



DOCUMENT DE RECHERCHE

EPEE

CENTRE D'ETUDE DES POLITIQUES ECONOMIQUES DE L'UNIVERSITE D'EVRY

Optimal Unemployment Benefit Financing Scheme: A Transatlantic Comparison

Julien ALBERTINI & Xavier FAIRISE

09 - 01

Optimal unemployment benefit financing scheme : a transatlantic comparison

JULIEN ALBERTINI¹
XAVIER FAIRISE²³

January 2009

Abstract

The aim of this paper is to study the properties of an optimal unemployment benefit financing scheme in the US and in France. We wonder if firms should be taxed in proportion of their layoffs and if such a tax should correspond to a part or all of the fiscal cost induced by a dismissal. The welfare gains generated by reforms of the US and French labor market institutions are evaluated. The US labor market is initially characterized by a flexible dismissal regulation and an experience rating system. We show that making firms more responsible for the cost caused by theirs layoff is welfare enhancing. Concerning the French labor market, we find that a more flexible dismissal regulation combined with an experience rating tax may significantly improve labor market performances. In both cases, the efficient layoff tax is close to the expected fiscal cost of an unemployed worker.

Keys-words : DSGE models, matching, firing tax, experience rating.

JEL Classification : E61; E65, J41.

¹Centre d'Études des politiques Économiques de l'Université d'Evry (EPEE et TEPP (FR CNRS n° 3126)), julien.albertini@univ-evry.fr, Université d'Evry, bd François Mitterrand, 91025 Evry Cedex.

²Centre d'Études des politiques Économiques de l'Université d'Evry (EPEE et TEPP (FR CNRS n° 3126)), xavier.fairise@univ-evry.fr, Université d'Evry, bd François Mitterrand, 91025 Evry Cedex.

³We are grateful to François Langot for helpful comments on a previous version of this paper.

1 Introduction

Solving the European unemployment puzzle has certainly become one of the biggest challenges among economists over the last decades. This debate comes mainly from the persistently high unemployment rates observed in Continental Europe and the comparison with the US performance. Since Europe features a stringent dismissal regulation, a high minimum wage and generous unemployment benefits compared to the US, labor market institutions have been largely pointed up to explain the transatlantic gap. Indeed, there is an abundant literature that aims at measuring the effects of unemployment benefits and employment protection on labor market outcomes. However, only few papers study how unemployment benefits should be financed and how they interact with employment protection. In the line of Blanchard and Tirole's studies (2003, 2007), we argue that these two institutions are strongly linked and may be jointly reformed to improve labor market performances. Then, we explore the properties of an optimal unemployment benefits financing scheme in two different economies: a flexible labor market as in the US and a rigid labor market as in France.

Our study starts from the recent debate on the employment protection legislation (EPL) in France. In their report, Blanchard and Tirole (2003) and Cahuc (2003) underline the inefficiency of the current unemployment insurance system. They point out that employers are not made responsible for the social cost induced by their dismissal decisions. When an employer lays a worker off, he does not pay for the entire cost induced by the dismissal. This is simply because his contribution to unemployment insurance is not proportional to the unemployment benefits earned by his ex-employees. As a consequence, firms do not internalize the effects their firing decisions have on others. The current system induces too many layoffs as firms bear a small share of the total cost of job destructions. Furthermore, unemployment benefits have to be financed by alternative resources, mainly employers' and employees' contributions. This, in turn, increases the cost of labor and the incentive to fire.

As a possible solution, Blanchard and Tirole (2003) recommend to tax redundancies in order to finance a part of the cost incurred by the unemployment benefit fund. They also plaid in favor of a reduction of the EPL stringency. Such a reform takes its inspiration from the US unemployment insurance system. Indeed, in the US, employers' contribution rates are varied on the basis of the contribution collected over the past and benefits paid to fired workers. Basically, the more dismissal, the higher the firms' contribution to unemployment insurance. This system, known as experience-rating (ER thereafter), has been designed to “*encourage employers to stabilize employment*” and to “*equitably allocate the costs of unemployment*”⁴. The effects of the payroll-tax indexation on

⁴According to the definition provided by the Employment and Training Administration (ETA).

temporary layoffs (which are frequent in the US) and on unemployment has been illustrated by several works like Feldstein (1976), Topel (1983), Topel (1984) and Card and Levine (1994). They argued that a higher payroll tax indexation lowers the incentive for firms to lay off during economic downturns and to hire during booms. On the other side, they show that unemployment insurance subsidies⁵ play a major role in reducing employment instead of hours in bad states. The reason is that firms pay less than the full cost of layoffs⁶.

In France the questions we ask are: Should firms' contribution to unemployment insurance be indexed on the cost induced by a dismissal? Can such an EPL reform improve labor market performance and be welfare enhancing? While in the US economy, we ask the following question: Is the current degree of payroll tax indexation efficient? But in both cases, we consider the question whether there exists an optimal unemployment compensation financing scheme.

To our knowledge, the first theoretical paper that deals with the optimal design of unemployment benefits and employment protection is the one written by Blanchard and Tirole (2008). They emphasize the need to study labor market institutions together. In a static model, they show that employment protection is likely to be efficient in the form of a layoff tax whose level corresponds to unemployment benefits. In this line of research, Cahuc and Zylberberg (2007) conclude that the optimal layoff tax is equal to the social cost of job destruction when the government provides a public unemployment insurance and aims at redistributing incomes. This social cost thus corresponds to the sum of unemployment benefits and payroll taxes (which represent a fiscal loss). However, as they underline in their conclusion, their analysis remains incomplete in some directions. They do not consider aggregate productivity shocks nor the dynamic effects of labor market institutions while one of the roles of layoff taxes is to stabilize employment fluctuations. Furthermore, they do not take into account how search frictions affect the optimality, although they influence the average duration of unemployment and therefore the total cost associated to a dismissal.

The study of Cahuc and Malherbet (2004) is of particular interest and we will follow the same approach for our purpose. Using the tractable framework of Mortensen and Pissarides (1999), they incorporate a simplified ER system and some features of a rigid continental European labor market to evaluate its impact on equilibrium unemployment. They show that ER reduces unemployment rate for the low-skilled workers and can improve their welfare in presence

⁵The experience rating system is said to be perfect when an employer pays for the entire cost of unemployment benefits that are perceived by his ex-employees. When it is imperfect, an employer who fires a worker obtains an implicit subsidy which is financed through other firms.

⁶In each state, regulation imposes a minimum and a maximum contribution rate. Then, if the contribution rate of an employer corresponds to the maximum, more dismissals do not increase his contribution to unemployment insurance. This is one of the reasons why an employer does not pay for the total expenditure caused by its action. See Fougère and Margolis (2000) for more details.

of a high minimum wage, a strict EPL and temporary jobs. In a more recent study, L’Haridon and Malherbet (2008) look on the consequences of reforming the French employment protection in the spirit of Blanchard and Tirole (2003). They show that such a reform can improve the efficiency of employment protection and reduce significantly unemployment, job creation and job destruction variability. There is a rich literature that addresses labor-market institutions issues from a business cycles perspective like Joseph, Pierrard, and Sneessens (2004), Algan (2004), Veracierto (2008) and Zanetti (2007). Most of them agree to say that employment protection in the form of an exogenous firing cost is likely to reduce job-flows volatility. However, none of them consider the firing cost as a layoff tax and do not make the link with unemployment benefits.

We take on these tasks to study the properties of an optimal financing scheme. We investigate whether employers should be liable for the social cost induced by their firing decisions. In order to make a comparison between the US and France, we consider a simple unemployment insurance system that combines both a layoff tax and a lump-sum tax to finance unemployment benefits⁷. In particular, we assume that the layoff tax is a function of the expected fiscal cost of an unemployed worker as in Cahuc and Malherbet (2004).

Numerical simulations show that an optimal combination of unemployment benefits and layoff taxes is welfare-enhancing and can reduce the cost of aggregate fluctuations in both economies. Concerning the US labor market (flexible), the optimal policy requires an increase in the layoff tax. Firms should take care almost entirely the burden of unemployment benefits. On the other side, the replacement rate should be reduced by around one third. In the French case, lightening the dismissal regulation and implementing a layoff tax is worthwhile. Such a reform may significantly improve labor market performances. Welfare gains appear to be greater than in the US case.

