

Do Marginal Employment Subsidies Increase Re-Employment Probabilities? Preliminary Results on the Experiment of the Agenzia del Lavoro of Trento (Italy)

Leonardo Felli-Andrea Ichino

Abstract. The purpose of this paper is to test whether a Marginal Employment Subsidy program (MES) is effective in reducing the length of unemployment spells. Our test is constructed in such a way as to isolate the direct effect of the MES from the business cycle effect (i.e. the variation in unemployment that would have normally occurred in the absence of the program). Specifically, we estimate a Markov chain duration model with time-varying covariates and we test if eligibility for an MES increases the hazard rate of leaving unemployment. One of the time-varying covariates is an index of macro-economic performance that controls for the variation in the hazard rate due to business cycle fluctuations. The net effect of the MES offered by the *Agenzia del Lavoro* of Trento, Italy, is shown to be significantly positive: the Marginal Employment Subsidy program increases the re-employment probability and reduces the expected duration of unemployment by twenty one months.

Introduction

In the last decade, Marginal Employment Subsidies (MES hereafter) programs have been proposed and used in many European Countries and in the U.S. as a tool against the increase of unemployment. The basic structure of these programs consists of a subsidy offered by the government to employers willing to hire new workers in excess of their current number of employees. The subsidy is usually given in a lump sum form or as a proportion of the worker's wage for a limited period of time.

Leonardo Felli, Massachusetts Institute of Technology.

Andrea Ichino, Massachusetts Institute of Technology.

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With respect to the Italian situation, one of the most attractive applications of MES is the possibility of using them to reduce the number of unemployed workers receiving the unemployment benefit from the *Cassa Integrazione Guadagni Straordinaria* (CIGS hereafter). Besides the usual reasons for which unemployment is not desirable — loss of output, social and psychological costs, etc. — the CIGS (a public income maintenance program) is also extremely costly for the government and introduces undesirable inefficiencies in the Italian labor market (see Section 1). For these reasons, in 1985, the *Agenzia del Lavoro* of the Province of Trento (Local Labor Department) started an experimental MES program targeted at reducing the length of CIGS unemployment spells. Our model tests the effectiveness of this MES program.

From a theoretical point of view the impact of MES programs is in principle limited by the size of the elasticity of labor demand. However, supporters of these programs have tried to show that for reasonable values of this elasticity the effect of MES could be fairly attractive¹. Furthermore, it has been argued² that when the primary goal of expansionary fiscal policies is the creation of employment, MES are the way in which public money should be spent. These programs should in fact have the strongest direct effect on employment for a given level of public expenditure.

MES have also been indicated as effective in those situations in which unemployment is highly concentrated within particular categories of the labor force. In those cases, hiring subsidies³ targeted at helping the disadvantaged workers can reduce the variance of unemployment among segments of the labor market⁴.

Other attractive features of these programs concern the possibility of financing the MES with the savings on unemployment benefits⁵. Suppose that an unemployed worker receives a benefit for one year. If half the yearly amount of the benefit were sufficient to convince an employer to hire the worker, the government would be able to finance the MES program and to save on the unemployment benefit. This is one of the arguments that make MES programs particularly interesting in Italy where the government deficit and the unemployment rate are large.

Finally, it has also been argued that MES have desirable properties with respect to two relevant macroeconomic trade-offs: on the one hand, hiring subsidies are claimed to be effective in increasing employment without inflationary pressure⁶; on the other hand hiring subsidies offered to price-taking firms operating on international markets help to

achieve a higher level of employment and to improve current account deficits⁷.

These arguments are in general convincing from a theoretical point of view, but the empirical evidence on the actual effectiveness of the programs already implemented in various countries is still, in our opinion, not conclusive⁸. Two main problems hamper the evaluation of the impact of MES programs on unemployment.

First, most programs are structured to avoid that employers fire and re-hire workers with the sole purpose of pocketing the subsidy. Given this, the number of hires for which a subsidy is claimed seems to be a measure of the effectiveness of the MES. However, even when an employer hires new workers without firing anyone, it is impossible to know with certainty whether these new workers were hired because of the subsidy or they would have been hired anyway. In the latter case the true impact of the MES would be negligible. Hence, the effectiveness of a program should not be measured, as it is often done, by the number of workers for which a subsidy is claimed. It would be more appropriate to consider the number of workers that are hired only because of the program. Unfortunately the estimation of this net effect is not a simple task.

Second, if the program is targeted at reducing unemployment among particular categories of the labor force, the evaluation of the MES should take into account the displacement effect on non-targeted groups of workers. However, the identification of this displacement effect is again not easy to tackle.

This paper deals primarily with the first of these problems. We try to test the effectiveness of an MES program in a way that isolates the direct impact of the hiring subsidy from macroeconomic effects — i.e. the variation in unemployment that would have normally occurred in the absence of the program. Implications of our procedure for the second of the problems mentioned above are also considered.

Specifically, we estimate a Markov chain duration model with time-varying covariates and we test if eligibility for an MES increases the probability of leaving unemployment. One of the time-varying covariates is an index of macroeconomic performance that controls for the variation in the probability due to changes in macroeconomic conditions.

In the first section we discuss some specific issues concerning the institutional framework to which our study refers; these issues are relevant to the understanding of our model and to the interpretation of the

results. In the second section we describe the MES program we have tested, and the characteristics of the sample used in the estimation. The basic model is then discussed in section three. The fourth and fifth sections are devoted to the derivation of the likelihood function and to the analysis of identification conditions. Results are reported and discussed in section six. Finally, conclusions and suggestions for further research follow.

1. The Institutional Framework

One of the most controversial institutions of the Italian labor market is the income maintenance government program called *Cassa Integrazione Guadagni Straordinaria* (CIGS). This program attempts to put into practice one of the principles on which the Italian labor market legislation is based, namely that workers should not lose their jobs unless because of their choice or gross misconduct. The purpose of CIGS is to give firms the opportunity to reduce their labor force temporarily without depriving the workers of salary or employment status. The validity of the principle and the efficiency of its implementation through the CIGS are subjects of a controversy we do not wish to address in this paper. However, a brief introduction to the working of the CIGS is required to understand the hypothesis of our model and to interpret the results of the estimation.

