaged adults and out-of-school youths. See Heckman, Ichimura and Todd (1997, 1998) and Heckman, Ichimura, Smith and Todd (1998). The dimension of the database is comparable to similar evaluations included in Dehejia and Wahba (1999, p. 1056-Table 1-). The control group was constructed by the regional labor authorities for our evaluation. For data, we assume some of them are missing at random (Rubin, 1976; Little and Rubin, 1987).

<sup>6</sup> They are individuals who, during the period of time considered, show the same characteristics of participants and have the requirements to participate in the training program. Also, it is possible that some of them could have applied for a program and could not participate due to place limitation.

<sup>7</sup> Referring to the theoretical approach of causality and its use in randomized experiments, see Cox (1992). Other authors such as Dawid (1979, 2000), Holland (1986), Heckman (1990) and Pearl (2000) also discuss the meaning of causality in such an environment. Finally, in the specific case of training programs, we have referred to the seminal papers of Rubin (1974) and Heckman and Hotz (1989).

<sup>8</sup> Cameron and Trivedi (2005, pp. 31 and onwards) expose the POM advantages compared to alternative models.

<sup>9</sup> The first references that Rubin considered were Neyman (1923, 1935) and Fisher (1928, 1935).

In the implementation of POM and RRM, the individual values of the main variables can be extracted from randomized experiments or from observational data. Both types of experiment will notably determine the evaluation and will promote different methodological developments.

In social sciences, randomized experiments face important problems related to cost, moral limitations, attrition and problems derived from the Hawthorne effect -Burtless (1995) and Cameron and Trivedi (2005)-. This can be solved by using observational data. In these cases, Rosenbaum (1999, p. 266) says that the researcher should design a treatment group and a control group from the individuals who have or have not been treated. The objective is to reproduce a scenario which is as similar as possible to a randomized experiment<sup>10</sup>.

However, models which include counterfactual events (like an individual participating and not participating at the same time in a training program) are ineffective in individual causal effects estimation. Holland (1986) named this problem as the fundamental identification problem.

The fundamental identification problem makes us look for second best solutions in which researchers leave the estimation of the individual causal effects, opting for an average effect estimation, which usually refers to the following specification.

To solve the identification problem, we maintain throughout the paper the unconfoundedness assumption (Rubin, 1978; Rosenbaum and Rubin, 1983), which is also known as the selection on observables assumption (Barnow, Cain and Goldberger, 1980), which asserts that conditional on the observed covariates, the treatment indicator is independent of the potential outcomes.

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<sup>10</sup> The seminal papers in this environment were implemented in Medicine. The papers of Cameron and Pauling (1976), Billewicz (1965) and Cochran (1968), must be highlighted. An interesting comment about these seminal papers is contained in Rosenbaum (1995, 1996). Two of the best known papers in quasi-experimental methods are Kiefer (1979) and Bassi (1984).



The Average Treatment Effect of the program<sup>11</sup> (ATE) is addressed in a partial equilibrium environment and, by using the potential outcome notation popularized by Rubin (1974), it is obtained as the average expected value from the difference between the potential values of  $Y_1$  (the case of an individual treated) and  $Y_0$  (the case of a non treated individual)<sup>12</sup>. Implicit in this notation is the stability assumption or SUTVA (Rubin, 1978) that individuals are not affected by receipt of treatment by others, and there is only one version of the treatment. As a consequence, no general equilibrium effects are considered (Cameron and Trivedi, 2005, p.872).

$$ATE = E [Y_1 - Y_0] \quad (1)$$

The Average Treatment Effect on the Treated (ATET) is given as the average expected value from the difference between the potential values of  $Y_1$  and  $Y_0$  but only with respect to individuals who have received treatment.

$$ATET = E [Y_1 - Y_0 | D = 1] \quad (2)$$

### **3.2. METHODOLOGY BASED ON THE SELECTION ON OBSERVABLES.**

Given the fact that the validity of average effects can be damaged if participants and controls show characteristics different from their participation or non participation in the training program, these characteristics must be controlled because of their effect on the values of the response variable. This is the base of the selection on observables method in which the characteristics are noted as the covariate or vector  $X$ <sup>13</sup>.