The rest of the paper is organized as follows. Section 2 presents the model and the unemployment insurance system. The equilibrium and the optimal policies are defined in section 3. Section 4 is devoted to simulation exercises and section 5 concludes.

2 The economic environment and the model

We use a DSGE model including a Non-Walrasian labor market with endogenous job destruction in the spirit of Mortensen and Pissarides (1994). Following Shimer (2005), we focus on workers flows between employment and unemployment. Workers “out of the labor force” are thus not taken into account. Time is discrete and our economy is populated by *ex ante* homogeneous workers

⁷Layoff taxes can be viewed as an ersatz of experience rating because firms are in charged of the benefits payments they create through their dismissal decisions. We discuss later the differences between the system we use and current regulations.

and firms. Endogenous separations occur because of firms specific productivity shocks. There are search and matching frictions in the labor market, wages are determined through a Nash bargaining process. There are no other market failures.

2.1 The labor market

Search process and recruiting activity are costly and time-consuming for both, firms and workers. To produce, a firm needs to hire one worker, thus, each firm offers one job. A job may either be filled and productive or unfilled and unproductive. To fill its vacant job, the firm posts a vacancy and incurs a cost κ . Workers are *ex ante* identical, they may either be employed or unemployed. Unemployed workers are engaged in a search process.

The number of matches M_t is given by the following Cobb-Douglas matching function :

$$M_t = \chi(1 - N_t)^\psi V_t^{1-\psi} \text{ with } \psi \in]0, 1[, \chi > 0 \quad (1)$$

with V_t the vacancies and $1 - N_t$ the unemployed workers. The labor force is normalized to 1, the number of unemployed workers U_t thus satisfied $U_t = 1 - N_t$. The matching function (1), satisfying the usual assumptions, is increasing, concave and homogenous of degree one. A vacancy is filled with probability $q_t = M_t/V_t$. Let $\theta_t = V_t/(1 - N_t)$ be the labor market tightness, the probability an unemployed worker finds a job is $\theta_t q_t = M_t/(1 - N_t)$. It is useful to rewrite these probabilities as follows :

$$q_t = \chi \left(\frac{1 - N_t}{V_t} \right)^\psi \quad (2)$$

$$\theta_t q_t = \chi \left(\frac{V_t}{1 - N_t} \right)^{1-\psi} \quad (3)$$

At the beginning of each period, separations occur for two reasons. Firstly, some separations occur at an exogenous rate ρ^x . Secondly, firms productivity is subject to idiosyncratic shocks *i.i.d.* drawn from a time-invariant distribution $G(\cdot)$ defined on $[0, \bar{\varepsilon}]$. If the firm specific productivity component ε_t falls below an endogenous threshold $\underline{\varepsilon}_t$, the job is destroyed and the employment relationship ceases. Endogenous separations occur at rate :

$$\rho_t^n = P(\varepsilon_t < \underline{\varepsilon}_t) = G(\underline{\varepsilon}_t) \quad (4)$$

2.2 The sequence of events

At each date, a firm is characterized by its specific productivity level ε_t drawn from the distribution $G(\cdot)$. The firm productivity is also subject to an aggregate productivity shock z_t . The production level is given by :

$$y_t = z_t \varepsilon_t \quad (5)$$

The productivity shock z_t has a mean equal to $z > 0$ and follows the random process :

$$z_t = (1 - \rho_z)z + \rho_z z_{t-1} + \varepsilon_t^z$$

ε_t^z is iid and normally distributed, that is $\varepsilon_t^z \sim N(0, \sigma_{\varepsilon^z}^2)$ and ρ_z is the persistence parameter and satisfies $|\rho_z| < 1$.

We now describe the sequence of events and the labor market timing, we mainly follow Zanetti (2007). Employment in period t has two components : new and old workers.

New employment relationship are formed through the matching process. Matches formed at period $t - 1$ contribute to period t employment. New jobs begin with the highest productivity level $\bar{\varepsilon}$, thus, all the new employment relationship are productive (at the first period). Let $N_t^N = M_{t-1}$ denote the new employment relationships.

At the beginning of period t , N_{t-1} jobs are inherited from period $t - 1$ and $\rho^x N_{t-1}$ jobs are exogenously destroyed. Then after, idiosyncratic shocks are drawn and firms observe their specific component ε_t . If the specific component is below the threshold $\underline{\varepsilon}_t$, the employment relationship is severed. Otherwise, the employment relationship goes on. A fraction ρ_t^n of the remaining jobs $(1 - \rho^x)N_{t-1}$ is destroyed. The number of continuing employment relationships is thus given by $N_t^C = (1 - \rho_x)(1 - \rho_t^n)N_{t-1}$ and the total separation rate is defined as follows :

$$\rho_t = \rho^x + (1 - \rho^x)\rho_t^n \quad (6)$$

Finally, the employment law of motion is described by the following equations :

$$N_{t+1}^N = M_t \quad (7)$$

$$N_t = N_t^C + N_t^N \quad (8)$$

$$N_t = (1 - \rho^x)(1 - \rho_t^n)N_{t-1} + N_t^N \quad (9)$$

2.3 The large family

To avoid heterogeneity, we suppose that infinitely lived households are members of a large family. There is a perfect risk sharing, family members pool

their incomes (labor incomes and unemployment benefits) that are equally redistributed. Following Algan (2004), the large family assumption allows to assess the own impact of layoff taxes on the cost of aggregate fluctuations. Contrarily to Andolfatto (1996) the large family model allows to distinguish unemployed workers and tenured workers trajectories.

The large family welfare is given by the expected discount sum of the consumption flows, that is :

$$E_t \sum_{s=t}^{\infty} \beta^{s-t} (C_s + (1 - N_t)h) \quad (10)$$

$\beta \in]0, 1[$ is the discount factor. h denotes unemployed workers home production. Family consumption is the sum of the total home production $(1 - N_t)h$ and of the market consumption goods C_t . The family budget constraint writes :

$$-C_t - T_t + N_t \bar{w}_t + (1 - N_t)b_t + \Pi_t = 0 \quad (11)$$

b_t is the unemployment benefit perceived by an unemployed worker and \bar{w}_t denotes the average wage. Finally, the large family receives instantaneous profits for an amount Π_t .

2.4 Firms and workers behaviors

As previously said, new jobs (filled in $t - 1$) begin with the highest idiosyncratic productivity $\bar{\varepsilon}$ in t . Two different values, for filled jobs and for employed workers, must be distinguished. The expected values of a new jobs $J_t^N(\bar{\varepsilon})$ and of continuing jobs $J_t(\varepsilon_t)$ are :

$$\begin{aligned} J_t^N(\bar{\varepsilon}) &= z_t \bar{\varepsilon} - w_t^N(\bar{\varepsilon}) + \beta E_t \left\{ (1 - \rho^x) \left[\int_{\bar{\varepsilon}_{t+1}}^{\bar{\varepsilon}} J_{t+1}(\tilde{\varepsilon}) dG(\tilde{\varepsilon}) \right. \right. \\ &\quad \left. \left. - \rho_{t+1}^n (F + \tau_{t+1}^E) \right] + \rho_{t+1} V_{t+1}^N \right\} \end{aligned} \quad (12)$$

$$\begin{aligned} J_t(\varepsilon_t) &= z_t \varepsilon_t - w_t(\varepsilon_t) + \beta E_t \left\{ (1 - \rho^x) \left[\int_{\bar{\varepsilon}_{t+1}}^{\bar{\varepsilon}} J_{t+1}(\tilde{\varepsilon}) dG(\tilde{\varepsilon}) \right. \right. \\ &\quad \left. \left. - \rho_{t+1}^n (F + \tau_{t+1}^E) \right] + \rho_{t+1} V_{t+1}^N \right\} \end{aligned} \quad (13)$$

Endogenous separations are costly. A firm that terminates an employment relationship has to support a cost F induced by the employment protection legislation and to pay a firing tax τ_t^E . Two wages must then be distinguished. New jobs begin with the highest specific productivity level and obviously no separation

occurs. New jobs are always productive at their beginning and new jobs wages⁸ do not take into account separation costs. Conversely, old jobs do not continue (recall the decision to continue is taken after observing the specific productivity shock) if their specific productivity level is below a threshold $\underline{\varepsilon}_t$. The continuing job wages take into account separation costs. Equations (12) and (13) only differ by the wage value.