According to the original design of the CIGS program, firms entering into a period of low demand for their product or into a period of internal reorganization may ask the government to admit temporarily excess workers into the CIGS. If the request is accepted, the workers receive from the government around 80% of the lost wage — with less than full coverage from inflation — for the period in which they are asked not to work.

A firm may ask the intervention of the government for a period no longer than six months. In the original design of the program this limit could not be extended except for very special cases.

Workers receiving the benefit can be laid off for just a part of the working day or for the entire working day. However, it is important to note that even the workers laid off for the entire working day — which is the case in our sample — are still legally employed by the firm and, unless they voluntarily quit, they are supposed to resume work after the period for which they received the benefit. This is the main differ-

ence between the CIGS and a standard unemployment benefit program⁹.

The CIGS was originally financed by all firms on a mutual fund basis, but in the late seventies and early eighties¹⁰, as a consequence of the deep crisis that involved a large part of the Italian manufacturing sector, the extent to which the program was used increased so much that firms' contributions became insufficient. The program could no longer finance itself and began to weigh heavily on the government deficit.

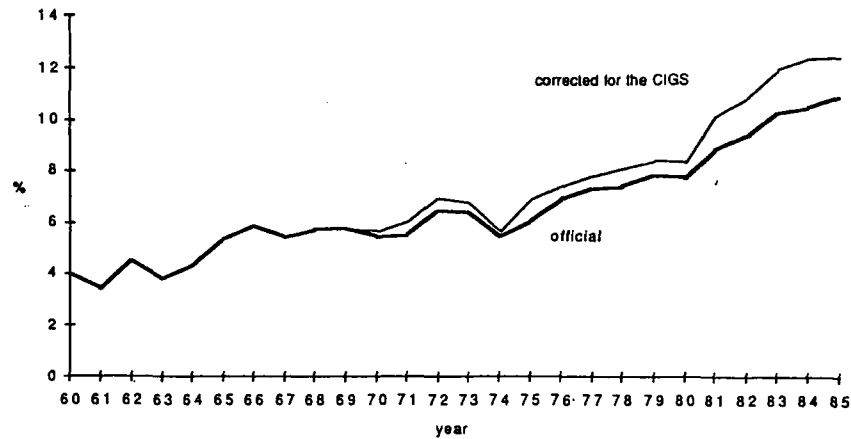
Because of the extent of the economic crisis, not only the financing but also the entire function of the CIGS in the Italian labor market changed in those years. More and more firms needed staff reductions that were unlikely to be temporary. In those situations, the strong social opposition to layoffs and the large number of workers involved compelled the government to use the CIGS even when it was clear that no short-term solutions to the crisis were available. Consequently, the program lost its original function and became a way to overcome the strong social opposition to collective layoffs.

Taking advantage of the willingness of the government to offer the CIGS for a period longer than six months, many firms used the program not as a temporary help to get over economic crisis, but more often as a way to definitively reduce excess labor. Social opposition to the CIGS was strong but more easily surmountable than the opposition to layoffs; hence, firms have been almost completely free to use the CIGS while trade unions and workers had to accept it as the least costly feasible solution.

Figure 1 gives an idea of the extent to which the CIGS has been used in Italy in the late seventies and early eighties; the unemployment rate evaluated taking into account the 'CIGS laid off' workers diverges from the official one. The corrected rate becomes more than two points higher than the official rate in the most recent years. It is reasonable to argue that the CIGS gave, and still gives, Italian employers a degree of freedom that usually is not recognized in the debate on the flexibility of the Italian labor market. In the meantime, the cost of the program for the government started to become fairly high and called for an alternative solution.

From the worker's point of view, given the size of the CIGS benefit, there were essentially no pecuniary motives to search for a new job.

FIG. 1 - OFFICIAL AND CORRECTED UNEMPLOYMENT RATES
(percentage of the labor force)



As long as a small probability of resuming the job in the old firm was there, the reasons for seeking a new position were even less compelling. Finally, it can be argued that the flourishing Italian semi-underground economy found in the CIGS workers a pool of labor force with the most desirable characteristics; namely, workers with no occupation but with other sources of income — the benefit — willing to accept low retributions free of social contributions and any written contract. The only, although certainly not irrelevant, motives to abandon the CIGS were probably those coming from social pressure and the individual human need to have a decent and respectable occupation. This, together with the other reasons mentioned above, contributed to an excessive duration of CIGS unemployment spells. Hence, it is not surprising to observe in our sample an average duration of CIGS spells equal to forty-three months with duration peaks reaching even ninety-four months (see Table 3 in the Appendix).

Leaving to Section 3 a full and detailed description of our model, we will conclude this section by sketching the structure of the model as implied by the institutional framework described above.

We assume that the worker's reservation wage is a function of the CIGS benefit, which is constant over time, plus whatever unobservable income he gets from parallel activities. The CIGS benefit is a function of the personal characteristics of the worker and of the characteristics

of his old job on the basis of the labor contract stipulated with the old firm. Hence, through the CIGS benefit the reservation wage became a function of the same variables plus the unobservable component.

The search behavior of the worker is assumed to be essentially passive. He leaves the CIGS program only if a new employer makes him a competitive offer, and our model estimates the probability that a prospective employer offers to the worker a wage higher than his reservation wage.

The wage offered by the prospective firm is also a function of the characteristics of the worker and of the perceived business cycle conditions. For given personal and professional characteristics of a worker, better macroeconomic conditions make the firm willing to offer a higher wage and consequently increase the probability that the worker leaves the CIGS.

In this framework an MES program is effective since it makes the worker more desirable to the firm through a reduction of hiring costs¹¹. Specifically, the firm, because of the subsidy, should be willing to increase the wage offer of an amount not greater, at the margin, than the subsidy. Hence the probability that a worker accepts the offer is increased.