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<sup>11</sup> Although in this paper only the most well-known average effects are used, Imbens (2004, p. 4) has summarized all the possible types of average effects of treatment in literature. In this sense, he refers first to the PATE (Population Average Treatment Effect) as the average effect that treatment causes on population, and to the PATT (Population Average Treatment effect for the Treated) as the average effect when only treated are considered. Secondly, the SATE (Selected Average Treatment Effect) would show the average treatment effect when the evaluation is carried out only taking into account only a sample of the population, and the SATT (Selected Average Treatment effect for the Treated) when the sample is extracted only from the treated population. Finally, the CATE (Conditional Average Treatment Effect) would estimate the average effect of the treatment conditioned to the covariates' distribution and the CATT (Conditional Average Treatment effect for the Treated) would estimate the same but only considering the treated population.

<sup>12</sup> The ATE is addressed in a partial equilibrium environment different, for example, to the mega mentioned in Cansino, Cardenete and Roman (2007).

<sup>13</sup> When controlled and treated differ in unobserved characteristics like psychological ones, average effect can be estimated by the differences in differences estimator. Referring to this context, see Cansino and Sanchez (2008).

If the observed characteristics are the only individual characteristics (of participants and controls) that differ, we can therefore control these differences.

Selection on observables allows us to isolate the effect of a covariate (or a vector of covariates)<sup>14</sup> maintaining the independence between the treatment indicator variable  $D$  and the response variable,  $Y$ . This condition can be expressed as

$$(Y_1, Y_0) \perp D | X \quad (3)$$

Selection on observables supports the independence assumption typical in randomized experiments, contributing to the comparison between participants and controls.

Following Heckman and Hotz (1989, p. 865), selection on observables is recommended when the independence between  $D$  and  $Y$  is because of the covariate  $X$  (or vector of covariates), which has influence on the individual selection process, so by controlling  $X$  we give a solution to possible biased selection, making the dependency between  $D$  and  $Y$  disappear.

In the selection on observable context, when the independence assumption is guaranteed, we considered, according to Dehejia and Wahba (1999, p. 1057), that

$$E[Y_1 - Y_0 | X] = E[Y | X, D = 1] - E[Y | X, D = 0] \quad (4)$$

Equation 3 lets us express the  $ATE$  as

$$\begin{aligned} ATE &= E[Y_1 - Y_0] = \int (E[Y_1 - Y_0 | X]) dP(X) = \\ &= \int (E[Y | X, D = 1] - E[Y | X, D = 0]) dP(X) \end{aligned} \quad (5)$$

In this way<sup>15</sup>, it is possible to determine  $ATE$  from the difference between the average observed value of the response variable of the participants and the controls, calculating the difference for every possible value of  $X$ .

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<sup>14</sup> As an introduction to the framework of the observational methods we recommended the examples that are used by Rosenbaum (1995, pp. 2 and onwards) in his exposition about these methods; this also can be said of Cochran (1968) and Cameron and Pauling (1976). We also recommend the papers of Billewicz (1965) and Moertel et al. (1985), both of them referring to the two previous examples.

<sup>15</sup> To improve knowledge of selection on observables, we recommend Barnow, Cain and Goldberger (1980).

In a similar way, it is possible to calculate the average effect of the training program only for participants (*ATET*) as:

$$ATET = E [Y_1 - Y_0 | D = 1] = \int (E [Y|X, D = 1] - E[Y|X, D = 0]) dP(X|D = 1) \quad (6)$$

Therefore, *ATET* will be equal to the difference between the average observed values in the response variable of the participants and the average values of the controls for every different value of *X* when *D* = 1.

#### **4. DEFINITION OF THE VARIABLES INCLUDE INTO THE MODEL.**

##### **4.1. DEFINITION OF *D* AND *Y* VARIABLES.**

We define *D* as the binary variable which indicates the participation of the individuals in the sample, taking values 1 or 0 depending on if the individual considered participates or not in the program.

$D_i = 1$  will indicate that individual *i* has participated in one of the programs and  $D_i = 0$  will indicate that individual *i* has not participated in any program.

The scalar *Y*, is the response variable from which the program's average effects will be evaluated. We define *Y* as the ability of the individual *i* to find a job, and shows how much time he has to spend searching for a job<sup>16</sup>.

The choice of the response variable is justified because the individuals of the sample, both the participants and the non participants (control group), are initially unemployed and included in the official census of people who are searching for jobs. Most of them have not been working before or have a short labor experience because of their age and lack of experience.

