# The Impact of Training Programs on the Unemployment Risk : Empirical and Theoretical Analysis

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November 2007

**Abstract**

Using matching estimators and French data, we study the effects of firm-provided training on the probability the workers have to undergo an unemployment spell. We then nicely and theoretically explain why these effects are significant but very small. To this purpose, we consider a matching model *à la* Mortensen D. and Pissarides C. (1994) where firms decide which sum to invest in specific training. This sum the firm offers to each hired worker leads to diminish their probability to be hired in future. Nevertheless, workers can capture some of the training costs by bargaining a higher wage ("holdup"), leading to a restriction of this direct effect of training on the unemployment risk.

## 1 Introduction

The European Heads of government in the Lisbon summit at the beginning of the new millennium strongly committed to make of Europe by 2010 "the most competitive and dynamic knowledge-based economy in the world". The development of high quality vocational training in Europe is then a crucial part of this strategy, especially in order to improve and adapt existing skills to the changes of technology, and finally in terms of promoting employability[1].

Firms, with government assistance, have then a key role in this objective since they are the main on-the-job training supplier. Indeed, according to the complement "Formation Continue 2000" of the French survey "Enquête Emploi" (INSEE), the employees-followed training in 1999 (whatever its type) has been firm-financed in near than 85% of cases and that 3/4 is reported to be at least partially initiated by firms[2]. However, they especially

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[1]For details about differences in training practices in Europe, see Bassanini A., Booth A., Brunello G., De Paola M. and Leuven E. (2005)

[2]It can be difficult to identify the type of the firm-provided training (specific or general). This problematic is not tackled here.

pay for short training since more than 80% of the whole of training targeted to employees they financed in 1999 have lasted less than one week, and near 95% less than one month.

In France, although many training programs targeted to workers exist, there have been very few studies dedicated to the evaluation of their impacts on the probability to undergo an unemployment spell. Indeed, existing empirical studies mainly focus on their effects on wages. For instance, Goux D. and Maurin E. (2000) show that the estimated impact of training on wages is close to zero. Fougère D., Goux D. and Maurin E. (2001) also show that training has no significant effect on wages in training firms. Ferracci M. (2006), using several estimators, propose a complete and detailed evaluation of training programs for unemployed workers in France. He finds that training's impact on the employment rate of trained individuals is strongly negative at the beginning of the program ("lock-in" effect), but then becomes weakly positive. The author also shows that training leads to a rise of the tenure of the new job.

Here, we propose to estimate the effects of employees-followed training on the probability they have to undergo an unemployment spell, two years after the beginning of the program. Using French data of "Enquête Emploi" and its complement "Formation Continue 2000" and matching estimators, we show that training's participation has a significant, but very small, effect on the probability to experience an unemployment spell. So, one can wonder what are the factors likely to explain this positive effect, but very small, of training's participation on the probability the workers have to keep their job? Of course, a short training's duration is supposed to be one of the elements of this empirical evidence. Nevertheless, are there not any further plausible explanations, notably relevant to the type of the relationship between workers and firms? We undertake to explore the lessons of the new developments on labor market theories devoted to this topic.

In a theoretical viewpoint, our paper is related to several contributions focusing on interactions between employers and employees in cases of labor market imperfections(see Acemoglu D. and Pischke J.-S. (1998) for a survey). In the case of a search frictions environment, Acemoglu D. and Shimer R. (1999) and Sato Y. and Sugiura H. (2003) consider for instance an ex-ante investment that has to take place before production begin. Such an approach allows them to analyze the likelihood for holdups relevant to the ex-post wage bargaining : the worker is in a position to capture some of the training's costs sunk by the firm by bargaining a higher wage. Acemoglu D. and Shimer R. (1999) examine how markets can internalize the resulting externalities of this holdup problem when firms invest in physical capital. Sato Y. and Sugiura H. (2003), considering a general human capital investment, investigate the effects of labor market policies in order to achieve efficiency.