If these conditions are met the MES represents a feasible way to reduce the costs and the inefficiencies of the CIGS program. Alternative solutions based on a sudden discontinuation of the CIGS program do not seem feasible from a social and political point of view, particularly in those areas in which the economic crisis is still acute.

For these reasons we believe that testing the effectiveness of an MES program — which lies somewhere between the status quo and the complete abolition of the CIGS — in reducing unemployment spells could have a great relevance for the Italian economy.

2. The MES Program and the Data

The MES program considered in our study offers a highly informative experimental situation for the test we want to perform. The program was offered for two years, 1985 and 1986, under the rules illustrated by Table 1.

During 1985 the eligibility for the subsidy was limited only to workers

with more than thirty six months time in the CIGS pool or to workers formerly employed in a firm that had shut down¹². After January 1986 the eligibility rules changed; in particular, the length of the spell required for eligibility was shortened according to the scheme illustrated in Table 1. Under both the 1985 and 1986 rules, for any given spell's length female workers were allowed a higher MES.

Table 1. Amounts of the Marginal Employment Subsidy

YEAR	Time in the CIGS in Months			
	0 to 6	7 to 18	19 to 36	more than 36
1985	no subsidy unless the old firm shut down			female 16 million male 14 million
1986	no MES	female 5.5 million male 4.5 million	female 11 million male 9 million	female 16 million male 14 million

Note: The amounts of the subsidy are expressed in millions of Italian liras.

The hiring subsidy was paid to the employer in two equal instalments, one at the hiring date and the second twelve months later¹³. It is also important to highlight the fact that in Italy individual labor contracts cannot be terminated at will by the employer. Therefore, while in other countries the rules of MES programs must specify how long the employer has to keep the worker in order to be eligible for the hiring subsidy¹⁴, in Italy this is usually not necessary since the labor contract is assumed to be permanent. Only voluntary quits, layoffs for just cause, retirement and death of either the worker or the employer can interrupt the individual labor contract. Temporary labor contracts are permitted by the law only in very special and restricted cases.

In order to test the effectiveness of the MES program illustrated above, the following information was collected by the *Agenzia del lavoro* in the fall of 1987 from file sources and phone calls. Two samples were

randomly selected from the files of the CIGS program according to the following procedure. The first concerned workers receiving the CIGS benefit in January 1985 (point 2 in Figure 2). Through the same files the positions of these workers twenty four months later were collected (point 4). If the workers were no longer in the files at this second date they were reached by telephone in order to find out their new condition. Those who were employed were asked the date at which they had found a new job (point 3) and the characteristics of the new job. For all the workers, some information about their personal and professional characteristics were also collected together with the date at which they entered the CIGS program (point 1). These workers were consequently in the CIGS program during the entire period in which the MES was available.

Figure 2. Relevant Events in the Sampled CIGS Spell

1	2	3	4
beginning of CIGS	sampling date:	exit from CIGS,	censoring date:
different across workers	Jan. 1985 (sample 1), Jan. 1983 (sample 2)	only for non censored	Dec. 1986 (sample 1), Dec. 1984 (sample 2)

The same procedure was repeated for a second sample of workers receiving the CIGS benefit during the years 1983 and 1984. In this period no MES program was effective and consequently this second sample was used as a control group for the effects of the hiring subsidy (see Section 4 and 5 for the econometric problems related to the use of this second sample as a control group).

Note that these samples are characterized by right and left censoring. Right censoring arises from the fact that after the dates corresponding to point 4 in figure 2, no more information was collected about the position held by the workers. Left censoring arises from the fact that spells beginning at dates corresponding to point 1 but terminating before point 2 were not observed. Left censoring plays an important role in our model since, as we will show in Section 5, it allows us to identify the effects of macroeconomic conditions and the MES program on unemployment spells (see Section 4).

The two samples merged together contain 2418 observations. We have excluded all the records in which at least one missing value appeared. This leaves 1916 observations for the analysis. Descriptive statistics for the data set are given in Table 3.

3. The Model

In this model we derive the probability for a worker in the CIGS program to receive and accept a job offer from a prospective employer in a given period. The following assumptions, justified by our interpretation of the institutional framework described in Section 1, are crucial to our model.

A1. We assume the existence of an unobservable index of ‘desirability’ of a worker by a firm. The distribution of this index across workers is not degenerate, i.e. not all the workers are ‘desired’ in the same way by the same firm since workers are not identical. Similarly firms are not identical and evaluate the ‘desirability’ of a given worker according to their own needs. This index is a function of two factors: the worker’s personal and professional characteristics and the demand schedule faced by the firm in its product market — i.e. the macroeconomic conditions. Desirability strictly depends on both these factors and the way they change over time. For example, better macroeconomic conditions result in higher desirability.

A2. The ‘desirability’ of the worker is translated by the firm in a wage offer. For relatively undesirable workers this wage can obviously be zero, i.e. the worker is not demanded. Our definition of desirability implies that the wage offer is a function of the observable personal and professional characteristics of the worker and of the macroeconomic conditions.

A3. The worker’s reservation wage is assumed to be equal to the CIGS benefit plus whatever unobservable income he gets from parallel underground activities¹⁵. The benefit is determined by the wage the worker was receiving from the previous employer. Hence, it is a function of the personal and professional characteristics of the worker and of the macroeconomic conditions that prevailed at the time in which the worker entered in the CIGS program. We also assume search behavior of the worker to be passive.

In this framework the amount of subsidy for which a worker is eligible in a given period increases the desirability of the worker to the firm.

If the MES program is effective, workers eligible for higher subsidies should receive, *ceteris paribus*, higher wage offers, the difference being, at the margin, equal to the amount of the subsidy. Under the above assumptions the hiring process can be formally interpreted as follows.