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<sup>16</sup> For a further investigation, we could define two outcomes in an alternative way. The first one let us to know the treatment average effect on the individual probability to find a job. The second would be the time needed to find a job conditioned to the unemployments subset (treated and controls) who have find a job.

For that reason, it is relevant for the program evaluation to consider a response variable which allows us to measure the abilities of these people to find jobs<sup>17</sup>.

In this sense,  $Y_i$  will measure the “ability of individual  $i$  to find a job”, and we define  $Y_i$  as:

$$Y_i = 1 - \frac{\text{number of consecutive days until the individual "i" find a job}}{\text{total duration of observation}} \quad (7)$$

The period of observation we have considered consists of three years<sup>18</sup> (1095 days). We started to measure this time from the moment the participants finished the training program (generally at the end of 1999) and January 1st 2000 for the individuals of the control group<sup>19</sup>.

The value of  $Y$  varies between 0 and 1. If  $Y$  is equal to 0, it means that individual  $i$  has not found a job during the period considered. This is the worse scenario for the program’s effectiveness. If  $Y$  is close to 1, the individual  $i$  has found a job in a short period of time and if  $Y$  is equal to 1, it implies that individual  $i$  has found a job the first day after finishing the training program.

*Table 2* summarizes the main descriptive data of  $Y$ , while *Figure 1* includes the frequency distribution and the accumulated frequency distribution of  $Y$ .

**Table 2**

Descriptive statistics related to response variable $Y$ “ability to find a job”			
Mean	0,578147	Kurtosis	-1,392020
Median	0,773516	Coefficient of Asymmetry	-0,533554
Mode	0	Minimum	0
Standard deviation	0,380657	Maximum	1

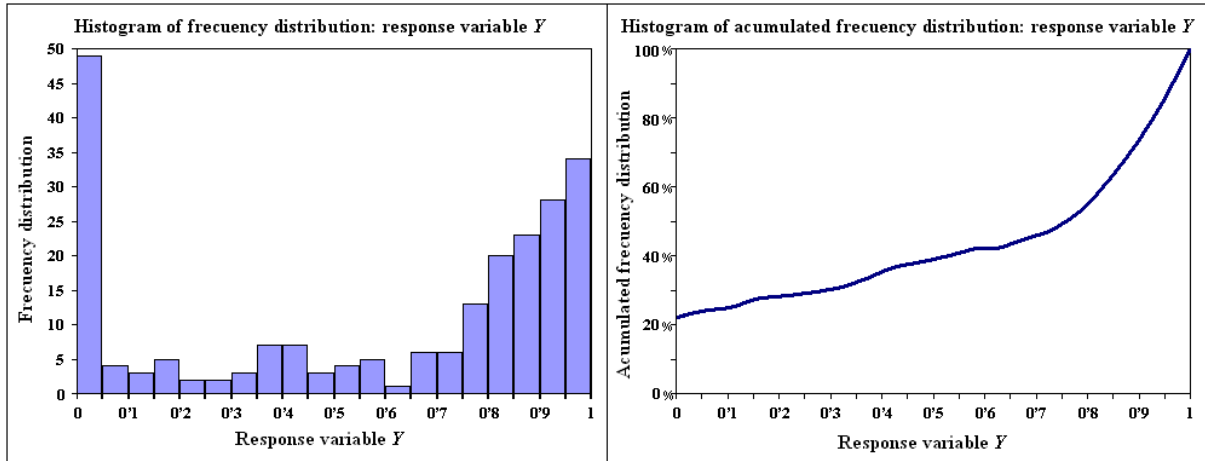
Source: Own elaboration

<sup>17</sup> The objective of this program is to act as an initiative of young unemployed, less than 25 years old, in finding a job.

<sup>18</sup> A relatively broad period of time has been considered, three years (1095 days) due to specific problems of this collective in finding jobs.

<sup>19</sup> The date fixed to start the test for the control group coincides with the starting date for many of the individuals in the participants group.

Figure 1



Source: Own elaboration

#### 4.2. THE COVARIATE VECTOR DEFINITION $X^3 = (X_1, X_2, X_3)$ .

With  $D$  defined,  $X$  will be a covariate<sup>20</sup> with respect to  $D$  if, for each of the individuals observed, its values remain the same for each value of  $D$ . That is to say  $X_{0i} = X_{1i}$ , being  $X_{0i}$  the  $X$  value before the event  $D$  ( $D = 0$ ) and  $X_{1i}$  the  $X$  value after happening  $D$  ( $D = 1$ ).