V_t^N denotes the present value of a vacant job. It can be written in the following manner :

$$V_t^N = -\kappa + \beta E_t \left\{ q_t J_{t+1}^N(\bar{\varepsilon}) + (1 - q_t) V_{t+1}^N \right\} \quad (14)$$

where κ represents a vacant job cost.

Consider now workers and let $W_t^N(\bar{\varepsilon})$ and $W_t(\varepsilon_t)$ respectively denote the present value of a new matched worker and the present value of an old matched worker :

$$W_t^N(\bar{\varepsilon}) = w_t^N(\bar{\varepsilon}) + \beta E_t \left\{ (1 - \rho^x) \int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} W_{t+1}(\tilde{\varepsilon}) dG(\tilde{\varepsilon}) + \rho_{t+1} U_{t+1} \right\} \quad (15)$$

$$W_t(\varepsilon_t) = w_t(\varepsilon_t) + \beta E_t \left\{ (1 - \rho^x) \int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} W_{t+1}(\tilde{\varepsilon}) dG(\tilde{\varepsilon}) + \rho_{t+1} U_{t+1} \right\} \quad (16)$$

Unemployed workers are engaged in a search process and the present value U of an unemployed worker satisfies :

$$U_t = b_t + h + \beta E_t \left\{ \theta_t q(\theta_t) W_{t+1}(\bar{\varepsilon}) + (1 - \theta_t q_t) U_t \right\} \quad (17)$$

An unemployed worker enjoys at time t a return composed of an unemployment benefit b_t and of a home production h .

2.5 Decision rules and wage setting

2.5.1 Decision rules

There is a free entry condition, thus, firms open vacancies up to the value of a vacant job be zero, that is :

$$V_t^N = 0 \quad (18)$$

At equilibrium, all profits opportunities from new jobs are exhausted.

The job destruction rule is determined through the endogenous specific productivity threshold. The job becomes unprofitable if the specific productivity

⁸The wage bargaining process will be described latter

component falls below the threshold $\underline{\varepsilon}_t$. It is better to dismiss the worker and to pay the firing tax τ_t^E and the cost F if $\varepsilon_t < \underline{\varepsilon}_t$. This rule writes :

$$J_t(\underline{\varepsilon}_t) + F + \tau_t^E = 0 \quad (19)$$

$\underline{\varepsilon}_t$ is the critical value of the idiosyncratic productivity below which a job becomes unprofitable and the separation takes place.

2.5.2 Wage setting mechanism

At equilibrium, filled jobs generate a return (the value of the job plus the corresponding employed worker value) greater than the sum of values of a vacant job and of an unemployed worker. The net gain issued from a filled job is the total surplus of the match. In our model, we have to distinguish two surplus, the surplus of a new job and the surplus of a continuing job, that is :

$$S_t^N(\bar{\varepsilon}) = J_t^N(\bar{\varepsilon}) - V_t^N + W_t^N(\bar{\varepsilon}) - U_t \quad (20)$$

$$S_t(\varepsilon_t) = J_t(\varepsilon_t) - V_t^N + W_t(\varepsilon_t) - U_t + F + \tau_t^E \quad (21)$$

Note that in equation (21), the surplus increases with $F + \tau_t^E$ because continuing the employment relationship allows to save firing costs amount.

The two wages are determined through an individual Nash bargaining process between a worker and a firm who share the total surplus. Each participant threat point corresponds to the value of the alternative option, that is the value of being unemployed or the value of a vacant job. The outcome of the bargaining process is given by the solution of the following maximization problems :

$$w_t^N(\bar{\varepsilon}) = \arg \max_{w_t^N(\bar{\varepsilon})} (W_t^N(\bar{\varepsilon}) - U_t)^{1-\xi} (J_t^N(\bar{\varepsilon}) - V_t^N)^\xi \quad (22)$$

$$w_t(\varepsilon_t) = \arg \max_{w_t(\varepsilon_t)} (W_t(\varepsilon_t) - U_t)^{1-\xi} (J_t(\varepsilon_t) - V_t^N + F + \tau_t^E)^\xi \quad (23)$$

where $\xi \in]0, 1[$ and $1 - \xi$ denote the bargaining power of firms and workers respectively. Using the free entry condition, the optimality conditions of the above problems may be written as follows :

$$\xi (W_t^N(\bar{\varepsilon}) - U_t) = (1 - \xi) J_t^N(\bar{\varepsilon}) \quad (24)$$

$$\xi (W_t(\varepsilon_t) - U_t) = (1 - \xi) (J_t(\varepsilon_t) + F + \tau_t^E) \quad (25)$$

Using equations (12) to (17) to substitute values in (24) and (25) by their ex-

pression, wages are given by :

$$\begin{aligned} w_t^N(\bar{\varepsilon}) &= (1 - \xi) \{ z_t \bar{\varepsilon} + \kappa \theta_t - \beta(1 - \rho^x) E_t ((F + \tau_{t+1}^E)) \} \\ &+ \xi(b_t + h) \end{aligned} \quad (26)$$

$$\begin{aligned} w_t(\varepsilon_t) &= (1 - \xi) \{ z_t \varepsilon_t + \kappa \theta_t + F + \tau_t^E - \beta(1 - \rho^x) E_t ((F + \tau_{t+1}^E)) \} \\ &+ \xi(b_t + h) \end{aligned} \quad (27)$$

The structure of the wage equations is the same as in the standard matching theory. It contains the weighted contribution of both parties. Both equations take into account the expected firing costs (F and τ_t^E). During the bargaining, firms internalized that hiring a worker may be costly if the job is destroyed. The burden of the expected firing costs is thus subtracted from the worker's contribution to firm's output.

Equations (26) and (27) differ because of the firing costs. Concerning an old job, firing costs should be paid in case of separation. Each party may use the cost of layoffs as a threat.

2.6 Job creation and job destruction

Job creation is driven by the free entry condition. At the equilibrium, all gain opportunities generated by a vacant job are equal to zero $V_t^N = 0$. Using equations (12) — (14), (18) and the two wage equations (26) and (27), the job creation condition may be rewritten as follows :

$$\frac{\kappa}{q_t} = \xi \beta E_t \left\{ z_{t+1} \bar{\varepsilon} - z_{t+1} \underline{\varepsilon}_{t+1} - F - \tau_{t+1}^E \right\} \quad (28)$$

The expected gain from hiring a new worker is equal to the expected cost of search (which is κ times the average duration of a vacancy $1/q_t$). It defines the relationship between the labor market tightness and the threshold value of idiosyncratic productivity. The threshold value of the productivity component is determined through condition (19). To obtain it, substitute equation (27) in (13) and set $\varepsilon_t = \underline{\varepsilon}_t$. After some algebra, one gets :

$$\begin{aligned} &\xi(z_t \underline{\varepsilon}_t + F + \tau_t^E - b_t - h) - (1 - \xi) \theta_t \kappa \\ &+ \beta(1 - \rho_x) \xi E_t \left\{ \left(\int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} (z_{t+1} \varepsilon - z_{t+1} \underline{\varepsilon}_{t+1}) dG(\varepsilon) - F - \tau_{t+1}^E \right) \right\} = 0 \end{aligned} \quad (29)$$

This equation teaches us that the critical value of a job productivity depends on the reservation wages and on firing costs. It states that higher firing costs lower the reservation productivity because separations are more costly.