At the beginning of each period, a worker i is contacted by one and only one firm j . Upon contact, the quality of the match is immediately ascertained. The prospective employer uses this information and his knowledge of the macroeconomic conditions in that period to decide whether or not to make a positive wage offer to the worker. Therefore, given A2, this offer $W_{i,t}^j$ is a function of:

- a vector X_i of personal and professional characteristics of the worker, constant over time;
- an index M_t of the macroeconomic conditions in the period in which the offer is made; M_t is a chronological time covariate¹⁶;
- a vector $S_{i,t}$ of elapsed time covariates such as age, duration of unemployment and the amount of subsidy for which the worker is eligible:

$$W_{i,t}^j = \alpha_1 + X_i \cdot \beta_1 + M_t \cdot \gamma_1 + S_{i,t} \cdot \delta_1 + \varepsilon_{i,t}^j \quad [1]$$

Assumption A1 gives us justification for the existence of the error term in this equation.

The worker will accept or reject this offer on the basis of his reservation wage $R_{a,i}^h$. Given A3, this is a function of:

- the same vector of worker's characteristics X_i ;
- a vector Z_h , of professional characteristics of the worker in the previous firm denoted by h ;
- an index $M_{a,i}$ of the macroeconomic conditions in the period 'a' in which worker i entered the CIGS pool:

$$R_{a,i}^h = \alpha_2 + X_i \cdot \beta_2 + Z_h \cdot \varphi_2 + M_{a,i} \cdot \varrho_2 + \eta_{a,i}^h \quad [2]$$

where the error term $\eta_{a,i}^h$ is given by all the unobservable determinants of the wage in the old firm h in period "a".

The probability that the worker i is hired by firm j in period t is then given by (we suppress indexes "h" and "a", that are specific to each individual i):

$$\Pr \{W_{i,t}^j \geq R_i\} = \Pr \{Y_{i,t}^{j*} \geq 0\} = \Pr \{Y_{i,t}^j = 1\} \quad [3]$$

where

$$Y_{i,t}^* \equiv (W_{i,t}^j - R_i)$$

is a latent variable and $Y_{i,t}^j$ is an observable binary variable defined according to the rule:

$$\begin{aligned} Y_{i,t}^j &= 1 \quad \text{if } W_{i,t}^j \geq R_i \quad \text{or} \quad Y_{i,t}^* \geq 0. \\ Y_{i,t}^j &= 0 \quad \text{if } W_{i,t}^j < R_i \quad \text{or} \quad Y_{i,t}^* < 0. \end{aligned} \quad [4]$$

Substituting [1] and [2] in the definition of the latent variable we get:

$$Y_{i,t}^* = \alpha_3 + X_i \cdot \beta_3 + Z_i \cdot \varphi_3 + M_i \cdot \gamma_3 + M_i \cdot \varrho_3 + S_{i,t} \cdot \delta_3 + \nu_{i,t}^j \quad [5]$$

$$\text{where } \alpha_3 \equiv \alpha_1 - \alpha_2, \beta_3 \equiv \beta_1 - \beta_2, \varphi_3 \equiv -\varphi_2, \gamma_3 \equiv \gamma_1, \varrho_3 \equiv -\varrho_2, \delta_3 \equiv \delta_1,$$

and $\nu_{i,t}^j \equiv \varepsilon_{i,t}^j - \eta_i$.

Assuming that the error terms $\nu_{i,t}^j$ are i.i.d. and their common cumulative distribution is F we can rewrite equation [3] as:

$$\Pr \{ Y_{i,t}^j = 1 \} = \Pr \{ Y_{i,t}^* \geq 0 \} = P_{i,t} \quad [6]$$

where using [5]

$$P_{i,t} \equiv 1 - F(-\alpha_3 - X_i \cdot \beta_3 - Z_i \cdot \varphi_3 - M_i \cdot \gamma_3 - M_i \cdot \varrho_3 - S_{i,t} \cdot \delta_3) \quad [7]$$

In this framework $P_{i,t}$ can be interpreted as the probability that a worker i , in the CIGS pool at time t , independently draws an acceptable wage offer from a distribution. This distribution is specific to worker i and varies with chronological time t and with the worker's time in the CIGS program. In other words this hiring process can be treated as a heterogeneous non-stationary Markov chain process of order equal to the duration of unemployment. The transition probability we are interested in is the probability to get an acceptable offer from a firm at chronological time t , conditional on having been unemployed for a number of periods equal to the time in the CIGS program. Using the previous notation and dropping the superscripts, this hazard rate can be written as:

$$\Pr \left\{ Y_{i,t}^i = 1 \mid \sum_{k=1}^{d^i} (Y_{i,t-k} = 0) \right\} = \frac{P_{i,t} \cdot (1 - P_{i,t})^{d^i}}{(1 - P_{i,t})^{d^i}} = P_{i,t} \quad [8]$$

where d^i is the length of time of worker i in the CIGS pool.

From [8] the unconditional probability of a period of time s in the CIGS pool, ending at the chronological time t can be derived as:

$$\Pr \{ d^i = s \} = \sum_{k=1}^s (1 - P_{i,t-k}) \cdot P_{i,t} \quad [9]$$

The estimation of these probabilities is described in the following section.

4. Estimation

We estimate the model using the method of Maximum Likelihood. In order to do this we have to specify the functional form of the probability distribution F in [7]. Assuming that the error terms $\nu_{i,t}^j$ are i.i.d. normally distributed, with mean zero and variance equal to one, equations [6] and [7] can be written as:

$$\Pr \{ Y_{i,t}^i = 1 \} = \Pr \{ Y_{i,t}^{i*} \geq 0 \} = \Phi_{i,t} \quad [10]$$

$$\begin{aligned} \Phi_{i,t} &\equiv 1 - \Phi(-\alpha_3 - X_i \cdot \beta_3 - Z_i \cdot \varphi_3 - M_i \cdot \gamma_3 - M_i \cdot \varrho_3 - S_{i,t} \cdot \delta_3) \\ &= \Phi(\alpha_3 + X_i \cdot \beta_3 + Z_i \cdot \varphi_3 + M_i \cdot \gamma_3 + M_i \cdot \varrho_3 + S_{i,t} \cdot \delta_3) \end{aligned} \quad [11]$$

where F is the cumulative normal distribution¹⁷. As we have shown in the previous section this is the hazard rate of leaving the CIGS for worker i at chronological time t . Using [11] we can derive the likelihood function of our sample, taking into account the presence of right and left censoring (see Section 2).