$X$  covariate is also named contaminant because of the fact that  $X$  can contaminate  $Y$ , adding its own effects<sup>21</sup> to those provoked by  $D$ .

The fact that  $X$  is predetermined with respect to  $D$  does not imply that this independence is bidirectional, because it is possible that, as a characteristic of considered population, dependence in an opposite direction can appear, making the value of  $D$  be affected for  $X$ .

From the sample information included in the database, we consider three predetermined variables which form the vector of covariates  $X^3 = (X_1, X_2, X_3)$ . The database only allows us to include in the model a complete information about this three covariates. We define the covariates in the following way:

<sup>20</sup> We talk about one covariate but everything we state can be extrapolated for the case that  $X$  is a vector of  $n$  covariates, as  $X^n = (X_1, X_2, \dots, X_n)$ .

<sup>21</sup> To read more, the comments of Rubin (1978) about covariates are very interesting.

- $X_1$ : sex. This shows if the individual considered is male or female. To prevent perfect multicollinearity, we have to introduce in the model as many dummies as categories less one. Then, we will include the dummy variable  $X_{11}$  which can value 0 and 1.

$$X_{11} = \begin{cases} 1 & \text{in the case of a male} \\ 0 & \text{in the case of a female} \end{cases}$$

- $X_2$ : age. This shows the individual's age at the beginning of the observational period. In the case of participants,  $X_2$  shows the individual's age when the training program is over. For controls,  $X_2$  shows the individual's age as of January 1 st, 2000.

Considering that age range for participants in one of the considered training programs is between 16 and 24 years old, and also considering that the program may extend for 1 or 2 years,  $X_2$  covariate will have values of between 17 and 26 years old.

- $X_3$ : zone, showing the city where individuals took the training program or, in the case of controls, where individuals lived. For this last variable, we have divided the area of Seville (Spain) into four zones, named as zone 1 (Sevilla city), zone 2 (east and northeast of Seville), zone 3 (south and southwest) and zone 4 (west and northwest). The criterion of mapping is an operational one. Considering that  $X_3$  is a qualitative variable, we need to define three dummies noted as  $X_{31}$ ,  $X_{32}$  and  $X_{33}$ , taking values 0 or 1.

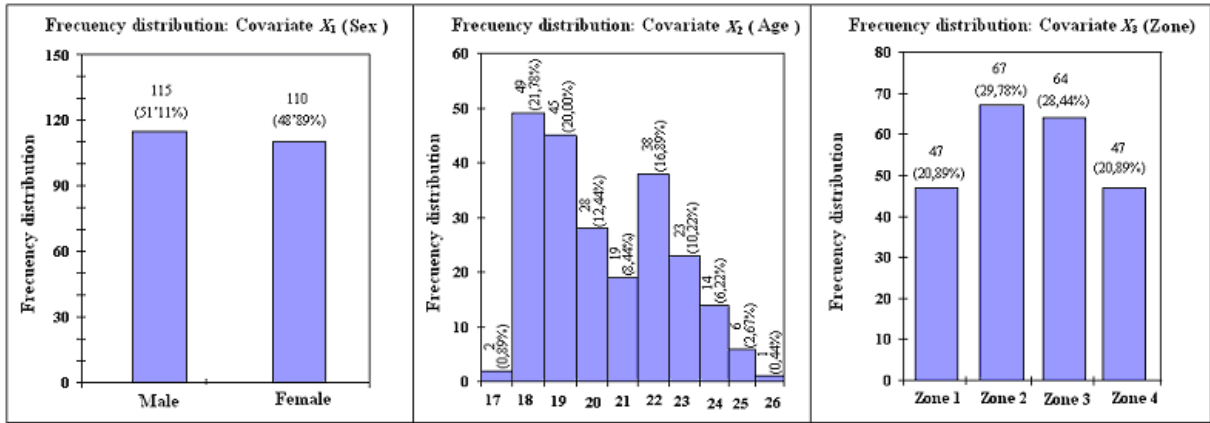
$$X_{31} = \begin{cases} 1 & \text{if the individual belongs to zone 1} \\ 0 & \text{if the individual belongs to any of the other three zones} \end{cases}$$

$$X_{32} = \begin{cases} 1 & \text{if the individual belongs to zone 2} \\ 0 & \text{if the individual belongs to any of the other three zones} \end{cases}$$

$$X_{33} = \begin{cases} 1 & \text{if the individual belongs to zone 3} \\ 0 & \text{if the individual belongs to any of the other three zones} \end{cases}$$

Figure 2 includes the frequency distribution of the covariates  $X_1$ ,  $X_2$  and  $X_3$ .