In this paper, we are interested in firm-financed specific human capital investments. We examine their consequences on firing decisions in a matching framework with endogenous job creations and destructions (Mortensen D. and Pissarides C. (1994)). We show that the holdup problem, due to an ex-post wage bargaining process, thwarts the direct and positive effect of training on productivity. Indeed, this kind of wage determination increases the trained worker's threat point as firms will have to pay another training cost if disagreement. Workers are then allowed to capture some of the rent created by the training cost while they have not paid for it[3]. Hence, this leads to reduce the positive effects of training in terms of reduction of the unemployment risk.

The remainder of the paper is organized as follows. The next section is devoted to the empirical analysis, the third one to the theoretical analysis. The last section concludes the paper.

[3]See Malcomson J. (1997) for further details about this "holdup" concept, and also Chéron A. (2005) for his analysis in a matching framework *à la* Pissarides. Charlot O. (2005) also mention the consequences of this holdup problem on the optimality of individuals' education choices in a matching model.

## 2 The impact of continuous training programs on the unemployment risk

Although many training programs targeted to workers exist in France, there have been very few studies dedicated to the evaluation of their impacts on the unemployment risk. In this section, we undertake to do so for employees-followed training (that is firm-financed in 85% of cases) using a propensity score matching estimator (2.3). Before this, we present the theoretical framework and the steps of the evaluation (2.1) and give an insight into the data (2.2).

### 2.1 The evaluation methodology

We use matching estimators that applies in all the situations in which a treatment is assigned to a group whereas another one is not treated. This method consist in building a control group of non-treated individuals whose characteristics are similar to the ones in the treatment group, and then in comparing the outcomes of the both groups. It allows us to control for the selection bias at the entry of programs that can alter the assignment to a training program, and finally to determine the causal effect of the treatment on the treated from the counterfactual outcome: what would have been the probability to undergo an unemployment spell of a trained worker, had she not been trained?

#### 2.1.1 General framework

The main problem in this framework is the lack of information. Let us apply the Roy A. (1953) and Rubin D. (1974)'s canonical model that enables to formalize this problem. Given $D$ the treatment variable which value is 1 if the individual is treated and 0 otherwise. Let us call $X$ a vector of observed covariates and $Y$ the response variable, where $Y_1$ refers to the outcome of a treated worker and $Y_0$ to the outcome of an untreated one.

We focus on the average treatment effect on the treated, defined by $E(Y_1|D = 1) - E(Y_0|D = 1)$. The lacking information is about $E(Y_0|D = 1)$ since the outcome of non-treatment for treated workers cannot never be observed directly from the data. Hence, this counterfactual outcome must be estimated. In order to do so, it is common to use the information given by the non-treated individuals: $E(Y_0|D = 0)$. But, to estimate the causal effect of the treatment on the treated in a unbiased way, we must ensure that treated and untreated groups are comparable conditionally on $X$, that is, given $X$, the untreated outcomes are what the treated outcomes would be had if they not been treated.

Under this conditional independence assumption on observable covariates $X$, the counterfactual outcome can be estimated using $E(Y_0|D = 1, X) = E(Y_0|D = 0, X)$. Nevertheless, when covariates $X$ are numerous, one might not find for each treated individual a non-treated with exactly the same characteristics. To deal with dimensionality problem, Rosenbaum P. and Rubin D. (1983) suggest that the conditional independence assumption on $X$ is also valid on a propensity score $P(X)$, that is in the form of a probability of being treated. This result allows for one-dimensional matching instead of full matching on all characteristics: treated and untreated individuals are matched on the basis of their propensity score.

### 2.1.2 Implememtation of the propensity score

We estimate the causal effect in three steps. The first one consists in explaining the treatment variable by the observable, that is in estimating the propensity score (the probability to get trained). To this end, we estimate a logit model.

Once the individual propensity scores have been estimated, the second step of the analysis consists in determining the region of common support of the densities of the two groups since the estimator is only defined in this region. Implementing the common support ensures that any combination of characteristics observed in the treatment group can also be observed among the control group, that is matching is plausible. We use the method of minima and maxima comparison which delete all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group. We also exclude observations whose propensity score is exactly zero.

