

# Impacts of hiring wage subsidies targeted to the long-term unemployed on the low-skilled labour market

Anne Bucher<sup>1</sup>

November 2007

Preliminary updated version.

## Abstract

This paper attempts to evaluate the effects of a targeted hiring subsidy program on the low-skilled labor market. We propose an equilibrium matching model in which the labor market segments are not juxtaposed. Then, we argue that the scheme reduces long-term unemployment but induces an indirect substitution effect driven by the wage bargaining process. Further, we provide an evaluation of a French program set up in 1995 and illustrate that although it generates substitution, it involves a substantial reduction in low-skilled unemployment and improves workers' welfare.

Keywords: Targeted wage subsidies, substitution, long-term unemployment, matching

Classification JEL: E24, J42, J48

---

<sup>1</sup>A.Bucher: GAINS, Université du Maine, Faculté de Droit et de Sciences Économiques, Avenue Olivier Messiaen, 72085 Le Mans Cedex 9 - tél: 02.43.83.31.34 - e-mail: anne.bucher.etu@univ-lemans.fr

I am grateful to François Langot and Arnaud Chéron for their helpful comments as well as to seminar participants at GAINS (Le Mans). Further thanks are due to participants at the 55th congress of AFSE (Paris, september 2006) and at the 22nd meeting of EEA (Budapest, august 2007).

# 1 Introduction

This paper proposes a theoretical framework to analyze the effects induced by targeted hiring wage subsidies to private employers. These policies are designed to improve employment prospects of workers excluded from the labor market. However, by improving the subsidized employment's relative return, it affects firms' and workers' decisions and could generate substantial deadweight and substitution effects. The specification of these interactions in a comprehensive view is essential to evaluate the efficiency of such instruments on employment. Our paper focuses on the low-skilled labor market and attempts to evaluate a scheme targeted to the long-term unemployed workers. We provide a matching model in which the various labor markets are not juxtaposed: It allows us to analyze how a targeted hiring wage subsidy affects the overall labor force and its aggregate impact on unemployment.

Employment subsidies cover various types of targeted schemes. They are paid to private employers to reduce their labor costs and then to induce them to favor in hiring and employment economically disadvantaged workers or structurally unemployed. The distinction between hiring and permanent employment subsidies is made (Orszag J M. and Snower D. (2003)). Permanent employment are targeted to employment (mainly low-skilled or low wage employment) and received during all the job's duration whereas hiring subsidies are targeted to unemployment and temporary. In this paper, we focus on hiring wage subsidies targeted to long-term unemployed, as was the Targeted Job Tax Credit in United States, Employment Subsidies in Sweden and subsidized contracts in France. Hiring wage subsidies are not a new policy: they have been in place in many OECD countries since the end of the seventies. However, the rise in long-term unemployment in the last two decades has pointed out the presence of workers excluded from the labor market thus leading to a renewed interest in active labor market policies. Economists have often advocated targeted wage subsidies as a relative efficient method to improve employment prospects of some high risk groups.

A number of previous empirical studies investigated the effects of a wage subsidies program's participation on the individuals' outcomes. These instruments were found to generate a significantly higher probability to get a job relative to the control group, (Forslund A., Johansson P. and Lindqvist L. (2004), Martin J. and Grubb D. (2001), Sianesi B. (2002), Katz L. (1996), Brodaty T., Crépon B. and Fougère D. (2002)). Brodaty T. et al. (2002) investigate the effects of youth employment programs<sup>2</sup> introduced in France since the mid-seventies on the individual reemployment probability. All the measures had

---

<sup>2</sup>Brodaty T. et al. (2002) consider all the French policies targeted to the young unemployed workers. The majority of the programs provide a subsidy or a reduction in employer's contributions. However, the authors do not report the results for each measure but distinguish between three types of programs.

positive effects on employment, but the authors show that the average effects of programs provided by private firms are "statistically more significant and higher" than the average effects of public measures. Further, wage subsidy schemes appear to be more efficient compared to alternative active labor market policies, (Martin J. and Grubb D. (2001)). Sianesi B. (2002) analyze the effects of participating in six different Swedish programs. She estimate that workers who have benefit from a wage subsidies program in the private sector experience a higher increase in their reemployment probability (ranging from 20 to 40 percentage points) than those who have participated to any other active labor market policy. The main reason of this efficiency is clearly that these schemes are very close to regular labor market. However, as participants use to occupy an ordinary job, targeted employment subsidies mainly lead to substitution. Subsidies are paid to employers to lower their cost thus creating a competitive advantage for targeted workers. Hence, the policy may induce firms to change their hiring patterns: subsidized workers could displace others. Further, firms can use subsidies to recruit workers they would have hired anyway, generating large deadweight effects.

The literature on macroeconomic effects induced by targeted wage subsidies has grown fast since 1990s, putting forth substantial deadweight and substitution effects for the whole OECD countries (OECD (1993), Calmfors L. (1994)). For example, in Australia, Belgium, Ireland and Netherlands, such effects are estimated to amount to 90%, (Martin J. and Grubb D. (2001)), whereas in Sweden, they are estimated to be around 60%, (Calmfors L., Forslund A. and Hemström M. (2001) and Dalherberg M. and Forslund A. (1999)). It means that for every 100 subsidized contracts, the number of jobs which would have been created anyway is respectively 60 and 90. As stated by Calmfors L. (1994), "such effects are likely to be most important in the case of subsidies for private-sector work, which are common in many countries for young people and long-term unemployed". As a result, subsidies to private employers could provide targeted workers with jobs and simultaneously induce small net employment gains, thus creating a difficult trade-off for policy makers.

The majority of these evaluations relies on aggregate data and attempts to establish robust econometric relationships between regular and subsidized employment. Calmfors L. (1994) used the basic Layard-Nickell model (Layard R., Jackman R. and Nickell S. (1991)) to investigate the various effects of active labor market policies in macroeconomic aggregates such as employment or real wages. Nevertheless, econometric or macroeconomic evaluations do not allow us to analyze the effects on microeconomic behaviors induced by a labor market program. At the opposite, the equilibrium matching model provides a powerful setting for such an analysis<sup>3</sup> as it has proved its strength to analyze labor market flows, unemployment composition and labor market policies. Further, simulations of calibrated model are often used to evaluate labor market policies. Mortensen D. and Pis-

---

<sup>3</sup> For instance, see Mortensen D. and Pissarides C. (2003) and Richardson J. (1998).

sarides C. (2003) investigate the effects of taxes and employment subsidies. They present computed solutions to their matching equilibrium model and conclude that permanent wage and employment subsidies targeted to low-skilled workers increase employment and wages. Hiring subsidies involve ambiguous effects. Cardullo G. and Van der Linden B. (2006) argue that the Mortensen-Pissarides model overestimates the effects of permanent subsidies on the targeted population, (the low-skilled workers), whereas it underestimates its effects on high-skilled employment. They show that employment subsidies are more efficient when targeted to low-skilled workers. Nevertheless, its efficiency could be reinforced by reforms of active and passive labor market policies. Vereshchagina G. (2002) proposes a simulation of a general equilibrium search model to study how the aggregate effects of targeted employment subsidies depend on the subsidy rate. In France, this methodology has been used to evaluate the impact of payroll tax subsidies on low wages (Doisy S., Duchene S. and Gianella (2004)), and the expected effects of a new type of contract implying lower firing taxes<sup>4</sup>, (Cahuc P. and Carcillo S. (2006)). Finally, simulations have the advantage of providing ex-ante evaluations of policies. Lise J., Seitz S. and Smith J. (2004) outlined the restrictions of social experiments where a small subset of the population is subjected to the potential program. They demonstrated the usefulness of general equilibrium models for analyzing the implications of that same policy implemented in the whole labor market. They also investigated the model efficiency to capture the response of individuals to the experiment.

This paper provides a partial equilibrium model set to capture the main features of the low-skilled labor market and of the subsidy programs targeted on long-term unemployed. We extend the basic framework of the matching model *à la* Pissarides to include heterogeneities of unemployed and vacancies. As the condition of free entry is determined endogenously, firms can decide to post vacancies awarded to recently unemployed workers or to enter a second segment where long-term unemployed are searching for low-productivity jobs. Employers benefit from the subsidy only for a fraction of targeted workers hired, and a subsidized contract can lead to an internal promotion.

First, a common finding is that targeted wage subsidies induce a direct substitution effect when the total number of jobs is fixed. As a free entry condition prevails on each segment, the subsidy attracts firms from the first segment to the second segment by improving the relative return of jobs. Further, we adopt a model in which labor market segments are not juxtaposed. Then, the subsidy affects the outside option of short-term unemployed workers as they negotiate their wage by improving the employment prospects when long-term unemployed. These interactions complement the traditional substitution effect and highlights an indirect effect driven by the wage bargaining process. Moreover,

---

<sup>4</sup>The "Contrat Nouvelle Embauche" is an open-ended contract targeted to small firms up to 20 employees and can be terminated without severance pay in the first two years.

by altering the employment composition and thus job destruction flows, targeted wage subsidies do have effects on short-term unemployment. Finally, a general equilibrium evaluation<sup>5</sup> would have shown that a subsidy program could raise employment of the non-targeted population as in Cardullo G. and Van der Linden B. (2006)<sup>6</sup>. However, productivity gains would have been reduced by our wage effect.

The results provided by the model allow us to conclude on the ambiguity of the aggregate effect of targeted wage subsidies on unemployment. It suggests intuitively that long-term unemployment is reduced whereas short-term unemployment increases.