For each non-right censored observation the likelihood is given (dropping the index i for convenience) by:

$$L_i = \frac{\sum_{k=1}^{d^i} (1 - \Phi_{i,t-k}) \cdot \Phi_{i,t}}{\sum_{k=1}^a (1 - \Phi_{i,t-h})} = \sum_{k=1}^{d^i-a} (1 - \Phi_{i,t-k}) \cdot \Phi_{i,t} \quad [12]$$

where “a” is the length of the time in the CIGS program before the sampling date and t is the failure date; the denominator takes care of the initial conditions related to the presence of left censoring in our sample.

For each right censored observation the likelihood is instead given by:

$$L_i = \frac{\sum_{k=1}^c (1 - \Phi_{t-k})}{\sum_{k=1}^a (1 - \Phi_{t-k})} = \sum_{k=1}^{c-a} (1 - \Phi_{t-k}) \quad [13]$$

where c is the right censoring date.

The likelihood of the whole sample is then equal to the product of the single individual likelihood as defined in [12] and [13]¹⁸.

5. Conditions for the Identification of MES Effects

An MES program is effective if the subsidy makes the worker more desirable to the firm. For this to occur the firm must be sufficiently sensitive to hiring costs reductions. Under these conditions we should observe, *ceteris paribus*, a higher hazard rate for eligible workers. Furthermore, the higher the amounts of the subsidy the higher should the hazard rate be. In our combined sample (see Section 2) we have workers eligible for different amounts of subsidies ranging from zero, for the workers in the 1983 sub sample, to sixteen million liras, for females with more than 36 months of unemployment in the 1985 sub sample. The amount of the subsidy for which each worker is eligible is one of the regressors, $S_{i,t}$, in equation [11]; hence, a test for the effectiveness of the MES program could simply be cast as a t-test for the positive significance of the coefficient of the variable $S_{i,t}$.

However, this procedure can be misleading if one does not control for the various sources of non-homogeneity between ‘cases’ — the workers eligible for a positive subsidy — and ‘controls’ — the workers not eligible for any positive subsidy. The most important of these sources of non-homogeneity in our samples concerns the fact that ‘controls’ do not face the same macroeconomic conditions faced by ‘cases’ for any given length of unemployment spell. This is because cases are observed between January 1985 and December 1986, while ‘controls’ are observed

between January 1983 and December 1984 (see Section 2). In this situation, if we observe shorter unemployment spells for the 'cases', we cannot argue that this is the effect of the eligibility for the subsidy $S_{i,t}$ because the macroeconomic conditions could have changed. Looking at the coefficient of the subsidy would be misleading because that coefficient would capture not only the effect of the difference in the eligibility conditions, but also the difference in macroeconomic conditions.

In order to have a situation in which workers face the same macroeconomic conditions at any length of unemployment, one would need a sample of 'cases' and 'controls' all entering unemployment at the same calendar date. But also having such a sample would not help in the evaluation of the program because it would be impossible to understand if the difference in the probability of re-employment between the two groups is due to a displacement effect that damages 'controls', or to a desirable overall net effect of the program. In our situation we have been able to overcome these problems by allowing for the existence of time-varying covariates in the model and by exploiting the existence of left censoring in the sample.

The introduction of time-varying covariates allows us to control, period by period, for changes in business cycle conditions affecting the hiring decision of the firm (see assumptions A1 and A2). Furthermore, it allows us to consider changes in the eligibility conditions for each worker due to the increasing length of elapsed unemployment spells.

The existence of left censoring allows us to exploit the difference in the variability of elapsed-time and chronological-time covariates (see note 16). If all the workers had entered the CIGS at the same date, these two types of covariates would have varied together. In particular, the amount of the employment subsidy and the macroeconomic conditions would have changed in the same way for each worker, leading to the impossibility of an identification of the two effects. Left censoring introduces a difference in these two variabilities that gives us the opportunity to identify both the effect of the macroeconomic conditions and the effect of the MES program.

There is a second relevant source of observable heterogeneity which has to be controlled. Workers in the sample 1983-84 who failed to leave the CIGS before the censoring date, may have been included again in the sample 1985-86 (see Section 2). Hence, we observe longer average CIGS spells in the group of workers eligible for the program (see Table 3). Since the amount of the subsidy is positively correlated with the time

in the CIGS, the 1983-84 sample can be used as a control group only if the estimation is conditioned on spells' duration. This is also justified in our theoretical specification of the hiring process by the fact that some personal and professional characteristics of the workers affect the hiring decision of the firm and it is reasonable to believe that the duration of the elapsed unemployment spell is one of these characteristics.

6. Results

The three columns of Table 2 show the results of the estimation of our model using three different specifications of the business cycle index¹⁹. The coefficient of the Marginal Employment Subsidy program is positive and highly significant in all the estimated equations. *Ceteris paribus*, the eligibility for the MES increases the probability of finding a new job in any given period t . On the basis of what we have argued in section 4, this can be interpreted as the net impact of the MES program on re-employment probabilities. The effect of the economic cycle, i.e. the variations in employment that would have normally occurred in the absence of the hiring subsidy, is captured by the coefficient of the macroeconomic index for each period.