2.7 The unemployment insurance financing

An unemployed worker receives a benefit b_t . Unemployment benefits are financed through a layoff tax and a lump-sum tax paid by the large family. The layoff tax (or experience rating tax) is paid by employers when an endogenous separation occurs. We impose the unemployment benefits may not be financed by debt. The unemployment insurance fund budget constraint is thus balanced every period :

$$\underbrace{(1 - N_t) b_t}_{\text{Unemployment benefits}} = \underbrace{T_t}_{\text{Lump sum tax}} + \underbrace{(1 - \rho^x) \rho_t^n N_{t-1} \tau_t^E}_{\text{Experience rating part}} \quad (30)$$

The sequences followed by T_t , τ_t^E and b_t may be chosen following different ways, provided they satisfy the above budget constraint. Our aim is to evaluate some rules close to the US and French labor market institutions and to study their optimality.

Experience rating system Here, we describe an institutional rule setting taxes and unemployment benefits levels. It is close to the US system, but may easily be adapted to approximate the French system. We follow Cahuc and Malherbet (2004) to represent an experience rating system. An unemployed worker receives a benefit b_t equal to a proportion of the average wage \bar{w}_t , that is :

$$b_t = \rho_R \bar{w}_t \quad (31)$$

$\rho_R < 1$ is the average replacement rate. The average wage of the economy \bar{w}_t is given by :

$$\bar{w}_t = \frac{N_t^N}{N_t} w_t^N(\bar{\varepsilon}) + \frac{N_{t-1}}{N_t} (1 - \rho_x) \int_{\bar{\varepsilon}_t}^{\bar{\varepsilon}} w_t(\tilde{\varepsilon}_t) dG(\tilde{\varepsilon}_t) \quad (32)$$

The experience rating system works as follows : the lay off tax is proportional to the expected fiscal cost of an unemployed worker Q_{t+1} . Let $e > 0$ be the experience rating index (ERI), the firing tax τ_t^E satisfies :

$$\tau_t^E = e Q_t \quad (33)$$

where

$$Q_t = b_t + \beta E_t \{ \theta_t q_t \times 0 + (1 - \theta_t q(\theta_t)) Q_{t+1} \} \quad (34)$$

The above equation recursively determines the expected cost of an unemployed worker. The lay off tax corresponds to a share of the expected fiscal cost of an

unemployed worker paid by the firm. The higher the ERI, the higher the firm contribution to the unemployment insurance.

Its a very simple way to represent the US experience rating system. Its consistency may be questionable considering the complexity of current regulations. However, our representation may be viewed as an approximation of the US unemployment insurance system. As emphasized by Cahuc and Malherbet (2004) and L'Haridon and Malherbet (2008), it is a convenient mean to make firms contribute to the fiscal cost they induce. The rule previously described embodies some important features such that :

- The higher the experience rating index, the higher the firms' contribution to the unemployment insurance fund. If $e = 1$, firms fully take care the expected fiscal cost of an unemployed worker.
- The experience rating tax is increasing in the replacement rate and decreasing in the labor market tightness. The first one raises the expected fiscal cost of an unemployed worker while the second moves it in the opposite direction, indeed, it reduces the average unemployment duration.

The unemployment benefits financing scheme formed by equations (30), (31), (33) and (34) encompasses the US and French systems. If parameters e and ρ_R are strictly positive, as previously discussed, we approximate the American system and firms are liable for their layoff decisions. If the experience rating parameter e is equal to 0, we approximate the French (and more generally the Continental Europe one) system, the cost of unemployment being fully shared.

3 The equilibrium and the optimal policies

In this section, we define the equilibrium and the different optimal policies that will be quantitatively evaluated. Before defining the equilibrium, we need to explain the aggregate resource constraint.

3.1 The aggregate resource constraint

The aggregate output Y_t is obtained through the sum of individual productions :

$$Y_t = (1 - \rho_x)N_{t-1} \int_{\underline{\varepsilon}_t}^{\bar{\varepsilon}} z_t \tilde{\varepsilon} dG(\tilde{\varepsilon}) + N_t^N z_t \bar{\varepsilon} \quad (35)$$

The aggregation of the individual profits provides the amount of profits Π_t received by the large family, that is :

$$\Pi_t = Y_t - \bar{w}_t N_t - \kappa V_t - (F + \tau_t^E)(1 - \rho^x)\rho_t^n N_{t-1}$$

The above equation together with equations 11 and 30 gives the aggregate resource constraint :

$$Y_t = C_t + \kappa V_t + F(1 - \rho^x)\rho_t^n N_{t-1} \quad (36)$$

3.1.1 Definition of the equilibrium

We define the equilibrium in two cases. To begin, we define the equilibrium for any tax processes.

Definition 1 *For given lump sum tax rate T_t and firing tax τ_t^E processes, and for a given exogenous stochastic process z_t , the competitive equilibrium is a sequence of prices and quantities $N_t, N_t^N, N_t^C, C_t, V_t, \underline{\varepsilon}_t, \theta_t, q_t, \bar{w}_t, w_t^N, Y_t, \rho_t^n, M_t$ and b_t satisfying equations (1)-(4), (7)-(9), (26), (28)-(32), (35) and (36).*

If taxes and benefits are set as described in subsection 2.7, the equilibrium definition writes as follows :

Definition 2 (Experience rating system) *For given parameters ρ_R and e and for a given exogenous stochastic process z_t , the competitive equilibrium is a sequence of prices and quantities $N_t, N_t^N, N_t^C, C_t, V_t, \underline{\varepsilon}_t, \theta_t, q_t, \bar{w}_t, w_t^N, Y_t, \rho_t^n, M_t, b_t, \tau_t^E, T_t$ and Q_t satisfying equations (1)-(4), (7)-(9), (26), (28)-(32), (35), (36) and (31) - (34).*

3.2 The Ramsey allocation

As shown by equation (30), unemployment benefit may be financed through two ways : an experience rating tax (τ_t^E) and a lump-sum tax (T_t). The lump-sum tax adjusts to equilibrate, at each date, the unemployment benefit fund. As the Hosios condition is not satisfied, the decentralized equilibrium of the economy without unemployment benefit and taxes is not optimal. Our aim is to determine an optimal unemployment benefit financing scheme and to compare the equilibrium allocation obtained with the Pareto allocation. The Ramsey policy is the taxation policy under commitment maximizing the intertemporal welfare of the representative household.

Definition 3 (The Ramsey allocation) *The Ramsey equilibrium is a sequence of prices, quantities and taxes $N_t, N_t^N, N_t^C, C_t, V_t, \underline{\varepsilon}_t, \theta_t, q_t, \bar{w}_t, w_t^N, Y_t, \rho_t^n, M_t, b_t, T_t, \tau_t^E$ maximizing the representative agent life-time utility :*

$$E_t \sum_{j=0}^{\infty} \beta^j (C_{t+j} + (1 - h)N_{t+j})$$

subject to the equilibrium conditions (1)-(4), (7)-(9), (26), (28)-(32), (35) and (36) and given the exogenous stochastic processes z_t .

3.3 The Pareto allocation and the equivalence with the Ramsey allocation

Consider equations (28) and (29), suppose the Hosios condition ($\xi = 1 - \psi$) be satisfied and set the unemployment benefit and taxes equal to 0. One gets the following equations :

$$-\frac{\kappa}{1-\psi} \frac{V_t}{M_t} + \beta E_t \{ (z_{t+1} \bar{\varepsilon} - y_{t+1} \underline{\varepsilon}_{t+1} - F) \} = 0 \quad (37)$$

$$(z_t \underline{\varepsilon}_t + F - h) - \kappa \frac{\psi}{1-\psi} \frac{V_t}{1 - N_t} + \beta(1 - \rho_x) E_t \left\{ \left(\int_{\varepsilon_{t+1}}^{\bar{\varepsilon}} (z_{t+1} \tilde{\varepsilon} - z_{t+1} \underline{\varepsilon}_{t+1}) dG(\tilde{\varepsilon}) - F \right) \right\} = 0 \quad (38)$$

Definition 4 (The Pareto allocation) *For a given exogenous stochastic process, the Pareto allocation is a sequence of quantities N_t , N_t^N , C_t , V_t , $\underline{\varepsilon}_t$, Y_t , ρ_t^n , M_t satisfying equations (1),(4), (7), (9), (26) and (35)-(37).*

Result 1 (The Pareto allocation implementation) *The optimal unemployment benefit financing scheme [definition 3] allows to implement the Pareto allocation.*

Proof See appendix.