Figure 2



Source: Own elaboration

## 5. ESTIMATION OF THE AVERAGE EFFECT: EMPIRICAL RESULTS.

### 5.1. THE PROPENSITY SCORE.

To avoid the need to match individuals on the values of all covariates, Rosenbaum and Rubin (1983, 1984) developed an approach based on the propensity score<sup>22</sup>, the probability of one individual to participate in a program (probability of  $D = 1$ ), conditioned to the values of vector  $X$ . By making this probability  $\varepsilon(X)$ , we can express this as:

$$\varepsilon(X) = P(D = 1 | X) \quad (8)$$

which is assumed to be bounded away from zero and one.

This shows that this probability is a function of  $X$ , which is usually unknown, and therefore it should be estimated by using the database.

Rosenbaum and Rubin (1983) also define the assumption of propensity score independence as

$$(Y_1, Y_0) \perp D | \varepsilon(X) \quad (9)$$

$\varepsilon(X)$  being the probability of participating in a program conditioned on  $X$ . In this way, the independence assumption typical in randomized experiments is guaranteed.

<sup>22</sup> Really, there is not exist consensus on the number of covariates which recommended the use of propensity score instead of the covariates vector (Imbens, 2004). Any case, this is recommended when the overlap assumption can not be guaranteed for all the covariates.

This assumption lets us argue that all of the observations with the same propensity score will have the same distribution as the vector  $X$ , which means that we can compare the data observed for either participants or controls with the same propensity score.

Following Hahn (1998, p. 316), the calculation of the conditioned probability of participation in a program, given certain observable characteristics, plays a crucial role in controlling bias in order to obtain an estimator of the program's effects.

By using propensity score, we proceed as if it were the case of an unidimensional variable, improving evaluation efficiency by avoiding the management of a large number of covariates included in vector  $X$ .

The way to estimate the effects of a training program using selection on observables and by applying propensity score, is divided into "two-stage":

## **5.2. THE CALCULATION OF PROPENSITY SCORE ON VECTOR COVARIATES $X^3 = (X_1, X_2, X_3)$ (SEX, AGE AND ZONE).**

From (6), we can now express the probability of an individual's participation in a program conditioned on the value of vector  $X$ , as

$$\varepsilon(X) = P(D = 1 | X) = F(\beta X) \quad (10)$$

$\beta$  is the parameter's vector associated with the covariates. The value of this probability will remain conditioned to the value of the distribution function at point  $\beta X_j$ ;  $X_j$  being every possible value that the vector of covariates  $X$  can adopt, with  $j = 1, \dots, k$ .

Depending on the specific function of  $F$ , different selection models of binary response could be specified. From the possible non linear options, we have selected three: the Probit Model, the Logit Model and the Extreme Value Model Type I. There is not a generally accepted selection criterion in choosing one of these three models for the estimation of the "propensity score", so the way in which the choice is made is due only to practical reasons. We will



estimate the three models and after analysing the obtained results, we will choose the one with the best results according to the criteria specified later on.

Carrying out regressions on the vector of covariates  $X^3 = (X_1, X_2, X_3)$ , the results obtained are contained in *Tables 3, 4 and 5*.

**Table 3**

The calculation of the “propensity score” by using the Probit Model					
Dependent Variable: $D$ (Prob. $D = 1$ )					
Method: ML - Binary Probit					
Variable	Coefficient	Coefficient Value	Std. Error	t -Statistic*	Prob.
Fixed effect	$\mu$	-2'366701	0'848762	-2'788414	0'0053
$X_{11}$	$\beta_{11}$	0'580077	0'185036	3'134942	0'0017
$X_2$	$\beta_2$	0'125535	0'040936	3'066652	0'0022
$X_{31}$	$\beta_{31}$	-0'254362	0'285963	-0'889491	0'3737
$X_{32}$	$\beta_{32}$	0'002826	0'254795	0'011091	0'9912
$X_{33}$	$\beta_{33}$	0'058707	0'257340	0'228131	0'8195