In the first column, the macroeconomic variable included in the regression is the yearly index of the amounts of CIGS interventions in the Province of Trento. In the second column we have used instead the quarterly index of industrial production computed by the *Camera del Commercio* of Trento. Neither of these indexes seems to capture in a convincing way the business cycle fluctuations in the Province. The amount of CIGS intervention, besides having an annual frequency, reflects the inheritance from previous economic downturns. The index of industrial production is also not satisfactory because it is based on the subjective statements of employers interviewed by the *Camera del Commercio* and not on objective measures of production. Probably because recoveries and downturns are recorded imprecisely by these indexes, the re-employment probability appears in the data to be countercyclical. The sign of the coefficients of the two indexes in Table 2 is in fact opposite to that expected. The re-employment probability appears to be higher when the amount of CIGS intervention is higher and appears to be lower when industrial production is higher. These are clearly unsatisfactory results. Taken in isolation, the first two columns of the Table do not provide sufficient evidence that the MES program has had a positive

Table 2. Determinants of Re-Employment Probabilities

Variables	Probit using index MACRO1	Probit using index MACRO2	Probit with monthly Dummies
Constant	-1.4064 (.1248)	0.8009 (.6248)	-0.8012 (.1435)
Marginal Employment Subsidy	.0987 (.0083)	.0971 (.0085)	.0984 (.0085)
Duration of permanence in the CIGS	-.0070 (.0019)	-.0060 (.0019)	-.0069 (.0019)
Age	-.0202 (.0023)	-.0201 (.0023)	-.0217 (.0024)
Macroeconomic conditions at each period	.0005 (.0001)	-.0281 (.0081)	coeff. of the dummies not included
Sex (1 = female)	-.3904 (.0586)	-.3805 (.0584)	-.4105 (.0614)
Seniority in previous job	-.0023 (.0040)	-.0023 (.0040)	-.0025 (.0041)
Qualification in previous job:			
(1 = low level)	-.3628 (.0595)	-.3509 (.0593)	-.3803 (.0620)
(1 = interm. level)	-.2010 (.0466)	-.1990 (.0465)	-.2146 (.0485)
Lost job sector			
(1 = metal industry)	-.1824 (.0551)	-.1848 (.0555)	.1713 (.0537)
(1 = tool industry)	-.2363 (.0944)	-.2299 (.0940)	-.2508 (.1002)
Project 2	-.3384 (.1125)	-.2648 (.1134)	-.2980 (.1162)
Project 6	5.9373 (9.1016)	5.9423 (9.0462)	6.6130 (37.7119)
Log likelihood	-1974.0	-1980.2	-1851.9

Note: Asymptotic standard errors are given in brackets.

net influence, over and above that of the business cycle, on re-employment probabilities.

The unreliability of these two indexes and the difficulty of finding alternative relevant macroeconomic variables at a quarterly or monthly frequency for the Province of Trento, forced us to use a non-parametric specification of the business cycle variable. The estimates obtained with this specification are shown in the third column of Table 2.

For each of the 48 months in which a worker is observed we have introduced a dummy variable that takes value 1 if the worker is still in the CIGS or has found a new job in that month, and zero otherwise. These dummies necessarily capture the effects on the constant of all possible determinants of re-employment probabilities that are not explicitly taken into account in the regression. Hence, the coefficients of these dummies do not have any simple economic interpretation because they capture more than just the effects of the business cycle. But, since our interest is focused on assessing the net effect of the MES program, these dummies give us the best control for what would have happened in the absence of the program.

Table 2 shows that this non-parametric specification of the macroeconomic index does not change significantly the point estimate of the net effect of the MES program. The robustness of this estimate in different specifications, including the non-parametric one, allows us to conclude that the MES program has had a positive impact on re-employment probabilities for the workers in our sample.

To understand the economic significance of these results we have performed a cost-benefit analysis of the MES program offered by the *Agenzia del Lavoro* of Trento. This analysis is preliminary and will be completed in future developments of this research project. Using the coefficients estimated in the third column of Table 2 we have computed the average probability of finding a job in a given period with or without the MES program being offered. Because of the MES program, this probability increases from .0132 to .0278. If we assume that the probability of re-employment is constant for each worker, the average length of the time in the CIGS, with or without the program is given by the inverse of these probabilities. According to these calculations the MES reduces the expected length of time in the CIGS by 21 months. This considerable reduction should not surprise the reader given that in our sample the average length of time in the CIGS is 43 months, with peaks of 94 months, and these figures do not take into account the right censoring of observations (see Table 3 in the Appendix).

Given that the average amount of the subsidy paid by the *Agenzia del Lavoro* is less than the amount of CIGS contributions for twenty one months, not only has this MES program increased the probability of re-employment, but also it has generated an overall saving of public expenditure.

Going back to the results reported in Table 2, the duration of CIGS spells has a negative effect on the probability of finding a job. This is an indicator of negative state dependence²⁰ with at least two inter-related interpretations fitting the model presented in the third Section.

First, it can be argued that prospective employers consider negatively — ‘desire less’ — a worker who stays longer in the CIGS. This fact is sometimes considered as a sign of lack of initiative or laziness. This worker is seen as someone who is taking excessive advantage of the situation. As implied by our model, the firm is consequently less willing to make competitive wage offers to these workers, and their probability of leaving the CIGS is reduced. Second, a complementary interpretation is that long term CIGS workers are more likely to be involved in the underground economy and therefore to have higher reservation wages. This again reduces the probability of an exit from the CIGS.

Unfortunately, in the reduced form estimation of our model, it is not possible to identify whether negative state dependency is the result of discriminating behavior of employers, or is the result of events affecting the reservation wage, like the participation to the underground economy.

In Table 2, female and older workers are shown to have a lower probability of re-employment. This is again the combined result of unidentifiable supply and demand behaviors. Women are likely to be discriminated against in the Italian labor market despite all attempts at enforcing non-discrimination. However, given the still prevailing traditional division of roles in the average Italian family, females receiving the CIGS benefit are likely to have less incentives to accept job offers. If they remain in the CIGS program they have in fact a quite relevant source of income and the possibility of dedicating themselves to household production.