The above result provides a simple way to determine the taxes and unemployment benefit processes implementing the Pareto allocation. The equilibrium values of N_t , N_t^N , N_t^C , C_t , V_t , $\underline{\varepsilon}_t$, θ_t , q_t , Y_t , ρ_t^n and M_t are determined using equations (1)-(4), (7)-(9) and (35)-(37). The exogenous stochastic process being given. The processes followed by the taxes and unemployment benefits T_t , τ_t^E and b_t are then easily deduced from equations (28)-(30). Finally, \bar{w}_t and w_t^N are provided by equations (26) and (32).

If the Hosios condition is not satisfied, that is if $1 - \psi \neq \xi$, the equilibrium is not a Pareto optima. Comparison of equations (28) and (29) with equations (37) and (38) allows to see how the firing tax τ_t^E works to restore Pareto optimality. To simplify, consider these equations at the steady state and suppose the Hosios condition be satisfied. One has :

$$\begin{aligned} \tau^E &= \frac{\kappa V}{\beta M} \frac{\xi - (1 - \psi)}{\xi(1 - \psi)} \\ b &= (1 - \beta(1 - \rho^x)) \frac{\kappa V}{\beta M} \frac{\xi - (1 - \psi)}{\xi(1 - \psi)} + \frac{V}{1 - N} \kappa \frac{\xi - (1 - \psi)}{\xi(1 - \psi)} \end{aligned}$$

It immediately follows that $\tau^E = 0$ and $b = 0$, this is obvious since there is no distortion.

Suppose now that $1 - \psi < \xi$, that is the bargaining process is in the favor of firms. The firing tax τ^E and the unemployment benefit b are positive. The labor market is characterized by trade externalities. A greater number of vacancies increases the probability an unemployed worker finds a job and reduces the probability a firm fills a vacancy. Similarly, a greater number of unemployed increases the probability a firm fills a vacancy and reduces the probability a worker finds a job. If the bargaining power of workers $1 - \xi$ is weak, that is less than ψ , the wage is low and firms post a lot of vacancies. In this case, without taxes and benefits, there are congestion externalities caused by searching firms posting a great number of vacancies, unemployment is below its optimal level. There exists a firing taxes and unemployment benefits scheme allowing to ensure optimality. Firing taxes reduce job creation, there are less searching firms. Unemployment benefits allow to strengthen the threat point of workers. Wage is thus set at a higher level, which reduces job creations. The optimal unemployment benefit financing scheme works like the Hosios condition. The negative intra-group externalities and the positive inter-group externalities just offset. The distortion comes from a too strong firms bargaining power and firing taxes allow to ensure optimality. Conversely, if the bargaining process is at the advantage of workers, that is if $1 - \psi > \xi$, firing taxes must be negative.

3.4 The Second best allocation

The equilibrium allocation (definition 1) is defined conditionally to the unemployment benefits financing scheme (equations (31) - (??)). This unemployment benefits financing scheme is a proxy of the American system. The key parameters, that is the replacement rate ρ_R and the ERI e , are set by the authorities. Thereafter, quantitative evaluations are made using a benchmark calibration based on US and Frennd data, but there is no reason these two parameters be optimal. Here, we define a second best allocation where ρ_R and e are chosen to maximize the conditional welfare.

Given initial conditions N_{-1} and N_0^N and given parameters ρ_R and e , let denote respectively by \tilde{C}_t and \tilde{N}_t the consumption and employment equilibrium allocation. The conditional welfare under the equilibrium allocation writes :

$$\tilde{W}(\rho_R, e; N_{-1}, N_0^N) = E_0 \sum_{t=0}^{\infty} \beta^t (\tilde{C}_t + (1 - \tilde{N}_t)h)$$

Optimal values for ρ_R^* and e^* are obtained solving the following problem :

$$\{\rho_R^*, e^*\} = \arg \max_{\rho_R, e} \tilde{W}(\rho_R, e; N_{-1}, N_0^N)$$

The second best allocation is given by definition 2, knowing that $\rho_R = \rho_R^*$ and $e = e^*$.

3.5 The welfare costs

In order to compare the different alternative allocations with the Ramsey allocation, we compute their welfare costs. We evaluate the fraction of the consumption stream from an alternative policy needed to be added to achieve the Ramsey allocation welfare.

Let \mathcal{W}_0^* be the conditional welfare under the Ramsey allocation and let C_t^a and N_t^a denote an alternative allocation. The welfare cost Ψ is obtained by solving the following equation :

$$\mathcal{W}_0^* = E_0 \sum_{t=0}^{\infty} \beta^t (1 + \Psi) (C_t^a + (1 - N_t^a)h) \quad (39)$$

Ψ can be written as follows :

$$\Psi = \left(\frac{\mathcal{W}_0^*}{\mathcal{W}_0^a} \right) - 1$$

with :

$$\mathcal{W}_0^a = E_0 \sum_{t=0}^{\infty} \beta^t (C_t^a + (1 - N_t^a)h)$$

Ψ is numerically computed using a second order approximation (see Schmitt-Grohé and Uribe (2004)).

4 Quantitative evaluation of the model

4.1 Calibrating and solving the model

The benchmark economy is calibrated according to quarterly frequencies over the period 1991Q1-2007Q2. We follow Shimer (2005) to set the US labor market parameters and Petrongolo and Pissarides (2008) for the French ones. Their approach concern only transitions between employment and unemployment and start from a simple measure of the job finding and separation probabilities. In the US, there is an unemployment insurance system as described previously and no administrative firing cost. The French labor market exhibit a high level of replacement rate compare to the US and a stringent employment protection. Unemployment compensations are only financed by lump-sum taxes. Baseline parameter are reported in table 1.

We set the discount factor to 0.99 to have an annual steady state interest rate close to 4%. The aggregate productivity shock follows a first order autoregressive process : $\log z_{t+1} = \rho_z \log z_t + \varepsilon_{t+1}^z$. ρ_z corresponds to the autocorrelation

coefficient; it is equal to 0.95 as in Den Haan, Ramey, and Watson (2000). ϵ_{t+1}^z is a random variable whose realization are *i.i.d.* from a time-invariant Gaussian distribution $H(\cdot)$ with mean zero and whose standard deviation (σ_z) is 0.007. The distribution $G(\cdot)$ of idiosyncratic productivity shock is *i.i.d.* and log-normal with mean zero and whose upper bound is equal to 95 percentile as in Zanetti (2007).

The probability of being unemployed is 3.22 percent on average in the US whereas it is equal to 1.52 in France. We suppose as is Den Haan, Ramey, and Watson (2000), Zanetti (2007) and Algan (2004) that exogenous separations are two times higher than endogenous ones. Consequently, in the US, $\rho_{us}^x = 0.0216$ and $\underline{\varepsilon}$ is fixed in such a way that $\rho_{us}^n \equiv 1/2\rho^x = 0.0108$ at the steady state. Using the same routine, French separation probabilities are $\rho_{fr}^x = 0.0102$ and $\rho_{fr}^n = 0.0051$.

We keep the traditional value of 0.5 for the US workers bargaining power while empirical contributions find a value between 0.25 and 0.4 in France (Abowd and Allain (1996) and Cahuc, Goux, Gianella, and Zylberberg (2000)). We will choose the lower bound. Following Shimer's estimations, the elasticity of the matching function with respect to unemployment is 0.7. In France estimations vary between 0.4 and 0.6. We choose an alternative value of about 0.5.