The last part of the paper presents simulations of the model calibrated using French data. France has a variety of wage subsidy programs targeted mainly to youth and long-term unemployed which have been introduced both in the private and public sector since 1980s<sup>7</sup>. France introduced in 1995 a reduction in employer's contribution thus establishing a new type of contract: the "Initiative-for-Employment Contract". It is specifically designed for unemployed excluded from the labor market, as long-term unemployed, welfare recipients or disabled workers. Jobs are either long-term labor contracts or fixed-term contracts lasting between 12 and 24 months. However, private employers benefit from the subsidy for a maximum period of 24 months. They are entitled to a 100% exemption from payroll tax to which a premium for priority unemployed persons can be added. Various empirical studies reveal the relative efficiency of this program. For example, Belleville A. and Charpail C. (2000) estimate that 70% of workers who have been employed in an "Initiative-for-Employment Contract" in 1996 are occupying a job three years after the end of the subsidy. Similarly, Berger E. et al. (2002) show that participants exhibit higher employment rate compared to the control group. Finally, Belleville A. (2001) find that the substitution effects induced by the program amount to 45%<sup>8</sup>. However, the evaluation is based on an interview with employers, which cannot guarantee the robustness of the results, (Fay R. (1996)).

This paper provides an evaluation of the aggregate effects induced by the French contract, aspect on which the previous studies did not provide any information. We investigate the program's efficiency to alleviate the low-skilled unemployment problem. The French policy generates an obvious reduction in unemployment. Nevertheless, there

---

<sup>5</sup>A general equilibrium analysis would require to consider an economy in which a final consumption good is produced with various types of labor. Calibrate the production function parameters is not straightforward and simulation results strongly depend on the elasticity of substitution. For this reason, we favor an analysis in partial equilibrium.

<sup>6</sup>Cardullo G. and Van der Linden B. (2006) develop a model where workers' productivity varies with the employment in all sector. Thus, a subsidy targeted to low-skill workers raise the marginal product of high-skilled labor and then employment.

<sup>7</sup>See Brodaty T. et al. (2002) for a presentation of employment programs in France.

<sup>8</sup>See Lee J-K. (2005) for a survey of wage subsidy programs' evaluations in OECD countries.

are more short-term unemployed in the economy and their reemployment probability is reduced. The wage subsidy has led to substitution effects even though the number of jobs occupied by ineligible workers increases. We observe that there are very few job creations in the segment where long-term unemployed are searching. Finally, the program improves the welfare of the economy and the government generates a budget surplus in both benchmark and subsidized economies.

The paper is organized as follows. Section 2 develops the model. Section 3 analyzes the comparative statics. Section 4 studies the simulation results for the model calibrated on the French economy. Section 5 concludes and qualifies the results drawn from our modelization.

## 2 A Segmented Labor Market Model

### 2.1 The framework

This section develops a partial equilibrium model in a continuous time setting and in steady state set to capture the main features of the low-skilled labor market. We extend the basic framework of the matching model *à la* Pissarides to include heterogeneities of unemployed and vacancies. The economy is composed by a constant and exogenous labor force,  $N_{LS}$ , and by a number of firms which is determined endogenously.

#### 2.1.1 Main assumptions

We consider the low-skilled labor force. Workers are either employed specialized in production, or unemployed specialized in job search. We distinguish long-term from short-term unemployment. Jobs seekers become long-term unemployed according to a Poisson process with rate  $\lambda$ . According to the regulation of the Unemployment Benefit System in place in many OECD countries, we assume that the initial replacement rate vary with unemployment duration. The fall from high to low benefit occurs exogenously with the same probability  $\lambda$ . Then, long-term unemployment income,  $z_{lt}$  is lower than short-term unemployment income,  $z_{st}$ .

Two types of jobs coexist in the economy and differ by the firm's technology,  $(\epsilon_i)$ . The output of a match is defined by  $y_i = p\epsilon_i$ , where  $p$  denotes the worker's ability. Since short-term and long-term unemployed have the same skills, they are equally able ( $p$ ) but may be differently productive ( $y_i$ ) as they are employed in a high-productive or in a low-productive job. Job separation occurs exogenously according to a poisson process. We assume that the destruction rate of a low-productive job,  $(s_{lp}^r)$ , exceeds the high-productive job termination rate,  $(s_{hp})$ <sup>9</sup>. We introduce payroll taxes and social contributions, denoted

---

<sup>9</sup>We provide statistical support to this assumption in the calibration section.

respectively by  $T_i^f$  and  $T_i^e$  with  $i = \{hp, lp\}$ .

A central feature of the model is that the labor market is segmented. The segmentation consists in two separated markets. Firstly, we assume that the expected value of short-term unemployment is higher than the expected gain from low-productive employment<sup>10</sup>. In the first segment of the labor market, short-term unemployed are searching for high-productive jobs. When a match is formed, firms and workers bargain over wage. Further, being long-term unemployed conveys a negative signal and yields to stigmatization. Firms of high-productive technology only direct their search to short-term unemployed. Then, the second segment describes the meeting process between long-term unemployed and low-productivity jobs. We assume that workers are paid at an exogenous wage.

As a condition of free entry is determined endogenously, firms can decide to post vacancies awarded to short-term unemployed or to enter the second segment.

### 2.1.2 Matching

The labor market is characterized by search frictions and incomplete information so that hiring a worker and searching for a job are costly activities. Hence, vacant jobs and unemployed workers are matched through a time-consuming process, captured by the matching function:  $M_i(U_i, V_i)$ .

Assume that jobless individuals are hired once matched with a firm, the matching function relates the flow of hires at any point of time on each segment of the labor market<sup>11</sup>. It is supposed to be increasing in both its arguments, concave and homogeneous of degree 1. For convenience, we denote the labor market tightness by the ratio of vacancies to unemployed:  $\theta = \frac{V}{U}$

Hence,  $\theta$  can be expressed as an average of the labor market tightness of each segment - defined as  $\theta_i = \frac{V_i}{U_i}$  - weighted by the proportion of short-term and long-term unemployed:

$$\theta = \theta_{st} \cdot \frac{U_{st}}{U} + \theta_{lt} \cdot \frac{U_{lt}}{U}$$

The shifts of vacant jobs states on the segment  $i$  are produced by a Poisson process with arrival rate  $\frac{M_i(U_i, V_i)}{V_i}$ . The linear homogeneity of the matching function allows us to make use of the  $\theta_i$  notation. The probability to fill a vacancy of type  $i$  is then equal to  $q(\theta_i)$ . Short-term or long-term Unemployed workers move into employment with rate  $\frac{M_i(U_i, V_i)}{U_i} = \theta_i q(\theta_i)$ , denoted by  $p(\theta_i)$ . From the properties of the matching function, we have  $q'(\theta_i) < 0$  and  $p'(\theta_i) > 0$ . Both probabilities depend on the segment tightness and reflect existing externalities. The matching probability for the average jobless workers on

<sup>10</sup>An equilibrium condition on parameters will be determined. We show that this condition does hold in numerical exercises.

<sup>11</sup> $M_{st}(U_{st}, V_{st})$  represents the number of short-term unemployed hired, and  $M_{lt}(U_{lt}, V_{lt})$  the number of hires of long-term unemployed workers.

the first (second) segment decreases with the number of short-term (long-term) unemployed. Simultaneously, the probability of filling a vacancy on the concerned segment will increase. Hence, the trading externalities are positive between groups whereas they are negative within a group, because of the congestion effects.

### 2.1.3 Wage subsidies

Supposed that the government subsidizes employers hiring long-term unemployed workers. As many empirical studies suggest that the participation rate of eligible firms does not reach 100%, (Katz L. (1996), Martin J. (1996))<sup>12</sup>, we assume that in each period, only a fraction  $\psi$  of the new matches will benefit from the labor market program. Employers are aware of the  $\psi$ -value but the type of contract is only known after they meet a worker. Low-productivity employment is then composed by "regular" and subsidized jobs, denoted respectively by  $L_{lp}^r$  and  $L_{lp}^s$ .

For all subsidized contracts, the firm receives at each period a financial aid as a percentage  $\xi$  of wage which ends with probability  $s_{lp}^s$ . The labor cost of subsidized jobs is then partly and temporarily supported by the government. According to the empirical evidence<sup>13</sup>, we assume that subsidized workers are retained and promoted within the firm with probability  $\tau$ : the post is converted into a high-productivity job. We suppose for simplicity that the promotion occurs once the subsidy ends. Hence,  $s_{lp}^s(1 - \tau)$  corresponds to the destruction rate of a subsidized contract. Finally, as in the private sector subsidized workers generally perform ordinary tasks, productivities and wages are equal for all the jobs within the second segment.