As far as age is concerned, the firm’s demand for labor is likely to be responsible for the negative sign of the coefficient shown in Table 2. It is, in fact, hard to believe that the lower re-employment probability is solely the result of a higher reservation wage of older CIGS workers. If the lower re-employment probability of older workers is explained by demand considerations — firms desire an older worker less than a

younger one — then the negative age coefficient can be interpreted as evidence against the usual belief according to which firing costs in Italy are very high. In fact, high firing costs should imply that older workers close to retirement age are more desired by firms willing to dispose of a flexible labor force²¹.

The qualification level is positively related with re-employment probabilities: low quality workers have a smaller probability of going through a short unemployment spell. This is not an obvious result. A highly skilled worker is very attractive to the firm so that a good offer should come sooner for him or her. But, from the supply side, it can be argued that highly skilled workers should have a higher reservation wage. They, in fact, have human capital more valued by the market. Low-skill workers, instead, should be willing to accept lower wage offers since for them the expected value of waiting is smaller. If these supply side considerations prevailed, we should have observed higher probability of short unemployment spells for low quality workers. Since, on the contrary, we observe a negative effect of low qualification, the demand side explanation — firms do not like low quality workers and prefer highly skilled workers — seems to be the relevant one.

Finally, the variables Project 2 and Project 6 control for the fact that a small number of workers in the 1985-86 sample were eligible for other experimental policies offered by the *Agenzia del Lavoro* of Trento. Project 2 was aimed at enhancing self-employment and entrepreneurship among workers; the negative sign of the correspondent coefficient shows that this program did not work as expected, at least for our sample of CIGS workers. The Project 6 consisted instead of job creation interventions outside the market for employees of specific companies. Within our sample, relatively few workers were involved in this program and this explains the insignificant coefficient.

Conclusions

The main goal of our research project is to test the effectiveness of a Marginal Employment Subsidy program in reducing the length of unemployment spells. The preliminary answer suggested by this paper is that this program is effective. Our data show that the MES offered by the *Agenzia del Lavoro* of Trento, Italy, has increased significantly the re-employment probability of a CIGS worker, controlling for macro-economic conditions, and has reduced the expected length of time in

the CIGS by twenty-one months. This reduction has been estimated for a sample of workers in which the average length of time in the CIGS was 43 months, with peaks of 94 months.

We believe that these results are important for the debate on the reform of the Cassa Integrazione Guadagni Straordinaria. The CIGS has been and still is very useful in reducing the social and occupational costs of firms' crises. However, as we have argued, it is an inefficient and costly instrument to reach this goal. An MES program, in the form experimented by the *Agenzia del Lavoro* of Trento, could be effectively combined with the CIGS in order to reduce its inefficiencies and to lighten the burden that the CIGS itself imposes on public expenditures.

Our research project is not completed yet, and for this reason we consider the results presented in this paper as preliminary. Further developments of our research will be along the following lines.

First, our assumptions on the likelihood function are quite restrictive and imply a very simple specification of the hazard of leaving the CIGS pool. We intend to move towards a continuous time specification of the hazard model — in a parametric or semi-parametric form. This alternative framework would still allow for the inclusion of time-varying covariates and at the same time would make it possible to account explicitly for the existence of unobservable heterogeneity. Testing in the Italian context for this unobservable heterogeneity in a model concerning CIGS workers would shed some light on the controversial issue of the size of the underground economy.

Second, we think that more information can be extracted from our sample. In particular we used the different amounts of the subsidy for which workers were eligible to identify the overall effect of the MES. The same variability may allow us to address additional issues. For example, one could test for differential effect of this program between male and female workers or for the existence of non-linear effects of time-varying covariates on the probability of being re-employed.

Third, the evaluation of targeted MES programs cannot be fully performed without taking into account the displacement effect on non-targeted workers. For example in our case the study of the effect of MES on the employment probability of non-CIGS workers is fundamental for a complete picture of the advantages and disadvantages of this type of program.

Finally, an additional issue that could be addressed in future research

is related to the existence of different competing hazards for the CIGS workers - i.e. different ways to leave the CIGS. Among these, we think that particular attention is due to the contraposition between the hazard of being re-hired by the original firm and the alternative hazard of being hired by a new firm. In such a framework it will become possible to test to what extent the CIGS program has been used for its original purpose — helping firms to overcome temporary crisis — as opposed to having been an inefficient way to introduce flexibility in the Italian labor market.

Appendix

Variables

All the variables have been supplied by the *Agenzia del Lavoro* of Trento by direct sampling or by auxiliary sources which will be stated in the description.

- (i) *Amount of the marginal employment subsidy, (MES)*
This is an elapsed time covariate (see note 16) corresponding to the actual amount of money, in millions of liras, that an employer was eligible to receive for hiring a worker in the categories described in Table 1 (Section 1). The MES variable for the workers in the sample 1983/84 is zero since no program was offered in those years.
- (ii) *Duration of time in the CIGS program, (DURAT)*
This is an elapsed time covariate measured in months. For each worker in each period 't', DURAT is equal to the difference between 't' and the period in which the worker entered the CIGS program.
- (iii) *Age, (AGE)*
This is an elapsed time covariate measured in years.

- (iv) *Sex, (FEMALE)*
This is a dummy variable independent from time equal to one if the worker is female.
- (v) *Seniority in the lost job, (OFSEN)*
This is a variable independent from time, equal to the seniority of each worker at the moment in which she (he) entered the CIGS pool.
- (vi) *Qualification level in the lost job, (OFWQ1), (OFWQ2), (OFWQ3)*
These are three dummies, independent from time, which account for the qualification level each worker had when she (he) entered the CIGS pool. OFWQ1 is a dummy variable for the lowest qualification level, OFWQ2 for the intermediate level and OFWQ3 for the highest level.
- (vii) *Lost job sector, (OF31, OF3437, OFALTRI)*
This is a dummy, independent from time, that controls for the industry classification of the previous employer. OF31 controls for the metal industry — group 31 in the two digit industry classification of *Istituto Centrale di Statistica, I.S.T.A.T., Roma*; OF3437 controls for the tool industry — groups 34 and 37; OFALTRI controls for other industries in the manufacturing sector.
- (viii) *Macroeconomic conditions at each period, (MACRO1, MACRO2)*
Both these indexes are chronological time covariates.
MACRO1 is a yearly index (1980= 100) of the total number of CIGS hours authorized by the government in the province of Trento. The source is: *Istituto Nazionale Previdenza Sociale, Trento*.
MACRO2 is the quarterly level of industrial production in the manufacturing sector in the Province of Trento. The source is: *Camera di Commercio of Trento*.
- (ix) *Projects 2 and 6, (PG02), (PG06)*
These are dummies which control for the fact that some workers in our sample were also eligible for two other experimental programs offered by the *Agenzia del Lavoro* of Trento. Project 2 was aimed at enhancing self employment and entrepreneurship among unemployed workers; Project 6 consisted of job creation interventions outside the market for employees of specific companies.