At last comes the estimation itself of the causal effect, for which we use Kernel matching estimators proposed by Heckman J., Ichimura H. and Todd P. (1998). This method uses weighted averages of all individuals in the control group to construct the counterfactual outcome. Weights depend on the distance between each individual from the control group and the participant observation for which the counterfactual is estimated[4].

## 2.2 Data

The data used for our study come from two French databases. The first is the so-called "Formation Continue 2000" French training survey, gathered by INSEE (National Institute for Statistics and Economic Studies) that describes precisely the whole of workers-followed training since their exit from school.
Additional information on individuals was obtained by merging the previous survey with the "Enquête Emploi" databases from 1998 to 2000, also gathered by INSEE. They particulary yield information about their mobility on the labor market and also about their job's characteristics.

The merged database contains 20266 individuals who have participated or not to a continuous training program. We only focus on employees-followed training. The employed population consists of workers who were employed in March 1998, where self-employed, farmers, state-employed and part-time workers are excluded. We also only consider work-related training whose duration is lower than one year. Finally, only the respondents who

[4]For more details about the implementation of propensity score matching, one can see Caliendo M. and Kopeinig S. (2005) or Becker S.O. and Ichino A. (2002)

have answered all of the relevant questions are included. After these eliminations, the sample consists of slightly 5745 individuals.

We define the treated people as the ones who have participated to one training spell at least between March 1998 and December 1998 while they were employed. We are therefore left with 1154 observations for the treatment group while the control one contains 4591 observations.

The response variable is the probability for each employee in March 1998 to undergo an employment spell (at least one month) between April 1998 and March 2000.

## 2.3 Results

### 2.3.1 Determinants of participation

Table 1 reports the estimate of the logit model describing the determinants of assignment to training (first step of the implementation of the estimator). Most of the results appear to be significant at the 1% level. Training participation decreases with age, as shown by the maximum of likelihood. Thus, to be 55/65 years old reduces the probability to get trained of about 80%, compared to the youth. The probability of receiving training is also weaker for individuals who have completed elementary school or lower school certificates. Likewise, there is one clear link between participation to a training spell and the qualification of the job: executives (the "cadres") are far more likely to get trained than low-skilled workers (-43% for "employés" and -58% for "ouvriers"). In addition, training proves to be more likely for the individuals who work in larger companies. Lastly, the higher the job seniority, the more likely the assignment to training is.

These results are in line with the usual analysis of the determinants of training participation (OCDE (2003) for instance).

### 2.3.2 The causal effect of participation

The main finding is that the participation to a training spell has a little and negative impact on the unemployment risk: it hardly reduces (5%) the probability to undergo an unemployment spell between April 1998 and March 2000. This lesson supports the results about the effects of training on wages mentioned above, that is a significative effect but close to zero.

Results also highlight the presence of some selectivity bias in our data relevant to the observable characteristics. The "apparent effect" (or unmatched effect) simply reports the observed difference between the average probability to have undergone an unemployment spell between April 1998 and March 2000 for the treated, and the same one for the untreated. This probability is about 50% higher for the untrained workers (6,39% *vs* 9,58%), suggesting that participation to training is likely to reduce the probability to experience an unemployment spell. But, when controlling for the selectivity bias with the kernel matching estimate, this effect is close to zero: the difference of probabilities between trained and