\* t - Statistics adjusted by White's method

Source: Own elaboration

**Table 4**

The calculation of the “propensity score” by using the Logic Model					
Dependent Variable: $D$ (Prob. $D = 1$ )					
Method: ML - Binary Logic					
Variable	Coefficient	Coefficient Value	Std. Error	t -Statistic*	Prob.
Fixed effect	$\mu$	-3'801614	1'384561	-2'745719	0'0060
$X_{11}$	$\beta_{11}$	0'959225	0'311150	3'082833	0'0021
$X_2$	$\beta_2$	0'201706	0'067164	3'003174	0'0027
$X_{31}$	$\beta_{31}$	-0'428509	0'477954	-0'896549	0'3700
$X_{32}$	$\beta_{32}$	0'007757	0'422600	0'018354	0'9854
$X_{33}$	$\beta_{33}$	0'090384	0'427989	0'211182	0'8327

\* t - Statistics adjusted by White's method

Source: Own elaboration

**Table 5**

The calculation of the “propensity score” by using the Extreme Value Model Type I					
Dependent Variable: $D$ (Prob. $D = 1$ )					
Method: ML - Binary Extreme Value Type I (Gompit function)					
Variable	Coefficient	Coefficient Value	Std. Error	t -Statistic*	Prob.
Fixed effect	$\mu$	-2'563204	1'079534	-2'374361	0'0176
$X_{11}$	$\beta_{11}$	0'773186	0'250257	3'089566	0'0020
$X_2$	$\beta_2$	0'156557	0'054409	2'877383	0'0040
$X_{31}$	$\beta_{31}$	-0'354458	0'376021	-0'942655	0'3459
$X_{32}$	$\beta_{32}$	-0'009549	0'331510	-0'028805	0'9770
$X_{33}$	$\beta_{33}$	0'048197	0'340991	0'141344	0'8876
* t - Statistics adjusted by White's method					

Source: Own elaboration

In every case, in order to avoid possible heteroskedasticity problems, the t-statistic values are adjusted by White's method.

According to the corresponding value estimations of the parameters and t-statistics contained in *Tables 3, 4 and 5*, the variables  $X_{11}$  and  $X_2$  appear to be significant when calculating the probability of participation in the three models considered, while the dummy variables  $X_{31}$ ,  $X_{32}$  and  $X_{33}$ , defined to include the zone covariate, appear insignificant. In any case, we have decided to maintain them because they help to improve the significance of all the estimated parameters and to improve goodness of fits.

From the three methods, the most efficient will be the one that shows less values of information criterion of Akaike, Schwarz and Hannan-Quinn and a higher value of the log likelihood function for each of the three models. This information appears in *Table 6*.

**Table 6**

Comparison of the obtained results from the three binary response models applied			
	Probit Model	Logit Model	Extreme Value Model
Log likelihood function	-134'5663	-134'6875	-134'8964
Criterion Akaike	1'249478	1'250555	1'252412
Criterion Schwarz	1'340574	1'341651	1'343508
Criterion Hannan-Quinn	1'286245	1'287322	1'289179

Source: Own elaboration

The model that shows the lowest values of the criterion of Akaike, Schwarz and Hannan-Quinn and the highest value of the verosimilitude function is the Probit Model, and for this reason, it has been selected.

Following the procedure of the Probit Model, the equation which reflects the participation probability of an individual of the sample in the program evaluated conditioned on the vector values is as follows:

$$P = -2'366701 + 0'580077 X_{11} + 0'125535 X_2 - 0'254362 X_{31} + \\ + 0'002826 X_{32} + 0'058707 X_{33}$$

*Table 7* contains the main data of descriptive statistics related to the probability of participation. The probability has been estimated for every individual of the sample by using the Probit Model. *Table 8* contains the estimation of the participation probability for every possible individual depending on the different values that vector  $X^3 = (X_1, X_2, X_3)$  can have.