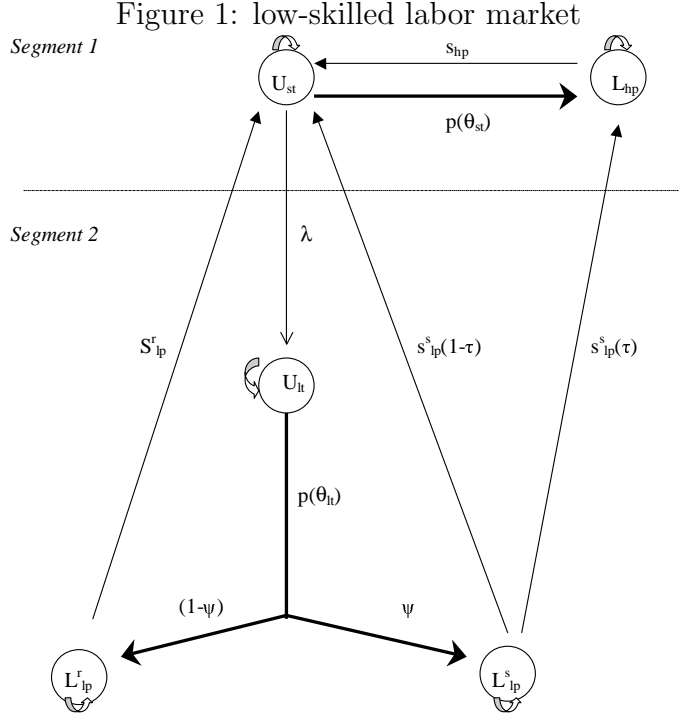
---

<sup>12</sup>One explanation for low participation to wage subsidies is the lack of information: Employers could be unaware of the required procedures they have to make. In our model, the parameter  $\psi$  can be viewed as the outcome of a match between firms and the government which would result in the creation of a subsidized contract. Hence,  $(1 - \psi)$  corresponds to the proportion of the firms which was misinformed and whose steps did not succeed.

<sup>13</sup>The well behind targeted wage subsidies is to assist workers experiencing difficulties in the labor market. However, these schemes could also induce employers to fail to retain subsidized workers. Thus, in many OECD countries, training could be provided to participants (as for the "Initiative-for-Employment Contract" in France (1995), the "Job Training Partnership Act" in the U.S (1983), and for the "New Deal for Unemployed Youth" in the U.K (1998)) to induce firms to retain and promote workers that would not have been promoted in the absence of program.  $\tau$  is a propensity to promote.



## 2.2 Labor Market Flows



At any time, a worker may be in one of the five following states: Either employed in a high-productivity job, in a regular or subsidized low-productivity job, or short-term or long-term unemployed.

In steady state, the flows into and out of unemployment must be equal, and then verify the two following equilibrium conditions:

$$s_{hp}L_{hp} + s_{lp}^r L_{lp}^r + s_{lp}^s(1 - \tau)L_{lp}^s = p(\theta_{st})U_{st} + \lambda U_{st} \quad (1)$$

$$\lambda U_{st} = p(\theta_{lt})U_{lt} \quad (2)$$

The number of workers who enter short-term unemployment are those who are separated from their jobs. As stated above,  $s_{lp}^s(1 - \tau)L_{lp}^s$  subsidized workers fall into short-term unemployment at any point of time whereas  $s_{lp}^s\tau L_{lp}^s$  enter first segment employment. Further, we assume that a worker becomes long-term unemployed with probability  $\lambda$ , so that  $\lambda U_{st}$  workers fall into long-term unemployment whereas  $p(\theta_{st})U_{st}$  have found a job. Finally, a worker remains long-term unemployed as long as he did not meet a vacancy.

Equations (3) and (4) imply that in steady state, the flows into low-productivity employment consist of new hires and are equal to the job's destruction flows.  $\psi p(\theta_{lt})$  corresponds to the probability that a long-term unemployed worker is hired on a subsidized

contract. Henceforth, only a fraction  $(1 - \psi)$  of the workers matched with firms,  $p(\theta_{lt})U_{lt}$ , move into regular low-productivity employment. It yields:

$$(1 - \psi)p(\theta_{lt})U_{lt} = s_{lp}^r L_{lp}^r \quad (3)$$

$$\psi p(\theta_{lt})U_{lt} = s_{lp}^s L_{lp}^s \quad (4)$$

As for high-productivity employment, entries correspond to the hires of short-term unemployed workers plus the workers whose subsidized job is converted:

$$p(\theta_{st})U_{st} + s_{lp}^s \tau L_{lp}^s = s_{hp} L_{hp} \quad (5)$$

## 2.3 Firms and Workers Behavior

### 2.3.1 Firms

We suppose for convenience that each firm has one job which can be either vacant or occupied once a worker is met.

$\Pi_i^v$  is the present-discounted value of expected profit from a vacant job when the firm is searching for a short-term or long-term unemployed worker.  $h$  corresponds to the hiring cost paid by the employer at any point of time on both segment. We assume that the real interest rate,  $r$ , is fixed and exogenous.

$$r\Pi_{st}^v = -h + q(\theta_{st})[\Pi_{hp} - \Pi_{st}^v] \quad (6)$$

$$r\Pi_{lt}^v = -h + (1 - \psi)q(\theta_{lt})[\Pi_{lp}^r - \Pi_{lt}^v] + \psi q(\theta_{lt})[\Pi_{lp}^s - \Pi_{lt}^v] \quad (7)$$

In a perfect financial market, the asset value is such that the cost,  $r\Pi_i^v$ , is equal to the rate of return on the asset, which corresponds in the first segment to an instantaneous cost plus a potential gain,  $[\Pi_{hp} - \Pi_{st}^v]$ , if the vacancy is filled with probability  $q(\theta_{st})$ .

In the second segment, the change of state yields net return  $[\Pi_{lp}^i - \Pi_{lt}^v]$  which depends on the type of job created: regular and subsidized jobs are filled respectively at rate  $(1 - \psi)q(\theta_{lt})$  and  $(\psi)q(\theta_{lt})$ .

$\Pi_{hp}$  and  $\Pi_{lp}^i$  are respectively the value to the firm of a high-productivity job and the value of a regular or a subsidized low-productivity job. They satisfy the following equations:

$$r\Pi_{hp} = y_{hp} - (1 + T_{hp}^f)w_{hp} + s_{hp}[\max \Pi^v - \Pi_{hp}] \quad (8)$$

$$r\Pi_{lp}^r = y_{lp} - (1 + T_{lp}^f)w_{lp} + s_{lp}^r[\max \Pi^v - \Pi_{lp}^r] \quad (9)$$

$$r\Pi_{lp}^s = y_{lp} - (1 + T_{lp}^f - \xi)w_{lp} + s_{lp}^s(1 - \tau)[\max \Pi^v - \Pi_{lp}^s] + s_{lp}^s \tau [\Pi_{hp} - \Pi_{lp}^s] \quad (10)$$

At any time, an occupied job brings back an instantaneous gain equal to the output of the match minus the labor cost  $(1 + T_i^f)w_i$ . Subsidized firms support a cost of  $(1 + T_{lp}^f - \xi)w_{lp}$ .

Let us recall that  $w_{hp}$  is the result of bargaining negotiation between employers and short-term unemployed workers hired. As for the workers hired on the second segment, they are paid to the minimum wage,  $w_{lp}$ . Given the separation rate, the change of state yields net return  $[\Pi_i^v - \Pi_i]$ . However, a subsidized worker can be promoted to a high-productivity job with probability  $s_{lp}^s \tau$ , which leads to a potential gain of  $[\Pi_{hp} - \Pi_{lp}^s]$ .

### 2.3.2 Workers

Let  $V_{st}^u$  and  $V_{lt}^u$  denote the present-discounted value of expected income from, respectively, short-term and long-term unemployment.

$$rV_{st}^u = z_{st} + p(\theta_{st})[V_{hp} - V_{st}^u] + \lambda[V_{lt}^u - V_{st}^u] \quad (11)$$

A worker who has just been separated from his job enjoys a non-employment income ( $z_{st}$ ), which we assume to be the sum of unemployment benefits ( $b_{st}$ ) and a value of leisure ( $l$ ), as in Pissarides C. (1990). A short-term unemployed gets a high-productivity job which has value  $V_{hp}$  at rate  $p(\theta_{st})$ .  $[V_{lt}^u - V_{st}^u]$  corresponds to the potential loss which occurs with probability  $\lambda$ , when falling into long-term unemployment.

Similarly,  $z_{lt} = b_{lt} + l$ . Since the replacement rate decreases with the length of unemployment spell, we assume that a long-term unemployed worker receives lower benefits. This parameter may also include minimum compensation paid to unemployed who exhaust their UI benefits. The value of long-term unemployment solves:

$$rV_{lt}^u = z_{lt} + (1 - \psi)p(\theta_{lt})[V_{lp}^r - V_{lt}^u] + \psi p(\theta_{lt})[V_{lp}^s - V_{lt}^u] \quad (12)$$

The associated value to the worker of a high-productivity or regular or subsidized low-productivity job - respectively  $V_{hp}$ ,  $V_{lp}^r$  and  $V_{lp}^s$ - satisfy:

$$rV_{hp} = (1 - T_{hp}^e)w_{hp} + s_{hp}[V_{st}^u - V_{hp}] \quad (13)$$

$$rV_{lp}^r = (1 - T_{lp}^e)w_{lp} + s_{lp}^r[V_{st}^u - V_{lp}^r] \quad (14)$$

$$rV_{lp}^s = (1 - T_{lp}^e)w_{lp} + s_{lp}^s(1 - \tau)[V_{st}^u - V_{lp}^s] + s_{lp}^s \tau[V_{hp} - V_{lp}^s] \quad (15)$$

An employed worker pays social security contributions as a percentage  $T_i^e$  of wage, so that  $(1 - T_i^e)w_i$  corresponds to the net wage he receives. Job destruction generates unemployed search. Whatever the type of contract, the worker falls into short-term unemployment which has value  $V_{st}^u$ . The expected gain from change of state when a subsidized worker is promoted is  $[V_{hp} - V_{lp}^s]$ .

### 2.3.3 Wage determination

Once a high-productivity job is filled in the first segment, the firm and the worker bargain over wages to share the total match surplus, defined as the sum of the two agents' surplus:

$$S = (V_{hp} - V_{st}^u) + (\Pi_{hp} - \Pi_{st}^v) \quad (16)$$

The worker's and the firm's net return from the job match is given by the difference between the value of the job and the outside option.