Table 1: Estimated coefficients from logit estimation

| | |
|---|---|
| Constant | -0,81*** (0,28) |
| **Gender** (Ref : Man) | |
| Woman | -0,18** (0,09) |
| **Nationality** (Ref : French) | |
| Stranger | -0,42** (0,20) |
| **Age** (Ref : 16-24 yo) | |
| 25-34 yo | -0,41** (0,20) |
| 35-44 yo | -0,68*** (0,21) |
| 45-54 yo | -0,81*** (0,22) |
| 55-65 yo | -1,60*** (0,27) |
| **Diploma**(Ref : Level 5 (academic degree)) | |
| Level 4 | 0,06 (0,16) |
| Level 3 | -0,14 (0,16) |
| Level 2 | -0,34** (0,16) |
| Level 1 | -0,46** (0,20) |
| Level 0 (no diploma) | -0,75*** (0,17) |
| **Occupational group** (Ref : Executives) | |
| Middl-skilled workers | -0,05 (0,12) |
| Low-skilled workers | -0,55*** (0,15) |
| Unskilled workers | -0,87*** (0,14) |
| **Job seniority**(Ref : Lower than 1 year) | |
| From 1 to 5 years | 0,37** (0,15) |
| From 5 to 10 years | 0,63*** (0,15) |
| Higher than 10 years | 0,63*** (0,15) |
| **Firm size** (Ref : Lower than 19 employees) | |
| 20-49 employees | 0,25* (0,13) |
| 50-99 employees | 0,41*** (0,15) |
| 100-499 employees | 0,70*** (0,11) |
| 500-999 employees | 1,07*** (0,14) |
| 1000 employees or more | 1,07*** (0,10) |
| **Sector** (Ref : Industries and energy) | |
| Construction | -0,22 (0,15) |
| Trade and repairing | 0,23** (0,11) |
| Transport | 0,06 (0,18) |
| Banking, insurance and property markets | 0,17 (0,10) |
| Education, health, public sector | 0,23* (0,12) |

Dependant variable : one if the individual has participated to one training spell at least in 1998. Standard errors reported within brackets; ***, **, * : significant at 1%, 5% and 10% level respectively.

Table 2: Causal effect of training based on kernel matching

| | Causal effect | Apparent effect |
|---|---|---|
| Training in 1998 | -0,047*** (0,015) | -0,69 |

Bootstrapped standard errors reported within brackets.
*** : significant at 1% level.

untrained workers largely comes from individual characteristics included in the propensity score estimation.

# 3 Continuous training and endogenous job destructions : a theoretical analysis

This section propose to explore the effects of continuous training in the basic labor market framework *à la* Mortensen D. and Pissarides C. (1994), extended to allow for the firms' decisions to invest in continuous training: to what extent this framework may be likely to account for the positive, but very small, impact of training on the probability the workers have to keep their job?

## 3.1 Model description

We consider a matching model with endogenous job creations and destructions where firms decide at job entry which sum $k$ to invest in training. This latter yields the job productivity[5] $y(k)\varepsilon$ where $\varepsilon$ refers to the random component of the productivity. This investment is supposed to be relevant on the match since the job destruction leads to a lost of its return for both parties in terms of productivity. In this way, training can be considered as specific.
We consider a discrete time model determined at steady state.

### 3.1.1 Labor market flows

Matches are one-to-one and are randomly formed according to a constant return to scale matching function $M(v,u)$ that gives the number of hirings as a function of the number of vacancies $v$ and the number of unemployed workers $u$, that is the job creation flows. Each worker matches with a firm with probability $\theta q(\theta) \equiv \frac{M(v,u)}{u}$ where $q(\theta) \equiv \frac{M(v,u)}{v}$ defines the firm's probability to fill a vacancy, with $\theta \equiv \frac{v}{u}$ the labor market tightness.

Job destruction flows derive from a new value of $\varepsilon$ that is drawn from its distribution $G(\varepsilon)\ \forall\ \varepsilon \in [0,\bar{\varepsilon}]$. Firms then decide to end endogenously any match whose productivity is below a productivity threshold $R(k)$. In the opposite case, workers continue their productive activities with this new value of $\varepsilon$ and can renegotiate their wage. For simplicity, we assume that a new value of $\varepsilon$ is drawn at each period so that $G(R(k))$ corresponds to the job destructions rate[6].

Denoting $u$ the unemployment rate (with active population normalized to unity), the equilibrium on the labor market implies:

$$u = \frac{G(R(k))}{G(R(k)) + \theta q(\theta)}$$

[5] The function $y(k_j)$ is assumed strictly increasing and concave, with $y(0) = 0$.