The equilibrium unemployment rates U_{us} and U_{fr} are calibrated to 5.5% and 8% respectively. At the steady state, the number of match must be equal to the number of separations: $M = \rho N$. Following Andolfatto (1996), the rate at which a firm fills a vacancy is 0.9. We assume that it takes the same value in the two benchmark economies. We can deduce the number of vacancy $V = M/q_t$ and the job finding probability of about 0.61 in the US and 0.18 in France. Then, it takes a little bit more than one and a half quarter on average for an unemployed worker to find a job in the US and fourteen month in France. χ is calculated in such a way that $M = \chi(1-N)^\psi V^{1-\psi}$. Statistics from the Census Bureau of labor exhibit an average ERI across states and over the period 1988-2007 of about 0.65. We assume the cost of employment protection legislation is approximatively one sixth of the annual wage in France. According to the OECD, the US net replacement rate is 0.32 while it is 55% in France. The remaining parameters κ and h are only given by solving the system of three equations (28), (29) and (32) in three unknown (κ , h and \bar{w}). So, κ represent 11% of the quarterly average wage in the two economies⁹. According to Den Haan, Ramey, and Watson (2000) and Trigari (2004), σ_ε can take a value between 0.1 and 0.4. The retained values lie in this interval and are consistent with the observed job creation volatility to job destruction volatility ratio.

⁹Due to the simplicity of the model, it is not possible to calibrate the different costs in such a way they rigorously match the data. To calibrate the model, we impose some ratio values and verify that the resulting parameters values remain acceptable.

Variables	Symbol	USA	France
Discount factor	β	0.99	0.99
Autocorrelation coefficient	ρ_z	0.95	0.95
Std. dev. of aggregate shock	σ_z	0.007	0.007
Std. dev. of idiosyncratic shock	σ_ε	0.16	0.20
95 percentile upper bound	$\bar{\varepsilon}$	1.3011	1.3895
Matching elasticity	ψ	0.7	0.5
Total separation rate	ρ	0.0322	0.0152
Exogenous separation rate	ρ^x	0.0218	0.0102
Endogenous separation rate	ρ^n	0.0108	0.0051
Firm bargaining power	ξ	0.5	0.75
Replacement rate	ρ^R	0.32	0.55
Experience rating index	e	0.65	0
Employment protection index	F	0	0.64
Vacancy cost	κ	0.11	0.11

Table 1: **BASELINE PARAMETERS.**

We solve the model with a second order perturbation method. State variables are N_t, N_t^N and z_t . Changing parameters lead up to a new steady state. It is calculated by a Newton algorithm. To evaluate integrals we use Gauss-Chebyshev quadratures with 100 nodes to compute the grid.

4.2 The optimal labor market policy

The optimal labor market policy (first-best allocation) solve the definition 3 problem¹⁰. The second best allocation is obtained by setting the two institutional parameters (e and ρ_R) at a value maximizing the large family welfare (sub-section 3.4). We quantitatively evaluate the welfare gains induced by reforms of the US and French labor market institutions.

The US labor market is characterized by an employment protection legislation cost F equal to zero. Unemployment benefits are partly financed by a firing tax aiming to make employers internalize the dismissal fiscal cost. The US financing scheme is approximate by equations (30), (31), (33) and (34), the parameters taking the benchmark calibration value (table 4.1). We evaluate the welfare gains induced by the first-best and the second-best allocations.

The French labor market institutions slightly differ from the US ones. It displays a positive employment protection legislation cost F and unemployment benefits are not financed through a layoff tax payed by firing firms. The French unemployment insurance system is approximated by equations (30), (31), (33) and (34), the parameter e being equal to 0. We evaluate a labor market reform

¹⁰We solve the model with a second-order approximation method around the steady state to make welfare comparisons (Schmitt-Grohé and Uribe (2004)).

consisting in establishing a layoff tax and lightening the unemployment protection legislation. For sake of simplicity, we impose $F = 0$.

The US Economy Numerical investigations concerning the US economy are reported in table 2.

	BENCHMARK	1 st BEST ALLOCATION		SECOND BEST
	ECONOMY	Pareto	Ramsey	ALLOCATION
Experience rating index	0.6500	0	0.9713	0.9661
Replacement rate	0.3200	0	0.2211	0.2185
Output	100.00		102.06	102.07
Consumption	100.00		101.95	101.95
Employment	100.00		102.74	102.75
Welfare	100.00		100.27	100.27
Welfare cost	0.2724%		0.0000%	0.0003%
Workers flows rate	3.22 %		2.18 %	2.18 %

Table 2: **OPTIMAL LABOR MARKET POLICY (US ECONOMY)**. *Mean levels of output, consumption, employment and welfare have been standardized. e and ρ^R have been recalculated when we compute the Ramsey. Percentage welfare losses are relative to the Ramsey allocation.*

The first best exhibits two features : (i) A layoff tax that is slightly lower than the fiscal cost of an unemployed worker and (ii) an average replacement rate that is thirty percent lower¹¹. The second best allocation displays similar features. The experience rating index appears to be a tiny bit lower than the Ramsey allocation as well as replacement ratio. The steady state effects and welfare comparisons are reported in table 2.

Optimal financing schemes (first and second-best) sharply depart from the benchmark one. Labor market failures are strongly reduced when the second-best allocation is implemented. In the first-best and the second-best allocation, the layoff tax is close to the expected fiscal cost of an unemployed worker. In the Ramsey allocation, equilibrium worker flows are reduced by around 32%. As mentioned Algan (2004) and L’Haridon and Malherbet (2008), turnover costs introduce a labor hoarding phenomenon. As long as firing is costly, firms prefer continue the relation with a low productivity level than pay for the layoff tax. They cut back the reservation productivity to reduce endogenous separations. The reservation productivity falls up to a point where endogenous separations are close to zero. Then, ins and outs of employment are almost only governed by exogenous separations. In that case, an higher index doesn’t reduce labor

¹¹To allow comparisons, values of e and ρ_R implied by the first best policy are computed using the steady state values of unemployment benefit and taxes.

market flows anymore¹². Output and employment increase by 1.95% and 2.74% respectively. The welfare is enhanced by 0.27% compare to the benchmark. The welfare loss (Ψ) of the benchmark economy is of about 0.27% relative to the optimal policy. The alternative policy (second-best) displays a very weak loss (0.0003%). In order to scrutinize the effects of the unemployment insurance, we compute the conditional welfare as a function of our two institutional parameters (figure 1) in the second-best allocation.

Figure 1 depicts a dome-shaped surface. The replacement rate seems to have an higher impact on welfare than the experience rating index. A maximum is reached when the replacement rate is equal to 0.2185 and the experience rating index to 0.9661. We also compute alternative labor market policy and calculate welfare losses. Results are reported in table 3.

	$e = 0.5$	$e = 0.7$	$e = 0.9$	$e = 1.1$	$e = 1.3$
$\rho^R = 0.10$	0.0533	0.0516	0.0512	0.0512	0.0513
$\rho^R = 0.15$	0.0383	0.0231	0.0207	0.0207	0.0208
$\rho^R = 0.20$	0.0935	0.0130	0.0023	0.0023	0.0025
$\rho^R = 0.25$	0.3357	0.0398	0.0076	0.0075	0.0076
$\rho^R = 0.30$	0.9119	0.1270	0.0671	0.0672	0.0675
$\rho^R = 0.35$	1.5770	0.3469	0.3304	0.3340	0.3377

Table 3: **WELFARE LOSS (US ECONOMY)**. *All welfare losses are relative to the optimal Ramsey allocation.*

The French Economy Numerical investigations concerning the French economy are reported in table 4.

¹²The reason come from the reservation productivity. When τ^E increase, $\underline{\varepsilon}$ strongly decreases to balance the job destruction rule (29). According to the shape of the distribution, a small negative change in $\underline{\varepsilon}$ lead to an important decrease of the endogenous separation rate $G(\underline{\varepsilon})$. These results remain virtually unchanged with a capital accumulation or/and a uniform distribution.