We assume that the equilibrium wage of this game equals to the Nash-bargaining solution. Therefore  $w_{hp}$  maximizes the weighted product of the employer's and the worker's surplus and satisfies:

$$w_{hp} = \operatorname{argmax}(V_{hp} - V_{st}^u)^\gamma (\Pi_{hp} - \Pi_{st}^v)^{(1-\gamma)}$$

where  $\gamma$  is the worker's relative bargaining power coefficient.

The first-order maximization conditions lead to:

$$(V_{hp} - V_{st}^u) = \frac{\gamma(1 - T_{hp}^e)}{[(1 - \gamma)(1 + T_{hp}^f) + \gamma(1 - T_{hp}^e)]} S \quad (17)$$

$$(\Pi_{hp} - \Pi_{st}^v) = \frac{(1 - \gamma)(1 + T_{hp}^f)}{[(1 - \gamma)(1 + T_{hp}^f) + \gamma(1 - T_{hp}^e)]} S \quad (18)$$

It comes:

$$w_{hp} = \frac{\gamma}{(1 + T_{hp}^f)} y_{hp} + \frac{(1 - \gamma)}{(1 - T_{hp}^e)} r V_{st}^u \quad (19)$$

Workers receive a fraction of the surplus that they create by occupying the job which decreases with the payroll tax paid by the firm and increases with their bargaining power. They also receive a fraction of their reservation wage,  $rV_{st}^u$ , decreasing with their bargaining power. An increase in the social security contributions will raise the fraction of the reservation wage they receive.

## 2.4 Steady-State Equilibrium

A steady state equilibrium for this economy is vector  $(w_{hp}, \theta_{st}, \theta_{lt}, u, L_{hp}, L_{lp}^r, L_{lp}^s)$  that satisfies the flow equilibrium conditions, the job creation conditions and the wage curve.

### 2.4.1 Beveridge Curve

The unemployment rate of the labor market can be defined as  $u = u_{st} + u_{lt}$  with  $u_i = \frac{U_i}{N_{LS}}$ . The flow equilibrium conditions<sup>14</sup> lead us to express these rates as a function of the labor market tightness on each segment,  $\theta_{st}$  and  $\theta_{lt}$ .

$$u_{st} = \frac{s_{hp}}{s_{hp} + p(\theta_{st}) + \tau\psi\lambda + s_{hp}\lambda\left[\frac{1}{p(\theta_{lt})} + \frac{(1-\psi)}{s_{lp}^r} + \frac{\psi}{s_{lp}^s}\right]} \quad (CB_1)$$

$$u_{lt} = \frac{\lambda s_{hp}}{p(\theta_{lt})\left\{s_{hp} + p(\theta_{st}) + \tau\psi\lambda + s_{hp}\lambda\left[\frac{1}{p(\theta_{lt})} + \frac{(1-\psi)}{s_{lp}^r} + \frac{\psi}{s_{lp}^s}\right]\right\}} \quad (CB_2)$$

These two equations correspond to implicit forms of Beveridge curves prevailing on each segment. It comes out that the labor market segmentation is not complete: short-term or long-term unemployment rates are function of the opposite segment tightness. Moreover, programs targeted to long-term unemployed workers have an impact on short-term unemployment:  $u_{st}$  depends on the policy parameters, as  $\psi$  and  $s_{lp}^s$ , but also on the propensity to promote,  $\tau$ .

Then the Beveridge Curve

$$u = \frac{[\lambda + p(\theta_{lt})]s_{hp}}{p(\theta_{lt})\left\{s_{hp} + p(\theta_{st}) + \tau\psi\lambda + s_{hp}\lambda\left[\frac{1}{p(\theta_{lt})} + \frac{(1-\psi)}{s_{lp}^r} + \frac{\psi}{s_{lp}^s}\right]\right\}} \quad (CB)$$

### 2.4.2 Job Creation equations

According to the competitive entry condition:  $\Pi_{st}^v = 0$  and  $\Pi_{lt}^v = 0$ . It implies that firms create vacancies until any incremental profit is exhausted.

From equations (6) and (8) the job creation condition on the first segment can be defined as:

$$\frac{h}{q(\theta_{st})} = \frac{y_{hp} - (1 + T_{hp}^f)w_{hp}}{(r + s_{hp})} \quad (JC_1)$$

$\frac{1}{q(\theta_{st})}$  can be viewed as the average duration of a vacancy posted to short-term unemployed workers. Then  $JC_1$ , as traditional job creation condition, implies that the average cost of a first segment's vacancy is equal to the expected profit of a high-productivity occupied job.

---

<sup>14</sup> $u_{lt} = \frac{\lambda}{p(\theta_{lt})}u_{st}$ , and  $u = \frac{\lambda + p(\theta_{lt})}{p(\theta_{lt})}u_{st}$

On the second segment:  $\frac{h}{q(\theta_{lt})} = \psi \Pi_{lp}^s + (1 - \psi) \Pi_{lp}^r$ .

The average cost of a second segment's vacant post is equal to the average expected profit of an occupied job in the second segment (denoted by  $\Pi_{lp}$ ). It equals the weighted average between expected profits of regular and subsidized jobs.

Then, equations (7), (9) and (10) lead to the following job creation condition:

$$\begin{aligned} \frac{h}{q(\theta_{lt})} = & \frac{\psi[y_{lp} - (1 + T_{lp}^f - \xi)w_{lp}]}{(r + s_{lp}^s)} + \frac{\psi s_{lp}^s \tau [y_{hp} - (1 + T_{hp}^f)w_{hp}]}{(r + s_{hp})(r + s_{lp}^s)} \\ & + \frac{(1 - \psi)[y_{lp} - (1 + T_{lp}^f)w_{lp}]}{(r + s_{lp}^r)} \end{aligned} \quad (JC_2)$$

### 2.4.3 Wage Curve

According to the bargaining process and solving equations (11) to (15), we obtain the Wage curve:

$$\begin{aligned} w_{hp} = & \frac{\gamma}{(1 + T_{hp}^f)} y_{hp} \\ & + \frac{(1 - \gamma)(1 + T_{hp}^f)(r + s_{lp}^s)(r + s_{lp}^r)\{[r + p(\theta_{lt})]z_{st} + \lambda z_{lt}\}}{(1 - T_{hp}^e)(1 + T_{hp}^f)D} \\ & + \frac{\lambda(1 - \gamma)(1 + T_{hp}^f)(1 - T_{lp}^e)p(\theta_{lt})\{(r + s_{lp}^r)\psi + (r + s_{lp}^s)(1 - \psi)\}w_{lp}}{(1 - T_{hp}^e)(1 + T_{hp}^f)D} \\ & + \frac{\{\gamma(r + s_{lp}^s)[r + p(\theta_{lt})]p(\theta_{st}) + \lambda\gamma\psi p(\theta_{lt})s_{lp}^s\tau\}\{(r + s_{lp}^r)(1 - T_{hp}^e)[\frac{h}{q(\theta_{st})}]\}}{(1 - T_{hp}^e)(1 + T_{hp}^f)D} \end{aligned} \quad (WC)$$

with

$$D = \{(r + s_{lp}^s)(r + s_{lp}^r)(r + p(\theta_{lt})) + \lambda[(r + s_{lp}^r)\psi p(\theta_{lt}) + (r + s_{lp}^s)(1 - \psi)p(\theta_{lt}) + (r + s_{lp}^s)(r + s_{lp}^r)]\}$$

As for the implicit forms of the Beveridge curves, it comes out that the outcome of the negotiation process depends on long-term unemployment's and low-productivity employment's characteristics. When a worker bargains over his wage, he takes into account, once fallen into long-term unemployment, the risk of remaining unemployed and the various existing opportunities. Short-term unemployed influence the equilibrium outcome only through their influence on the bargaining process.

### 2.4.4 Welfare

The government collects social security contributions, pays unemployment benefits ( $b_{st}$  and  $b_{lt}$ ) and finances the wage subsidy program. In the equilibrium, the budget of the state can be written as follows:

$$G = L_{hp}(T_{hp}^f + T_{hp}^e)w_{hp} + (L_{lp}^r + L_{lp}^s)(T_{lp}^f + T_{lp}^e)w_{lp} - \{L_{lp}^s \xi w_{lp} + U_{st}b_{st} + U_{zt}b_{zt}\} \quad (20)$$

where  $G > 0$  (resp.  $G < 0$ ) is the budget surplus (deficit).

Assume that the government distributes its budget surplus among the population or taxes workers to cover the deficit: It modifies workers' value functions (11)-(15) while leaving unchanged the steady state equilibrium.