[6] By definition, shocks are *iid*.

### 3.1.2 Firms decisions

**The vacancies** The value of a vacancy satisfies the Bellman equation that follows:

$$V = -c + q(\theta)[\beta J(\bar{\varepsilon}, k) - C(k)] + (1 - q(\theta))\beta V$$

with $\beta \in [0, 1]$ the discount factor, $c \geq 0$ the flow cost of recruiting a worker. $J(\varepsilon, k)$ defines the expected value of a job with idiosyncratic productivity $\varepsilon$ once filled by a worker that has received a specific training $k$ for which firms have directly sunk its cost $C(k)$. We assume that a new job start at the highest productivity level, $\bar{\varepsilon}$.

The free-entry of firms hypothesis, $V = 0$, determines the labor market tightness:

$$\frac{c}{q(\theta)} = \beta J(\bar{\varepsilon}) - C(k)$$

**The firing decision** The expected value of a filled job by a worker reports on the instantaneous profit and on the expected gain in the future, given that the post will be vacant if the new productivity drawn at the next period is below to $R(k)$:

$$J(\varepsilon, k) = y(k)\varepsilon - w(\varepsilon, k) + \beta \left[ \int_{R(k)}^{\bar{\varepsilon}} J(x, k) dG(x) + G(R(k))V \right]$$

where $w(\varepsilon, k)$ denotes the real wage.

The endogenous job destruction rule $J(\varepsilon, k) < 0$ leads to a reservation productivity $R(k)$ defined by $J(R(k), k) = 0$ such as:

$$y(k)R(k) = w(R(k), k) - \beta \int_{R(k)}^{\bar{\varepsilon}} J(x, k) dG(x)$$

From this rule, it follows that a firm can afford to lose some instantaneous profit since it can be compensated for future gains.

**The human capital investment decision** The firm chooses how much specific training to invest so as to maximize the net expected value of a filled job. It follows that the investment decision is stated as:

$$\underset{k}{max} \beta J(\bar{\varepsilon}, k) - C(k) \quad \Longrightarrow \quad C'(k) = \beta \frac{\partial J(\bar{\varepsilon}, k)}{\partial k}$$

Thus, the firm chooses how much specific training to invest so as to equate the expected marginal return on investment to the marginal cost of investment. The marginal return especially depends on the relation between the bargained wage and the firm-decided investment level.

### 3.1.3 The wage bargaining

Let us consider worker's and unemployed worker's behaviors respectively given by:

$$W(\varepsilon, k) = w(\varepsilon, k) + \beta \left[ \int_{R(k)}^{\overline{\varepsilon}} W(x, k) dG(x) + G(R)U \right]$$
$$U = z + \beta \left[ \theta q(\theta) W(\overline{\varepsilon}, k) + (1 - \theta q(\theta))U \right]$$

where $W$ defines the value of a job for an employee and $U$ the expected utility of an unemployed worker, with $z$ her instantaneous utility.

We assume that wages are determined by a Nash bargaining. The firm and its worker then share the global surplus generated by a job according to their bargaining power. But, following Mortensen D. and Pissarides C. (1999), the wage structure that arises when firms is liable for hiring costs (a training cost here) is a two-tier one. On one hand, the initial wage reflects the fact that the worker shares the initial hiring cost by accepting a lower wage[7]. On the other hand, the renegotiated wages subsequent to match productivity shocks do not include training costs, those are sunk.
But, following Mortensen D. and Pissarides C. (1999) again, because the first tier wage is lower than the second tier, workers have an incentive to renegotiate immediately after been hired. Training investment requires to continuing the relationship to be efficient; workers are hence in a position to renegotiate immediately. The initial wage is then not credible ; the second tier wage contract applies initially as well as subsequent to any shock to match productivity ("insider wage"), leading to a holdup problem. Indeed, the ex-post bargaining process increases the employee's threat point, allowing her to capture some of the rent created by the training cost while she has not paid for it by bargaining a higher wage (one can refer to Malcomson J. (1997) and Chéron A. (2005) on this topic).