	BENCHMARK	1 st BEST ALLOCATION		SECOND BEST
	ECONOMY	Pareto	Ramsey	ALLOCATION
Experience rating index	0	0	0.9875	0.9800
Replacement rate	0.5500	0	0.3701	0.3700
Output	100.00		113.28	113.27
Consumption	100.00		113.64	113.64
Employment	100.00		114.52	114.52
Welfare	100.00		106.80	106.80
Welfare cost	6.8016%		0.0000%	0.0003%
Workers flows rate	2.25 %		1.02 %	1.02 %

Table 4: **OPTIMAL LABOR MARKET POLICY (FRENCH ECONOMY)**. *Mean levels of output, consumption, employment and welfare have been standardized. e and ρ^R have been recalculated when we compute the Ramsey. Percentage welfare losses are relative to the Ramsey allocation.*

As previously said, the first and the second-best are computed for an employment legislation protection cost F equal to 0. The evaluated reform thus combines a more flexible labor market and an unemployment benefit financing scheme including a layoff tax. The first-best allocation, sharply increases output, consumption and employment. The mean employment is increased of 14.5%. The welfare loss of the of the benchmark economy is of about 6.8% relative to the first-best. Concerning the second-best allocation (and contrarily to the US economy calibration) the algorithm approximating optimal values of parameters e and ρ_R does not converge easily. These numerical difficulties are illustrated by figure 2 depicting a dome-shape surface. The optimal value of ρ_R is close to 0.37. However, the optimal level of e seems more difficult to determine. Indeed, an increase of the experience rating index seems to have no significant effect on welfare. For the second-best, we retain the following values: $\rho_R = 0.37$ and $e = 0.98$, underlying the first-best allocation. We take these values as an approximation of the second-best allocation problem solution (this is the case for the US calibration). Numerical results are close to the first-best ones and the welfare cost relative to the first-best allocation problem is almost imperceptible.

We also compute alternative labor market policy and calculate welfare losses. Results are reported in table 5 and confirm the numerical difficulties to determine the optimal level of the experience rating index.

	$e = 0.5000$	$e = 0.6250$	$e = 0.7500$	$e = 0.8750$	$e = 1.0000$
$\rho^R = 0.25$	0.0400	0.0400	0.0400	0.0399	0.0399
$\rho^R = 0.29$	0.0200	0.0200	0.0200	0.0200	0.0200
$\rho^R = 0.33$	0.0055	0.0055	0.0055	0.0055	0.0054
$\rho^R = 0.37$	0.0002	0.0002	0.0002	0.0002	0.0002
$\rho^R = 0.41$	0.0118	0.0118	0.0119	0.0119	0.0120
$\rho^R = 0.45$	0.0582	0.0584	0.0586	0.0588	0.0590

Table 5: **WELFARE LOSS (FRENCH ECONOMY)**. *All welfare losses are relative to the optimal Ramsey allocation.*

Policy implementation For the two economies, welfare may be enhanced through a labor market reform. Our numerical experiments suggest the experience rating index and the replacement rate of the US economy are away from their optimal levels. Results concerning the French economy must be taken carefully, they however suggest that French labor market institutions appear highly suboptimal. A less stringent dismissal regulation, an unemployment benefits financing scheme with a less generous replacement rate and a layoff tax may significantly increase welfare. The reason is that EPL costs was constant over time and costly in terms of production (thrown into the sea). Conversely, the layoff tax is redistributed to the unemployed workers. There are no resource losses. It follows that making firms in charge of the cost induced by redundancies allows to increase the average employment level and welfare.

In terms of welfare cost, the second-best appears to be a good approximation of the first-best. The second-best thus provides a good way to implement a labor market reform allowing to enhance welfare. Concerning the US economy, a welfare improvement may be achieved through a change in parameters e and ρ_R . The French economy welfare may be improved with a less stringent dismissal regulation and an unemployment benefits financing scheme similar to the American one.

The tax layoff and the bargaining power The benchmark calibrations assume a workers' bargaining power $(1 - \xi)$ less than the elasticity of matches with respect to unemployment (ψ). Therefore, the bargaining power is in favor of firms and the first-best allocation features a positive layoff tax that offset congestion externalities.

What happened in the opposite case *i.e. if the bargaining process is in the favor of workers*? For the two economies, we compute the optimal layoff tax when ξ varies from 0.2 to 0.9. Results are plotted in figure 5. The greater the firms bargaining power the higher the layoff tax. When $1 - \xi = \psi$, the Hosios condition is satisfied and $\tau^E = 0$. When $1 - \xi > \psi$, the layoff tax become negative. In other words, the competitive economy does not yield enough job destructions. The intuition is as follows. Increasing the workers' bargaining power enhances

their threat point. It raises wages and makes the labor market less tighten. The value of a job falls and firms set the productivity threshold at a lower level. Consequently, firms reduce layoff and retain low productivity workers. In this case, the layoff tax has to be negative to diminish labor market failures.

4.3 Impulse response function analysis

Let us now investigate how labor market policies affect aggregate fluctuations. We simulate a one percent negative aggregate productivity shock and compute impulse response functions (see Fig. 3 and 4). We carry out this exercise for the benchmark and the two optimal allocations. We compare the results obtained in the US economy with those obtained in the French economy. It shows that optimal policies strongly influence the propagation of shocks and especially French separations while the adjustment path is roughly similar between the US and French economies. Furthermore we find that the second-best allocation slightly differs from the first-best. These results remain virtually unchanged in the two economies.

We first look on the dynamic of the benchmark economies. On impact, firms post fewer vacancies while the size of unemployment increases with a one-lag period, reproducing the Beveridge curve. The labor market tightness and the number of matches both jump below their steady state level. The probability of finding a job falls while the jump in the reservation productivity raises the job separation rate instantaneously. The number of old workers is reduced as well as total employment. As in Den Haan, Ramey, and Watson (2000), the increase in unemployment after the shock drives new matches above their initial level (known as the "echo effect"). Output and consumption decline following the shock and return gently to their equilibrium value.

In the two optimal allocations, the jump of separation rate is strongly reduced. In the French economy, it does not seem to fluctuate following the shock. The reason is that the policy strongly influences the steady state reservation productivity which is now located at the bottom of the distribution¹³. Therefore, a shift of $\underline{\varepsilon}_t$ does not generate a strong increase of endogenous separations. The initial fall of hirings, measured by the variable N_t^N , is lower in the two Ramsey economies. The interpretation is symmetrical with regard to a positive productivity shock. The higher the degree at which firms internalize the cost of separations, the lower the incentive to hire during expansions. Implementing the second-best allocation leads to the same qualitative results but the impact is weaker than in the Ramsey. These results are consistent with the commonly-admitted hypothesis according to which a high payroll tax indexation lowers separations during recessions and hirings during booms (Card and Levine (1994))¹⁴. The drop of vacancies and

¹³On the bottom, the slope of the log-normal cumulative distribution function is nearly horizontal.

¹⁴The comparison is not self-evident since the US unemployment insurance system is based

the labor market tightness are almost three times weaker in the US economy and twenty times lower in the French case. As previously, the second-best allocation exhibits similar features but fluctuations remain higher than in the first-best. Consumption and output decline with a more pronounced hump-shaped response than in the two benchmark cases.

We now scrutinized the dynamic effects of the financing scheme. We first deal with benchmark economies and discuss later how the optimal policies affect benefit and tax fluctuations. In the US economy, the unemployment compensation is reduced according to its wage indexation. But the probability of finding a job falls, leaving the overall effect on the expected fiscal cost of an unemployed worker undetermined. Simulations show that the increase in the average duration of unemployment has a higher impact on the fiscal cost Q_t than the decrease of benefits per unemployed worker. Consequently, the layoff tax jumps above its steady state level to cut back on the cost incurred by the unemployment benefit fund. The lump-sum tax decreases following the shock and overtake its initial value as soon as unemployment increase. In the French economy the lump-sum tax has to go up because there is no other resource to finance the increase of benefits paid. Since the increase in unemployment is persistent, the fiscal cost of an unemployed worker remains high for a long time. Taxes slowly converge to their equilibrium value.

In the Ramsey allocation, it is shown that taxes jump in the opposite direction. One can explain it by the dampened fluctuations of unemployment and the strong sensitivity of wages (and therefore of the unemployment compensation). As a consequence, unemployment insurance expenditures go down following the shock. Taxes have to decrease in order to balance the budget. The main difference between the Ramsey and the second-best allocation is the path followed by taxes. Once again, the reason is that total benefits paid increase with the rise of unemployment and decrease with the fall of benefits per unemployed worker. The overall effect depends on the sensitivity of the two key variables. In the second-best allocation unemployment benefits respond little to shifts in productivity compare to the Ramsey economy while the rise of unemployment is stronger. In the French economy, the interpretation remains the same.