The steady state utilitarian welfare function ( $W$ ) is the sum of workers' welfare ( $W^w$ ), firms' welfare ( $W^f$ ) and transfers:

$$W_w = rV_{st}U_{st} + rV_{lt}U_{lt} + rV_{hp}L_{hp} + rV_{lp}^rL_{lp}^r + rV_{lp}^sL_{lp}^s \quad (21)$$

$$W_f = r\Pi_{hp}L_{hp} + r\Pi_{lp}^rL_{lp}^r + r\Pi_{lp}^sL_{lp}^s \quad (22)$$

Substituting the value functions (8)-(15), and using the steady state equilibrium conditions (1)-(5),  $JC_1$  and  $JC_2$ , workers' and firms' welfare can be written as a weighted average of individuals' instantaneous utilities:

$$W^w = L_{hp}(1 - T_{hp}^e)w_{hp} + (L_{lp}^r + L_{lp}^s)(1 - T_{lp}^e)w_{lp} + U_{st}z_{st} + U_{lt}z_{lt}$$

$$W^f = L_{hp}[y_{hp} - (1 + T_{hp}^f)w_{hp}] + (L_{lp}^r + L_{lp}^s)[y_{lp} - (1 + T_{lp}^f)w_{lp}] + L_{lp}^s\xi w_{lp} - (\theta_{st}U_{st} + \theta_{lt}U_{lt})h$$

Finally, the welfare of the economy is given by:

$$\begin{aligned} W &= L_{hp}[y_{hp} - (T_{hp}^e + T_{hp}^f)w_{hp}] + L_{lp}^r[y_{lp} - (T_{lp}^e + T_{lp}^f)w_{lp}] + L_{lp}^s[y_{lp} - (T_{lp}^e + T_{lp}^f - \xi)w_{lp}] \\ &\quad + U_{st}z_{st} + U_{lt}z_{lt} - \theta U h + G \end{aligned} \quad (23)$$

which simplifies to:

$$W = L_{hp}y_{hp} + (L_{lp}^r + L_{lp}^s)y_{lp} + U l - \theta U h \quad (24)$$

where  $l$  denotes the leisure's value.

### 3 Comparative Statics analysis

We now examine how an increase in the opportunity to benefit from the subsidy (measured by  $\psi$ ) influences the endogenous variables. As our concern is a steady-state analysis, we find long-run effects induced by a permanent change in the psi-value.

Firms do not benefit from the subsidy for all long-term unemployed workers they hires. A rise in the psi-value has to be seen as an improvement in the participation rate of firms. It then implies a larger number of subsidized jobs for a given number of hires. It should also be pointed out that an economy without wage subsidies program is characterized by a null value of the parameter  $\psi$ .

Initially, we analyze the short run effects as firms and workers do not adjust their decisions in response to an increase in the psi-value. We consider the labor market tightness and the negotiated wage as given. A rise in the parameter  $\psi$  will result in an exogenous substitution of regular low-productivity jobs by subsidized contracts in the second segment. As a subsidized job can be converted, it will also affect high-productivity employment. Hence, a rise in  $\psi$  alters employment composition and leads to a first mechanical effect whose sign depends on the different job destruction rates. We assume for the analysis that  $s_{lp}^s > s_{lp}^r$  which is verified in the simulations. The parameter  $\tau$  have to be higher than a threshold<sup>15</sup> defined as  $s_{hp}[\frac{1}{s_{lp}^r} - \frac{1}{s_{lp}^s}]$  so that unemployment decreases. If the policy is not sufficiently efficient, only few subsidized jobs will be preserved and destructions flows into short-term unemployment will raise. Since the exit rates of short-term and long-term unemployment are constant, the surplus of workers falling into short-term unemployment is transferred to long-term unemployment. This effect corresponds to a displacement of the Beveridge curves for both segment.

Secondly, we analyze how firms adjust their labor demand by posting more or less vacancies.

If  $\psi$  increases, employers are more likely to benefit from the program in the second segment. Assuming that the value of a subsidized contract is higher than the value of a regular job, the average expected profit of an occupied job in the second segment increases. Firms are then induced to post more vacancies directed to targeted workers. As the exit rate of long-term unemployment raises, the first direct effect is a reduction in the stock of long-term unemployed workers. Nevertheless, according to  $CB_1$ , the increase in the low-productivity jobs creations will raise short-term unemployment<sup>16</sup>. This

<sup>15</sup> Differentiating  $CB_1$  for a given  $\theta_{st}$  yields:  $\frac{du_{st}}{d\psi} = \frac{-\lambda s_{hp} \left\{ \tau + s_{hp} \left[ \frac{1}{s_{lp}^r} - \frac{1}{s_{lp}^s} \right] \right\}}{\left\{ s_{hp} + p(\theta_{lt}) + \tau\psi\lambda + s_{hp}\lambda \left[ \frac{1}{p(\theta_{lt})} + \frac{(1-\psi)}{s_{lp}^r} + \frac{\psi}{s_{lp}^s} \right] \right\}^2}$

<sup>16</sup>At steady state, the impact of  $\theta_{lt}$  on short-term unemployment is given by

$$\frac{du_{st}}{d\theta_{lt}} = \frac{s_{hp}^2 \lambda \left[ \frac{dp(\theta_{lt})/d\theta_{lt}}{p(\theta_{lt})^2} \right]}{\left\{ s_{hp} + p(\theta_{st}) + \tau\psi\lambda + s_{hp}\lambda \left[ \frac{1}{p(\theta_{lt})} + \frac{(1-\psi)}{s_{lp}^r} + \frac{\psi}{s_{lp}^s} \right] \right\}^2} > 0$$



leads to the same effect that previously stated: an increase in low-productivity employment implies additional job destruction flows into short-term unemployment. Long-term unemployment will respond according to variations in the exit rate of short-term unemployment. However, intuitively, the labor demand should be stimulated enough so that long-term unemployment is reduced whereas short-term unemployment increases.

The analysis shows that for a given wage  $w_{hp}$ , job creation decisions in the first segment are not affected by the program. Firms adjust their labor demand according to variations of short-term unemployment<sup>17</sup>, but the tightness,  $\theta_{st}$ , is constant. Further, when the total number of jobs is fixed, a rise in the psi-value improves the relative return of low-productivity employment and then induces a direct substitution of jobs offered to short-term unemployed by vacancies posted on the second segment.

We now consider the effect of an increase in  $\psi$  on the wage bargaining process. The outside option of a short-term unemployed depends on the value of long-term unemployment which increases with the parameter  $\psi$ . Firstly, long-term unemployed are more likely to be hired in a subsidized job whose value is supposed to be higher than the value of regular employment. Secondly, as labor demand is stimulated in the second segment, the exit rate of long-term unemployment increases. These effects tend to push up the negotiated wage. However, variations in unemployment have also an impact on the bargaining process which outcome is unknown. Actually, if the first mechanical effect, as before, implies a rise in short-term unemployment, the wage tends to be reduced. Nevertheless, the effect of the improvement in the employment prospects of long-term unemployed should be intuitively stronger. Thus, we assume for the rest of the analysis that workers would negotiate their wage up<sup>18</sup> in response to a rise in  $\psi$ . The expected profit of a high-productivity job would then be reduced, which induces firms to post fewer vacancies on the first segment. The reemployment probability decreases and short-term unemployment increases. Note that if  $\tau = 0$ , variations in  $w_{hp}$  do not affect the labor market tightness of segment 2. Short-term and therefore long-term unemployment increase unambiguously. When subsidized contracts can be converted into high-productivity jobs, an increase in  $w_{hp}$  will also reduce the labor demand in the second segment - cf. equation  $JC_2$ . But that effect depends on the conversion rate of subsidized contracts and should be of limited magnitude.

Intuitively, according to the labor demands variations, we expect long-term unemployment to fall whereas short-term unemployment increases. Note that for low values of  $\tau$ , the reduction of long-term unemployment should be lower, and short-term unemployment would increase unambiguously, (the two cases are illustrated in Appendix A).

---

<sup>17</sup>It refers to labor market externalities: if the jobless individuals are more numerous in the segment,  $\theta_{st}$  is reduced and the probability to fill a vacancy increases. Firms are induced to open more vacant jobs which will increase the tightness to its initial level. The same argument is available when short-term unemployment decreases.

<sup>18</sup>It corresponds to the most likely case and we obtain this effect in the simulation.

If the segmentation of the labor market was total, a rise in  $\psi$  would stimulate job creations on the second segment whereas it would not affect the labor demand of short-term unemployed. As we assume that labor market segments are not juxtaposed, our paper highlights an indirect substitution effect driven by the wage bargaining process.

## 4 Simulations

The model we developed above does not allow us to conclude on the overall impact of wage subsidies programs. The ambiguity of the effects reflects the multiple channels of influence on unemployment. Which is the net effect is a quantitative question.

We next calibrate our model for the French economy to evaluate the effects pointed out previously.

### 4.1 Calibrating the model

The parameters values are computed to match the French low-skilled labor market in 1995. The benchmark economy (where there is no wage subsidies) stands for the situation of the active population of employees, except public office, and unskilled workers.

We adopt the following Cobb-Douglas matching function:  $M(U_i, V_i) = U_i^{(\alpha)} V_i^{(1-\alpha)}$ . We assume that the matching technology is identical for both segments. The elasticity with respect to unemployment of the segment,  $\alpha$ , is set to 0.5. As we consider the low-skilled labor market, the workers' share of the match surplus,  $\gamma$ , is fixed to 0.4, which is consistent with Abowd J. and Allain L. (1996). We take the month as unit of time. The interest rate is set to 0.004 (5% on an annual basis), and  $\lambda$  is fixed so that short-term unemployment duration is 12 months, ( $\lambda = \frac{1}{12}$ ). The destruction rates,  $s_{hp}$  and  $s_{lp}^r$ , are calibrated according to the French database on job creations and job destructions<sup>19</sup>. The average duration of a high-productivity job is about 80 months whereas a low-productivity job is destroyed after 40 months. The exogenous wage of low-productive employment is set to the minimum wage level (SMIC) of 1995. Similarly, payroll taxes, and social contributions are computed according to the French law in 1995. The net replacement rate of a short-term unemployed worker was equal to 73% in 1995 (Martin J. (1996)). As the minimum duration of a job is 40 months, all short-term unemployed received unemployment benefits. Then, we computed the value of  $b_{st}$  according to an effective replacement rate of 73%. As a long-term unemployed worker remains in unemployed until he finds a job, we consider an average value of the replacement rate: 45.33%, (Martin J. (1996)). In France only 55% of unemployed were indemnized in 1995. Then, the effective replacement rate

---

<sup>19</sup>Enquête sur les Mouvements de Main-d'Oeuvre

for long-term unemployed is set to 25%.