**Table 7**

Descriptive statistics related to "Propensity score" obtained by using the Probit Model			
Mean	0'667158	Kurtosis	-0'795769
Median	0'681896	Coefficient of Asymmetry	-0'145460
Mode	0'682903	Minimum	0'358889
Standard deviation	0'129550	Maximum	0'920798

Source: Own elaboration

Table 8

"Propensity score" values depending on possible values that vector $X^3 = (X_1, X_2, X_3)$ can have, according to the Probit Model								
	Male				Female			
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
17 years old	0'537092	0'636943	0'657695	0'635882	0'313141	0'409132	0'430973	0'408034
18 years old	0'586537	0'682903	0'702538	0'681896	0'358889	0'458488	0'480714	0'457367
19 years old	0'634645	0'726203	0'74449	0'725261	0'406757	0'508494	0'530757	0'507366
20 years old	0'680721	0'766358	0'783123	0'765491	0'456062	0'558366	0'580319	0'55725
21 years old	0'724162	0'803015	0'818146	0'80223	0'506053	0'607328	0'628636	0'606241
22 years old	0'76448	0'835956	0'849398	0'835257	0'55595	0'654647	0'675006	0'653605
23 years old	0'801313	0'865097	0'876852	0'864483	0'604975	0'699663	0'718811	0'69868
24 years old	0'834439	0'890472	0'900591	0'889942	0'65239	0'74182	0'759548	0'740906
25 years old	0'863765	0'912224	0'920798	0'911773	0'697532	0'780683	0'796839	0'779847
26 years old	0'889321	0'930579	0'93773	0'930201	0'739839	0'81595	0'830443	0'815197

Source: Own elaboration

Finally, to every individual (participants and controls) the estimated value of his "propensity score" conditioned on vector  $X^3$  has been assigned. After doing this we proceed to calculate  $ATE (\hat{\alpha}_{ATE})$  and  $ATET (\hat{\alpha}_{ATET})$ .

### 5.3. WEIGHTING OBSERVATIONS BY THE PROPENSITY SCORE.

By weighting observations by the inverse of a nonparametric estimate of the propensity score, we have an efficient estimator of the average effect. ATE and ATET's estimators are expressed as follows<sup>23</sup>:

<sup>23</sup> Hirano, Imbens and Ridder (2003) developed  $ATE (\hat{\tau})$  and  $ATET (\hat{\tau}_{treated})$  estimators obtaining,

$$\hat{\tau} = \frac{1}{N} \sum_{i=1}^N \left( \frac{Y_i \cdot T_i}{\hat{p}(X_i)} - \frac{Y_i \cdot (1 - T_i)}{1 - \hat{p}(X_i)} \right) \quad 0 = \sum_{i=1}^N \hat{p}(X_i) \cdot \left( \frac{Y_i \cdot T_i}{\hat{p}(X_i)} - \frac{Y_i \cdot (1 - T_i)}{1 - \hat{p}(X_i)} - \tau_{treated} \right)$$

where  $Y_i$  is the outcome,  $T_i$  the binary variable which indicates if individual it's treated or control and the  $X$  covariate's vector which let us to define  $\hat{p}(X_i)$  as the probability to participate in the program, conditioned on  $X$ .

$$\hat{\alpha}_{ATE \rightarrow WEIGHTING PS} = \frac{1}{n} \sum_{i=1}^n Y_i \cdot \frac{D_i - \hat{\varepsilon}(X_i)}{\hat{\varepsilon}(X_i) \cdot (1 - \hat{\varepsilon}(X_i))} \quad (11)$$

$$\hat{\alpha}_{ATET \rightarrow WEIGHTING PS} = \frac{1}{n_1} \sum_{i=1}^n Y_i \cdot \frac{D_i - \hat{\varepsilon}(X_i)}{1 - \hat{\varepsilon}(X_i)} \quad (12)$$

where  $\hat{\varepsilon}(X_i)$  is the estimated value of the propensity score for the  $i$ -individual on vector  $X$ .

The obtained results are  $\hat{\alpha}_{ATE} = 0,421280$  and  $\hat{\alpha}_{ATET} = 0,430409$ .

The estimated value of the ATE is positive. In average, the sample's individuals' ability to find a job increases by 0,421280. In the case of the ATET, the estimated value is also positive, meaning that there is a favourable causal effect from the program. This result indicates that participant's ability to find a job has increased, on average, by 0,430409.

#### 5.4. THE “TWO-STAGE” ESTIMATOR ON THE PROPENSITY SCORE.

Additionally, from the estimated values of propensity score, we can obtain an estimator of the training program effects on  $Y$  by applying Heckman's “two-stage” estimator –Heckman (1979)<sup>24</sup>-, which is also known as “probit conditioned”.

By following this procedure, to solve the possible selection's bias, in the first stage we confront the question of participation or non participation in the training program. In the second stage, we estimate the effect that the program causes on the  $Y$  values of the treated.