Table 3. Descriptive Statistics

Number of observations = 1916				
Variable	Minimum	Maximum	Mean	Standard Deviation
Duration of Time in CIGS (months)	1.000	94.000	43.067	17.783
Age (years)	18.000	65.000	39.472	10.620
Index of Macroeconomic Conditions:				
MACRO1 and START*	100.000	893.000	428.212	329.310
MACRO2	65.060	76.240	69.243	3.146
Sex, 1 = female	0.000	1.000	0.288	0.453
Seniority in Previous Job (years)	1.000	35.000	10.621	5.803
Qualification in Previous Job:				
1 = low level	0.000	1.000	0.284	0.451
1 = intermediate level	0.000	1.000	0.368	0.483
1 = high level	0.000	1.000	0.347	0.476
Lost Job Sector:				
1 = metal industry	0.000	1.000	0.295	0.456
1 = tool industry	0.000	1.000	0.181	0.385
1 = other industries	0.000	1.000	0.523	0.499
Project 2 (1 = eligible)	0.000	1.000	0.629	0.483
Project 6 (1 = eligible)	0.000	1.000	0.003	0.051
Censored Jobs., 1 = censored	0.000	1.000	0.559	0.496

* The number of observations for these indexes are: 8 for MACRO1 and START, 16 for MACRO2.

Notes

¹ Chiarella and Steinherr (1982).

² Steinherr and Van Haeperen (1983), Chiarella and Steinherr (1982), Baily and Tobin (1978), Kesselman (1969), Kaldor (1936).

³ In what follows the terms 'marginal employment subsidies' and 'hiring subsidies' will be considered synonymous.

⁴ Bishop and Haveman (1978), Bishop and Haveman (1979), Layard (1979), Hamermesh (1978).

⁵ Steinherr and Van Haeperen (1983), Chiarella and Steinherr (1982), Baily and Tobin (1978).

⁶ Rehm (1980), Baily and Tobin (1978).

⁷ Layard and Nickell (1980).

⁸ Spiegelman and Woodbury (1987), OECD (1982), Schmidt (1979) Johnson and Blake-more (1979) Perloff and Wachter (1979).

⁹ For a model that compares the overall employment effect of the CIGS and of a fixed unemployment benefit program — like the French *Allocation de Solidarité* — see Padoa Schioppa (1988).

¹⁰ Our research covers the years from 1979 to 1986.

¹¹ Bentolila and Bertola (1987) show that a reduction of hiring costs, in an uncertain dynamic environment, can be much more effective than a reduction of firing costs in increasing the number of new workers hired by the firm.

As far as long run effects of MES are concerned, with respect to Italian firing legislation, see the second paragraph of p. 11.

¹² These workers were no longer in the CIGS program since they were not employees of an existing firm. However, they were automatically transferred to another unemployment benefit program (the *Disoccupazione speciale* program) with characteristics essentially similar to those of the CIGS. Since for these workers there was no hope to go back to work in the old firm they were considered eligible for subsidy in 1985 also if their elapsed spell was shorter than 36 months.

¹³ As a reference for the non Italian reader, 16 million liras (see Table 1: 1985 rules, female, more than 36 months) can be considered roughly equal to two thirds of the yearly labor cost of an average worker in the manufacturing sector in 1985.

¹⁴ See for example Spiegelman and Woodbury (1987).

¹⁵ The existence of the underground economy and the possibility that the CIGS worker is involved in it may have implications for our analysis. In fact, the reservation wage of the worker can change over time with the income derived from underground activities, making the worker less or more willing to leave the CIGS. This is a source of potential unobservable heterogeneity that can bias our estimate. A spurious decline over time in the hazard rate is introduced because workers with the higher propensity not to leave the CIGS make up a larger proportion of the individuals with longer durations. See, among others, Lancaster (1979), Nickell (1979), Heckman and Singer (1983). Future developments of our research will try to take into account these possible sources of bias and evaluate their relevance.

¹⁶ In what follows the term elapsed time covariates is used to mean variables that

change with the length of the unemployment spell. These must be distinguished from chronological time covariates that change with the calendar.

¹⁷ We also performed the estimation assuming a logistic distribution for the errors. All the formulas that follow hold in this case substituting F with L for the logistic cumulative function. Results are robust with respect to this alternative parametric hypothesis.

¹⁸ In terms of programming, the likelihood of the entire sample can be more easily computed by expanding the observations for each individual in order to have a sample in which a record contains the variables for worker i at time t . In other words, for each worker we have as many records as periods in which he was observed after the sampling date. The hypotheses of independence and serial uncorrelation of the errors in equation [8] imply that the above model is equivalent to a probit model applied to the expanded data set. This procedure makes the job harder for the computer since, in our case, the expanded data set have 31,904 observations. A Sun microcomputer was required to perform computations.

¹⁹ See the Appendix for a detailed definition of the variables and Section 2 for information about the sample.

²⁰ The term 'negative state dependence' in duration models is used to indicate the situations in which the transition probabilities decline with the length of the spell. See for example Lynch (1985).

²¹ The CIGS itself is for example one of the reasons why firing costs in Italy are probably less high than usually believed (see Section 1).

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