Finally, we have four parameters,  $l$ ,  $h$ ,  $y_{hp}$  and  $y_{lp}$ , which are unobservable. The leisure utility and productivities are fixed to match employment and wages observed in 1995, Table 1, whereas  $h$  is set so that the total cost of vacant posts equals 5% of the output. Then, the average cost of a vacancy posted to short-term unemployed represents 35% of the annual productivity of a first segment job. On the second segment, it equals to 12% of the job annual productivity.

Unemployment rate	18.95%
Employment paid at the minimum level	22%
Bargained wage of low-skilled workers	1.3*SMIC

In 1995, France introduced a reduction in employer’s contribution thus establishing a new type of contract: the ”Initiative-for-Employment Contract”, (CIE). It’s a measure targeted to unemployed excluded from the labor market, as long-term unemployed, welfare recipients and disabled workers. The jobs are either of undetermined duration or fixed-term contracts lasting between 12 and 24 months. However, firms benefit from the subsidy for a maximum period of 24 months. They are entitled to an exoneration of payroll tax combined with a premium for priority unemployed persons.

We compute the values of  $\psi$ ,  $\tau$ ,  $\xi$ , and  $s_{lp}^s$  in order to match the program’s characteristics. The probability that the subsidy ends is calibrated so that the average payment duration is 24 months. As a CIE involves an average reduction in the labor cost of 40% (Insee, Dares and Liaisons Sociales (1997)),  $\xi$  is set to 48.72%. According to Charpail C. and Zilberman S. (1999), there is only few internal mobility after the completion of a CIE. The parameter  $\tau$ , fixed to 16%, corresponds to the proportion of the ex-recipients who were promoted within the firm. Finally, structural parameter  $\psi$  is unknown. It is then numerically computed to reproduce the stock of CIE observed in the economy, (300000 contracts in 1999). The policy parameters that we use are reported in Table 2.

Finally, a sensitivity analysis is reported in Appendix C. We computed values of  $l$ ,  $h$ ,  $y_{hp}$  and  $y_{lp}$  in order to reproduce the benchmark economy for different values of the elasticity of the matching function, the bargaining power and destruction rates. Results for the economy with the French program are reported in Tables (6) to (9).

Table 2: Policy parameters values

$\psi$	$\xi$	$s_{lp}^s$	$\tau$
0.33	0.4872	$\frac{1}{24}$	0.16

## 4.2 Simulation results of the French policy

The first column of Table 3 - Appendix B - characterizes the economy without wage subsidies. The equilibrium unemployment rate of low-skilled workers is 18.95%. Short-term unemployed workers experience fewer difficulties in finding a job than those who are searching for more than a year. Consequently, 71.7% of jobless individuals are long-term unemployed which is higher than the real French proportion.

The second column summarizes the simulation results for the stable economy in which the French contract was set up. The targeted wage subsidy program appears to be efficient as the unemployment rate decreases by 6.7 points. The program has a significant impact on the targeted group since it improves its hiring prospects. Long-term unemployed workers represent henceforth 45% of job seekers of the whole economy. Although the net effect on employment is obviously positive, the CIE implies perverse effects, which tends to reduce the policy's impact.

There are more workers searching for short time periods in the economy with a lower reemployment probability. This is due to the increase in the number of job destructions and to the shift in the labor demand from short-term to long-term unemployed. Firstly, from the calibration, we find  $\tau$  lower than  $s_{hp}[\frac{1}{s_{lp}^r} - \frac{1}{s_{lp}^s}]$ . Consequently, as stated in the comparative statics, destruction flows into short-term unemployment increase. Secondly, since the wage is pushed up, firms post fewer vacancies within the first segment. It refers to the indirect substitution effect we highlight in the comparative statics. If the measure had had no impact on the bargaining process, and then on job creation decisions, the labor demand of short-term unemployed would have increased. This is due to positive inter-group externalities. To illustrate it, we have done a simulation of the policy keeping the negotiated wage of the benchmark economy constant: the results are reported in the third column of Table 2- Appendix B. We observe that the net employment gain induced by the CIE would have been stronger. Even if the labor demand is reduced when the CIE is set up, high-productivity employment increases. About 39% of the creations are due to promotions of subsidized workers<sup>20</sup>. The rest is due to hirings of short-term unemployed workers who are more numerous. Moreover, the majority of jobs created are highly productive: as reported in Table 3-Appendix B, they represent 82.8% of the total creations.

<sup>20</sup>The conversion of subsidized contract represents 32.6% of the total jobs' creations, Table 4-Appendix B

The French program induces firms to post more vacancies to long-term unemployed. Although 300000 subsidized contracts are opened, we observe that low-productivity employment does not increase much. This is due to strong deadweight effects within the second segment. However, these effects occur exogenously and depend on the parameter  $\psi$ . We should have adopted an ex-ante segmentation of low-productivity employment to estimate deadweight effects induced by the scheme. Nevertheless, we have assumed that employers who post vacancies in the second segment ignore if they will benefit from the subsidy. This assumption does not modify the program's effect on the labor demand of long-term unemployed significantly. On one hand, we overestimate the labor demand of the firms that will not be subsidized, and on the other hand, we underestimate the entries of employers who will benefit from the scheme.

Further, we examine how the French program affects the welfare of the economy. Results are reported in Table 5 - Appendix B.

The government collects social security contributions, pays unemployment benefits and supports the subsidy payment. We observe that the benchmark and the subsidized economies are both characterized by a budget surplus. The first point is that the policy is self-financing. Firstly, in the absence of a concern for redistribution, the analysis shows that the wage subsidy program improves the situation of workers and firms, thus increasing the aggregate net output (by 2%). As the situation of all groups of workers get better, we can conclude to a steady state Pareto improvement. Then, we assume that the government distributes its budget surplus among the population. Table 4 shows that the welfare improves as before but also that the program's effects get stronger. Because both employment and negotiated wage increase, government revenues are higher in the subsidized economy. Similarly, expenditures on unemployment benefits are reduced. Hence, the budget surplus is 8% higher even if the government has to support the subsidy's payment. Workers' welfare and then net aggregate output increase more than in the absence of redistribution.

Finally, the program involves a substantial increase in employment and improves the welfare of the economy. As we were expecting, long-term unemployment is reduced whereas short-term unemployment increases. Although workers face more risks of remaining at least one year in unemployment, once long-term unemployed, they will get a job more quickly than in the benchmark economy. The analysis suggests that the net employment gain is strongly positive. However, let us recall that as the model is developed in steady state, we focus on the long-run effects of the CIE introduction. As a result, it does not give us any information about the dynamic behind the response.

## 5 Conclusion

This paper can be viewed as an attempt to evaluate the impact of a wage subsidy targeted to the long-term unemployed on the low-skilled labor market. A matching model enriched to take into account interactions between labor markets provides a powerful setting for analyzing perverse effects of such targeted schemes.

The analysis developed in the paper argues that a wage subsidy program set up in a large scale will obviously stimulate labor demand of the targeted group, and reduce long-term unemployment. However, it will also have repercussions within the first segment, where short-term are searching for highly productive jobs, through the wage bargaining process and transitions between the labor market states. The model suggests that various effects depend on the targeted schemes efficiency to allow workers to keep a job and to be promoted. Although wage subsidy programs may improve hiring and employment prospects of the targeted group, the net effect on unemployment is ambiguous. Some indirect effects should reduce the negative impact on long-term unemployment without overcoming it. Our modelization mainly brings out an indirect substitution effect driven by the negotiation.

Using this framework, the simulation shows that the reduction in employer's contribution introduced in France in 1995 (the "Initiative-for-Employment Contract") performs well as it involves a substantial increase in low-skilled employment and improves workers' welfare. As we were expecting, long-term unemployment is reduced whereas short-term unemployment increases. The results suggest that the program leads to large substitution effects.

Simulating a model developed at steady state, as Cardullo G. and Van der Linden B. (2006) or Vereshchagina G. (2002), allows us to analyze the long-run implications of a permanent change in the program. Search frictions and incomplete information tend to lengthen the transition between the benchmark economy and the new steady state. As noted by Cardullo G. and Van der Linden B. (2006), "a fully rigorous analysis would require to look also at the adjustment path towards the steady state values". Nevertheless, what matters here for our study on the French CIE is the mechanisms relative to the adverse effects we highlight and the net employment gain.