Following this model, in the first stage we estimate the “propensity score” by using a Probit Model on vector  $X^3 = (X_1, X_2, X_3)$ .

Secondly, we analyze how participation in a training program influences the observed values of  $Y$  through a regression using Least Squares.

The estimation by Least Squares in the second stage will be carried out by using a linear model which is adjusted to the expression

$$Y = \mu + \alpha D + \sigma \hat{\varepsilon}_{(X)} + \varepsilon \quad (13)$$

---

<sup>24</sup> See also Heckman (1990) and Heckman and Vytlacil (2005).

$Y$  is the response variable (the ability to find a job),  $D$  is the binary variable and  $\hat{\varepsilon}_{(X)}$  (the “propensity score” values estimated in the first stage) is added as an additional explanatory variable.

The model’s parameters are  $\mu$ , which collects the fixed effects in the model,  $\varepsilon$ , which collects the random error of the model, with an average value equal to 0,  $E[\varepsilon | D, \hat{\varepsilon}_{(X)}] = 0$ , and  $\alpha$ , as the parameter which allows us to determine the average effect of the program on participants. The  $\alpha$  parameter will be the “two-stage” estimator ( $\hat{\alpha}_{ATE}$ ) of the program’s effects on participants. The *Table 9* shows the results after regression by Least Squares:

**Table 9**

The calculation of $\hat{\alpha}_{ATE}$ by using “two-stage” estimator					
Dependent Variable: $Y$ (Ability to find a job)					
Method: Least Squares					
Variable	Coefficient	Coefficient Value	Std. Error	t -Statistic*	Prob.
Fixed effect	$\mu$	-0'100162	0'111391	-0'899191	0'3695
$D$	$\alpha$	0'407455	0'050691	8'037953	0'0000
$\hat{\varepsilon}_{(X)}$	$\sigma$	0'609559	0'177733	3'429642	0'0007
R-squared		0'354277	F-statistic		60'90033
Adjusted R-squared		0'348460	Prob(F-statistic)		0'000000
* t - Statistics adjusted by White’s method					

Source: Own elaboration

After estimating the parameters, the linear model results are as follows.

$$Y = -0'100162 + 0'407455 D + 0'609559 \hat{\varepsilon}_{(X)} \quad (14)$$

The  $\alpha$  parameter (0'407455) is the “two-stage” estimator of the program’s effects on participants ( $\hat{\alpha}_{ATE}$ ).

To correctly adjust the model in the presence of heteroskedasticity, the t-statistics values have been adjusted by White’s method.

The values of the t-statistics (8'037953) and the associated probability (0'0000) let us reject the null hypothesis that implies that  $\alpha$  equals 0, so the  $D$  variable becomes significant in the model. The adjustment also shows the "propensity score" of individuals to be significant. In relation to the fixed effects, the adjustment shows non significance of the constant in the regression.

The joint significance of all the model estimated parameters can also be tested from the value of the probability of the F-Snedecor contrast. In this case the probability is equal to 0'00000, meaning the acceptance of the joint significance of all the parameters of the model. This implies that we can consider that all the parameters are significantly different from 0.

With respect to goodness of fit, the R-squared statistic equals 0'354277 and shows that the explanatory power of  $D$  is equal to 35'4277 percent. On the other hand,  $R^2$  adjusted is equal to 0'348460.

In short, we conclude that the estimator of  $ATE_T$  ( $\hat{\alpha}_{ATE_T}$ ) takes a positive value, showing a favourable causal effect from the training program on the time it takes for an individual, who participated in the evaluated program, to find a job. On average, the ability to find a job for the participants increases by 0'407455.

## **6. CONCLUSIONS.**

The training scholl program's average effect estimated by weighting observations by the inverse of a nonparametric estimate of the propensity score let us to conclude that, for treated, the time needed to find a job is reduced in 471 days. As the program was designed to improved the employ between youngers unemployed; this results supports the effectiveness of this public policy.

The paper allowing us to compare this result with the obtained by applying Heckman's "two-stage" estimator. With the second method we conclude that the estimator of  $ATET$  ( $\hat{\alpha}_{ATET}$ ) takes a positive value although minor than the previous one. In this case, on average, the period needed for a treated for find a job, is reduced in 446 days. The result is also interesting for policy purpose.

Further investigations might improve conclusions if public authorities let researchers to extend the database information with data related with others individual characteristics.

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