We then derive the following expression for the wage:

$$w(\varepsilon, k) = (1 - \gamma)z + \gamma(y(k)\varepsilon + c\theta) + \gamma\theta q(\theta)C(k)$$

On one hand, the wage is a weighted average *i* of the productivity and of the recruitment costs the firm saves, and *ii* of the reservation wage of the worker. On the other hand, the last term of the right-hand side represents the holdup that depends on the human capital investment level, and that rises the bargained wage: workers are all the more in a position to threaten firms than the probability they have to find a job ($\theta q(\theta) \equiv \frac{M(v,u)}{u}$) is high. The holdup problem becomes then stronger.

[7]This refers to one of the Becker G. (1964)'s lessons that suggests that firms and their workers would share the returns and the cost of the investments in specific training to be efficient.

### 3.2 Equilibrium : training's impact on firing job destructions

**Proposition 1:** A labor market equilibrium with wage bargaining exists and it is characterized by a triplet $\{R(k), \theta, k\}$ solving:

$$\begin{cases} \frac{c}{q(\theta)} & = \beta(1-\gamma)y(k)[\bar{\varepsilon} - R(k)] - C(k) \\ (1-\gamma)y(k)R(k) & = (1-\gamma)z + \gamma\big[c\theta + \theta q(\theta)C(k)\big] - \beta(1-\gamma)y(k)\int_{R(k)}^{\bar{\varepsilon}}(1-G(x))dx \\ C'(k) & = \beta(1-\gamma)y'(k)\,[\bar{\varepsilon} - R(k)] - \beta(1-\gamma)y(k)R'(k) \end{cases}$$

**Property:** $\frac{dR(k)}{dk}y(k)\Big[1 - \beta\big[1 - G\left(R(k)\right)\big]\Big] = -y'(k)\left[R(k) + \beta\int_{R(k)}^{\bar{\varepsilon}}[1-G(x)]dx\right] + \frac{\gamma}{(1-\gamma)}\theta q(\theta)C'(k)$

**Corollary 1:** If $\gamma = 0$, $\frac{dR(k)}{dk} < 0$. Given the wage, the firm-provided training leads to diminish the probability the worker has to be hired since it leads to increase the present and future productivity gains (first term of the right-hand side of the property). This is the direct and intuitive effect of training in terms of reduction of the unemployment risk.

**Corollary 2:** If $\gamma > 0$, $\frac{dR(k)}{dk} \lesseqgtr 0$. If workers have a positive bargaining power, that is if they are able to capture some of the rents generated by the training cost, the effect of training at equilibrium is ambiguous: the holdup on the training cost thwarts the direct and positive effect of training on productivity. Thus, even if the participation to a training spell result in a decrease of job destructions thanks to the productivity gains the training generates, this effect is lightened by the part of the rent created by the training cost the worker capture. This finally reduces the value of a filled job and then rises the reservation productivity.
In a theoretical viewpoint, this mechanism is likely to be one the causes of our previous empirical evidence: the participation to a training spell weakly reduces the unemployment risk.

## 4 Conclusion

On one hand, this paper can be viewed as an attempt to investigate from the empirical viewpoint the impact of employees-followed training on the probability they have to keep their job. We have shown that this impact is significative and positive but very small. On the other hand, we puts forth that a matching framework is likely to give an explanation of this empirical evidence.
Our work should be thorough in several ways. First, we ought to deal with the question of the type of the firm-provided training, especially if it is specific or general, that is if skills are of use or of no use to other firms. Specials concerns to age also seems to

be an important question for future research: from the empirical viewpoint, the return on investment training and then the incentive to invest in training must be naturally age dependant. From the theoretical viewpoint, and to take up our argumentation, the possibility for workers to capture some of the rent created by the training costs (holdup) must also rely on worker's age.

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