## References

- Abowd J. and Allain L.**, “Compensation Structure and Product Market Competition,” *Annales d’Economie et de Statistique*, 1996, (41/42), 207–217.
- Belleville A.**, “L’utilisation des aides à l’emploi par les entreprises: permanence ou logique conjoncturelle?,” *Premières Synthèses, DARES*, 2001, (25.1).
- **and Charpail C.**, “Maintien dans l’emploi ou retour au chômage à l’issue d’un Contrat Initiative Emploi: le poids de la conjoncture économique,” *Premières Synthèses, DARES*, 2000, (44.2).
- Berger E., Defosseux M., Even K., De Palmas J-P., Mas S., Sanchez R., and Zamora P.**, “Les bénéficiaires des politiques de l’emploi: des parcours sensibles aux mouvements conjoncturels de l’économie,” *Premières Synthèses, DARES*, 2002, (52.3).
- Brodaty T., Crépon B., and Fougère D.**, “Do long-term unemployed workers benefit from active labor market programs? Evidence from France, 1986-1998,” *working paper*, 2002.
- Cahuc P. and Carcillo S.**, “Que peut-on attendre des Contrats Nouvelle Embauche?,” *Revue française d’économie*, 2006, 21 (1), 37–86.
- Calmfors L.**, “Active labour market policy and unemployment, a framework for the analysis of crucial design features,” *OECD Economic Studies*, 1994, (22).
- **, Forslund A., and Hemström M.**, “Does active labour market policy work ? Lessons from the Swedish experiences,” *Swedish Economic Policy Review*, 2001, 8 (2), 61–131. .
- Cardullo G. and Van der Linden B.**, “Employment Subsidies and Substitutable Skills: An Equilibrium Matching Approach,” *IZA Discussion Paper*, 2006, (2073).
- Charpail C. and Zilberman S.**, “Le Contrat Initiative Emploi, une mesure de réinsertion durable?,” *Premières Synthèses, DARES*, 1999, (46.1).
- Dalherberg M. and Forslund A.**, “Direct Displacement Effects of Labour Market policies,” *Working paper, IFAU*, 1999, (7).
- Doisy S., Duchene S., and Gianella**, “Un modèle d’appariement avec hétérogénéité du facteur travail : un nouvel outil d’évaluation des politiques économiques,” *Economie et Prévision*, 2004, (162), 1–22.

- Fay R.**, “Enhancing the Effectiveness of Active Labour Market Policies: Evidence from Programme Evaluations in OECD Countries,” *Labour Market and Social Policy Occasional Papers*, OECD, 1996, (18).
- Forslund A., Johansson P., and Lindqvist L.**, “Employment subsidies- A fast lane from unemployment to work?,” *Working paper*, IFAU, 2004, (18).
- Insee, Dares, and Liaisons Sociales**, “Les aides à l’emploi marchand,” *Les dossiers thématiques*, 1997.
- Katz L.**, “Wages Subsidies for the Disadvantaged,” *NBER Working paper*, 1996, (5679).
- Layard R., Jackman R., and Nickell S.**, “Unemployment,” *Oxford University Press*, 1991.
- Lee J-K.**, “Evaluation of and lessons from Wage Subsidy Programmes in OECD countries,” *working paper*, OECD, 2005.
- Lise J., Seitz S., and Smith J.**, “Equilibrium policy experiments and the evaluation of social programs,” *NBER Working Paper*, 2004, (10283).
- Martin J.**, “Indicateurs de taux de remplacement aux fins de comparaisons internationales,” *Revue économique de l’OCDE*, 1996, 86.
- and **Grubb D.**, “What works and for whom : A review of OECD countries experiences with active labour market policies,” *Swedish Economic Policy Review*, 2001, 8, 9–56.
- Mortensen D. and Pissarides C.**, “Taxes, Subsidies and Equilibrium Labor Market Outcomes,” in *Designing Inclusion: Tools to Raise Low-End Pay and Employment in Private Enterprise*, edited by Edmund S. Phelps, Cambridge: Cambridge University Press, 2003.
- OECD**, “Active Labour Market Policies: Assessing Macroeconomic and Microeconomic Effects,” *OECD Employment Outlook*, 1993, pp. 39–80.
- Orszag J M. and Snower D.**, “Designing employment subsidies,” *Labour economics*, 2003, 10.
- Pissarides C.**, “Equilibrium Unemployment Theory,” *Basil Blackwell: Oxford*, 1990.
- Richardson J.**, “Wage subsidies for the long-term unemployed : a search theoretic analysis,” *Working paper*, Centre for economic performance, LSE, 1998.
- Sianesi B.**, “Differential effects of Swedish active labour market programmes for unemployed adults during the 1990s,” *Working paper*, IFAU, 2002, (5).

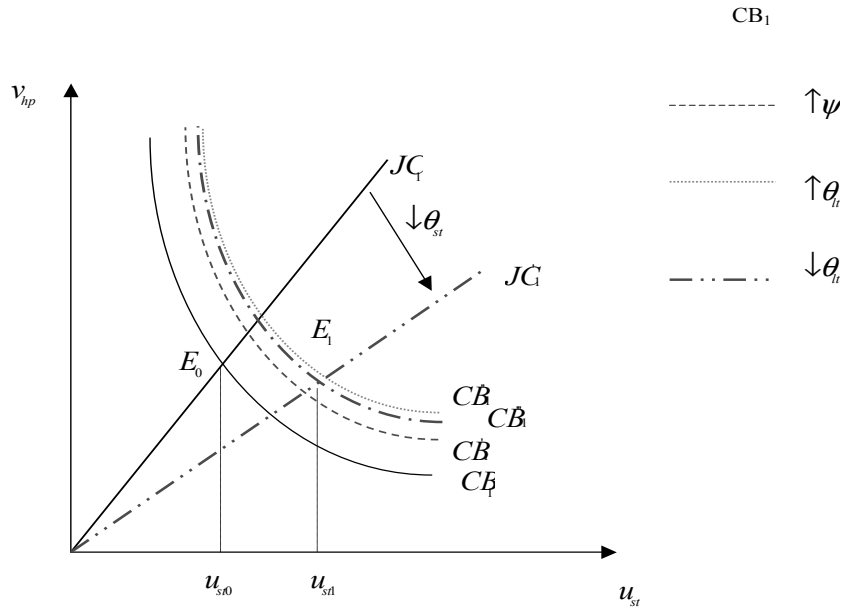


Vereshchagina G., “Unemployment, Firm Dynamics, and Targeted Employment Subsidies,” *CERGE-EI Discussion Paper*, 2002, 88.

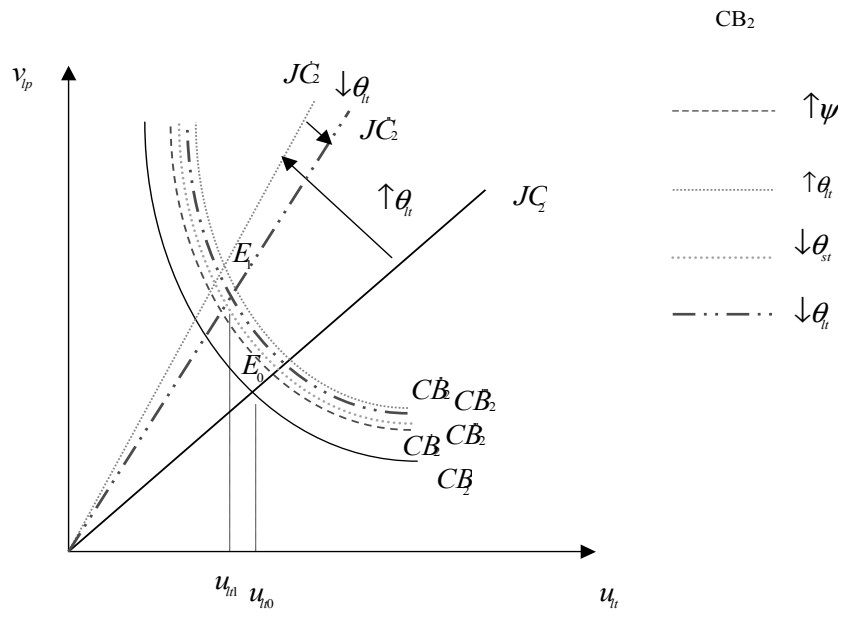
## Appendixes

### A Comparative Statics

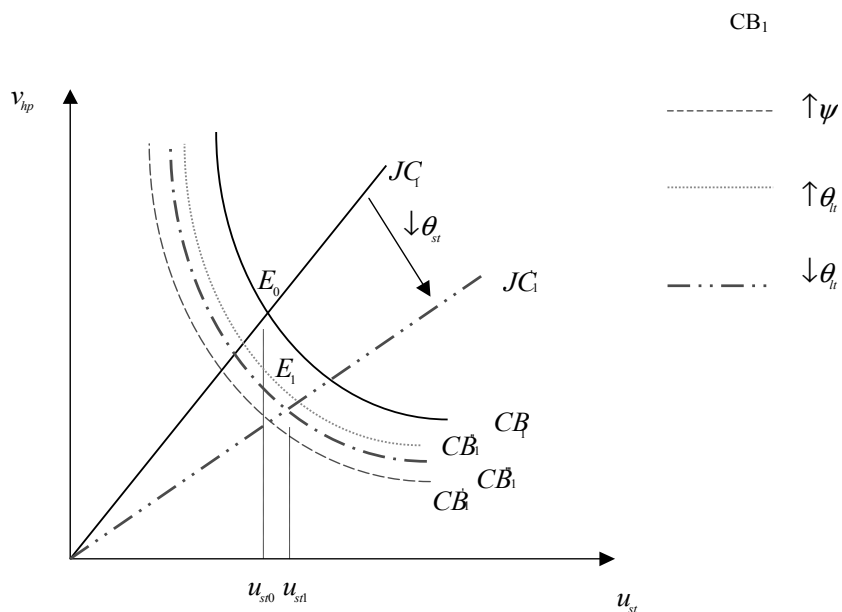
Short-term unemployment’s response to an increase in  $\psi$  when  $\tau < s_{hp}[\frac{1}{s_{lp}^r} - \frac{1}{s_{lp}^s}]$ :



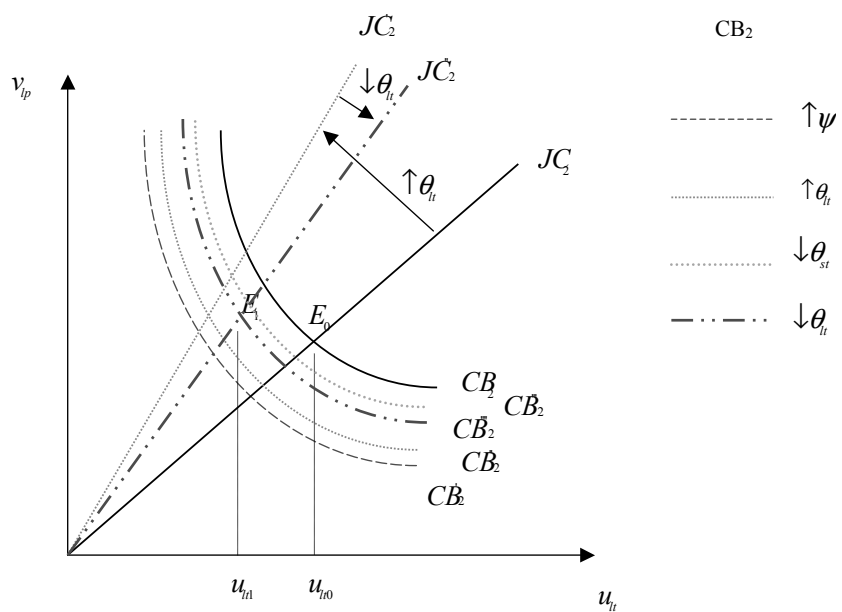
Long-term unemployment’s response to an increase in  $\psi$  when  $\tau < s_{hp}[\frac{1}{s_{lp}^r} - \frac{1}{s_{lp}^s}]$ :



Short-term unemployment's response to an increase in  $\psi$  when  $\tau > s_{hp}[\frac{1}{s_{tp}^r} - \frac{1}{s_{tp}^s}]$ :



Long-term unemployment's response to an increase in  $\psi$  when  $\tau > s_{hp}[\frac{1}{s_{tp}^r} - \frac{1}{s_{tp}^s}]$ :



## B Tables

Table 3: Simulations Results

	Benchmark Economy	Economy with wage subsidies (CIE)	Economy with wage subsidies (CIE) $w_{hp}$ fixed to its benchmark value
Unemployment rate (%)	18.95	12.25	11.06
$u_{st}$ (%)	5.36	6.52	5.91
$u_{lt}$ (%)	13.59	5.73	5.15
Proportion of long-term unemployed (%)	71.7	44.76	46.52
Proportion of high-productivity jobs (%):	78	78.3	80.6
- occupied by short-term unemployed (%)	78	75.8	78.4
- which are subsidized jobs promoted	0	2.5	2.2
Proportion of low-productivity jobs (%):	22	21.7	19.4
- Regular contracts	22	17	15.2
- Subsidized jobs	0	4.67	4.2
wage $w_{hp}$ /SMIC	1.3	1.3131	1.3

Table 4: Net employment gains

Proportion of high-productivity jobs created (%):	
Short-term unemployed hired	50.22
CIE promoted	32.63
Proportion of low-productivity jobs created (%):	17.15*

\*Low-productivity employment creations represent 17.15% of the total jobs' creations.

Table 5: Welfare effects of the French program

	$V_{st}^u$	$V_{lt}^u$	$V_{hp}$	$V_{lp}$	$W_w$	$W_f$	$W$	$G$
(1)	+1.77%	+2.52%	+1.58%	+1.96%	+2.02%	+3.03%	+2.04%	
(2)	+4.01%	+4.55%	+3.86%	+4.17%	+4.17%	+3.03%	+4.16%	+8.34%

(1) refers to the case where the budget surplus ( $G$ ) is not distributed among workers.

(2) refers to the case where the budget constraint is fulfilled.

$V_{lp}$  denotes the value of low-productivity employment and equals to  $(1 - \psi)V_{lp}^r + \psi V_{lp}^s$ .

## C Sensitivity Tests

Table 6:  $\Delta$  Workers' bargaining power

$\Delta\gamma$ $\alpha = 0.5$	Benchmark Economy	Economy with wage subsidies		
		$\gamma = 0.3$	$\gamma = 0.4$	$\gamma = 0.5$
$u$ (%)	18.95	11.87	12.25	12.56
$u_{st}$ (%)	5.36	6.33	6.52	6.68
$u_{lt}$ (%)	13.59	5.54	5.73	5.88
$w_{hp}/SMIC$	1.3	1.309	1.313	1.316

Table 7:  $\Delta$  Elasticity of the matching function

$\Delta\alpha$ $\gamma = 0.4$	Benchmark	Economy with wage subsidies		
	Economy	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$
$u$ (%)	18.95	12.11	<i>12.25</i>	11.59
$u_{st}$ (%)	5.36	6.78	<i>6.52</i>	6.26
$u_{lt}$ (%)	13.59	5.33	<i>5.73</i>	5.33
$w_{hp}/SMIC$	1.3	1.311	<i>1.313</i>	1.3076

Table 8:  $\Delta$  Regular low-productive job's destruction rate

$\Delta s_{lp}^r$ $s_{hp} = 0.0125$	Benchmark	Economy with wage subsidies			
	Economy	$s_{lp}^r = 0.033$	$s_{lp}^r = 0.025$	$s_{lp}^r = 0.02$	$s_{lp}^r = 0.0125$
$u$ (%)	18.95	14.41	<i>12.25</i>	10.21	6.26
$u_{st}$ (%)	5.36	8.06	<i>6.52</i>	5.53	3.81
$u_{lt}$ (%)	13.59	6.35	<i>5.73</i>	4.68	2.45
$w_{hp}/SMIC$	1.3	1.308	<i>1.313</i>	1.316	1.321

Table 9:  $\Delta$  High-productive job's destruction rate

$\Delta s_{hp}$ $s_{lp}^r = 0.025$	Benchmark	Economy with wage subsidies			
	Economy	$s_{hp} = 0.025$	$s_{hp} = 0.0143$	$s_{hp} = 0.0125$	$s_{hp} = 0.0111$
$u$ (%)	18.95	9.40	11.61	<i>12.25</i>	12.84
$u_{st}$ (%)	5.36	7.13	6.66	<i>6.52</i>	6.41
$u_{lt}$ (%)	13.59	2.27	4.95	<i>5.73</i>	6.43
$w_{hp}/SMIC$	1.3	1.317	1.314	<i>1.313</i>	1.312

## D Optimal design

We look for the optimal subsidized contract taking the subsidy period and the propensity to promote as given, ( $s_{lp}^s = \frac{1}{24}$  and  $\tau = 0.16$ ). The subsidized contract is optimal if the participation and the subsidy rates are such that the workers' welfare is maximized. We simulate the model for values of  $\psi$  and  $\xi \in [0.01, 1]$ .

Workers' welfare is maximized for  $\psi = 1$  and  $\xi = 0.18$ . The government has to subsidize all long-term unemployed. However, the subsidy rate is lower than its benchmark value: 18% vs 48.72%. As the situation for all workers is improved, this equilibrium corresponds to a Pareto optimum. Let's note that the unemployment rate is higher than in the economy with the French subsidy program.

Figure 2: Simulation results: Workers' welfare

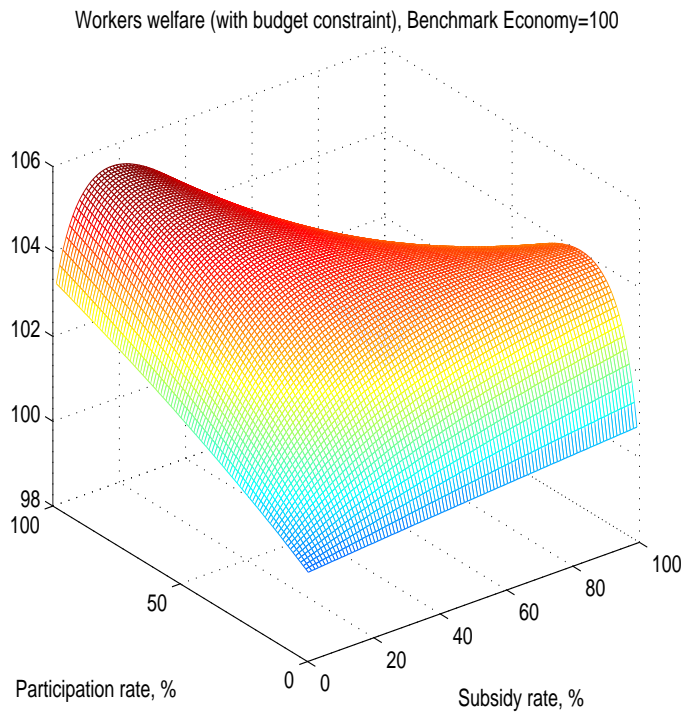


Table 10: Simulation results: The low-skilled labour market

	Benchmark Economy	Economy with French CIE	<b>Economy with optimal CIE</b>
	$\psi = \xi = 0$	$\psi = 0.32 ; \xi = 0.4872$	$\psi = 1 ; \xi = 0.18$
Unemployment rate (%)	18.95	12.25	<b>13.30</b>
$u_{st}$ (%)	5.36	6.52	<b>7.47</b>
$u_{lt}$ (%)	13.59	5.73	<b>5.82</b>
Employment rate (%):			
- High-productive, $l_{hp}$	63.18	68.73	<b>71.76</b>
- Regular Low-productive, $l_{lp}^r$	17.87	14.92	<b>0</b>
- Subsidized jobs, $l_{lp}^s$	0	4.1	<b>14.94</b>
wage $w_{hp}/w_{lp}$	1.3	1.313	<b>1.327</b>
Workers' welfare	100	104.17	<b>105.51</b>