5 Conclusion

In this paper, we use a DSGE model to study the properties of an optimal unemployment benefits financing scheme. We investigate whether a more incentives system based on the principle of making firms more responsible for their dismissal decisions is efficient. In particular, we wonder if firms should be taxed in pro-

on a payroll tax indexation whereas we use a layoff tax. Once again, we try to assess the consequences of a change in the degree at which firms support the social cost of their dismissal decisions.

portion of their separations and if such a tax should correspond to a part or all of the cost incurred by the unemployment insurance. We compare the optimal labor market policy in an initially *rigid* economy (France) to the one obtained in a *flexible* economy.

In our simple framework, we find that the optimal unemployment benefits financing scheme require that employers should be responsible for their dismissal decisions in the two economies. In the French economy, reducing administrative and legal constraints, and introducing a layoff taxes is welfare enhancing. In the US economy, optimality imposes an increase of the degree at which firms internalize the social cost of layoffs. Like in the French economy, the optimal degree is close to one. In both cases, an optimal combination of unemployment benefits and layoff taxes may reduce unemployment and improve agents' welfare. Furthermore, it is found that layoff taxes induce a labor hoarding phenomenon by increasing the cost of separations. Then, they create a financial incentive for employers to stabilize their employment, reducing the cost of aggregate fluctuations.

However, the model remains limited and can be extended in several directions. First, throughout this paper we use a simple unemployment insurance system, borrowed from Cahuc and Malherbet (2004), as a proxy of current regulations. However, the experience system in force exhibits wide differences, leaving the comparison between an improvement in the US system and an EPL reform in France difficult. In the US, employer contribution rates depend on the firm layoff history and unemployment benefits that are perceived by its ex-employees. Here we consider a combination of a layoff tax and a lump-sum tax which are forward looking variables. To catch up with current regulations, it will be worth introducing a better approximation that takes into account the past record of insured unemployed.

Second, it will be interesting to take into account more labor market rigidities like a minimum wage or temporary jobs (Cahuc and Malherbet (2004)) to evaluate whether these institutions influence the optimum. A rigid wage as in Shimer (2005) or a capital accumulation would be interesting issues to match the business cycle and to assess the impact of a change in the financing scheme.

Finally, one can ask the following questions: what are the consequences of an imperfect experience rating system when labor turnover is heterogenous among firms. Does the implicit subsidy financed through other firms induce too many layoffs? To answer these questions, ex-ante heterogeneity among firms have to be considered. These issues remain interesting topics for future research but are beyond the scope of this paper.

A Proof of result 1

Let's write the lagrangian of the Ramsey allocation problem :

$$\begin{aligned}
\mathcal{L} = & E_0 \sum_{t=0}^{\infty} \beta^t [(C_t + (1 - N_t)h) \\
& + \Omega_t^1 \left(\kappa \frac{V_t}{M_t} - \beta \xi ((z_{t+1} \bar{\varepsilon} - z_{t+1} \underline{\varepsilon}_{t+1} - F - \tau_{t+1}^e) \right) \\
& + \Omega_t^2 \left(\xi (b_t + h - z_t \underline{\varepsilon}_t - F - \tau_t^e) + (1 - \xi) \kappa \frac{V_t}{1 - N_t} \right. \\
& \left. - \beta (1 - \rho_x) \xi \left(z_{t+1} \int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} (\varepsilon - \underline{\varepsilon}_{t+1}) dG(\varepsilon) - F - \tau_{t+1}^e \right) \right) \\
& + \Lambda_t^1 (Y_t - C_t - \kappa V_t - F(1 - \rho_x) \rho_t^n N_{t-1}) \\
& + \Lambda_t^2 (-N_{t+1}^N + M_t) + \Lambda_t^3 (-N_t + (1 - \rho_x)(1 - \rho_t^n) N_{t-1} + N_t^N) \\
& + \Lambda_t^4 (-M_t + \chi(1 - N_t)^\varphi V_t^{1-\varphi}) + \Lambda_t^5 \left(-\rho_t^n + \int_0^{\underline{\varepsilon}_t} dG(\varepsilon) \right) \\
& + \Lambda_t^6 \left(-Y_t + (1 - \rho_x) N_{t-1} z_t \int_{\underline{\varepsilon}_t}^{\bar{\varepsilon}} \varepsilon dG(\varepsilon) + N_t^N z_t \bar{\varepsilon} \right) \\
& + \Lambda_t^7 (-(1 - N_t) b_t + T_t + (1 - \rho_x) \rho_t^n N_{t-1} \tau_t^E)]
\end{aligned}$$

The optimality conditions with respect to T_t , b_t and τ_t^E write :

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial T_t} &= \Lambda_t^7 = 0 \\
\frac{\partial \mathcal{L}}{\partial b_t} &= \Omega_t^2 \xi - \Lambda_t^7 (1 - N_t) = 0 \\
\frac{\partial \mathcal{L}}{\partial \tau_t^E} &= \Omega_{t-1}^1 \xi - \Omega_{t-1}^2 \xi + \Omega_{t-1}^2 (1 - \rho_x) \xi + \Lambda_t^7 (1 - \rho_x) \rho_t^n N_{t-1} = 0
\end{aligned}$$

It immediately follows that $\Omega_t^1 = \Omega_t^2 = \Lambda_t^7 = 0 \forall t$. The others optimality conditions may then be written as follows :

$$\frac{\partial \mathcal{L}}{\partial C_t} = 1 - \Lambda_t^1 = 0 \quad (40)$$

$$\frac{\partial \mathcal{L}}{\partial Y_t} = \Lambda_t^1 - \Lambda_t^6 = 0 \quad (41)$$

$$\frac{\partial \mathcal{L}}{\partial V_t} = -\Lambda_t^1 \kappa + \Lambda_t^4 \chi (1 - N_t)^\varphi (1 - \varphi) V_t^{-\varphi} = 0 \quad (42)$$

$$\frac{\partial \mathcal{L}}{\partial \rho_t^n} = -\Lambda_t^1 F (1 - \rho_x) N_{t-1} - \Lambda_t^3 (1 - \rho_x) N_{t-1} - \Lambda_t^5 = 0 \quad (43)$$

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial N_t} &= -\beta E_t \Lambda_{t+1}^1 F (1 - \rho_x) \rho_{t+1}^n - \Lambda_t^3 + \beta E_t \Lambda_{t+1}^3 (1 - \rho_x) (1 - \rho_{t+1}^n) \\ &\quad - \Lambda_t^4 \chi \varphi (1 - N_t)^{\varphi-1} V_t^{1-\varphi} + \beta E_t \Lambda_{t+1}^6 (1 - \rho_x) z_{t+1} \int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} \varepsilon dG(\varepsilon) \\ &\quad - h = 0 \end{aligned} \quad (44)$$

$$\frac{\partial \mathcal{L}}{\partial N_{t+1}^N} = -\Lambda_t^2 + \beta E_t \Lambda_{t+1}^3 + \beta E_t \Lambda_{t+1}^6 z_{t+1} \bar{\varepsilon} = 0 \quad (45)$$

$$\frac{\partial \mathcal{L}}{\partial M_t} = \Lambda_t^2 - \Lambda_t^4 = 0 \quad (46)$$

$$\frac{\partial \mathcal{L}}{\partial \underline{\varepsilon}_t} = \Lambda_t^5 - \Lambda_t^6 (1 - \rho_x) N_{t-1} z_t \underline{\varepsilon}_t = 0 \quad (47)$$

The system formed by equations (40) — (47) can easily be reduced to the equations system defining the Pareto allocation.

It immediately follows from equation (40) and (41) that $\Lambda_t^1 = 1$ and $\Lambda_t^6 = \Lambda_t^1 = 1$.

>From equations (42), (43), (46) and (47), is is easily deduced that :

$$\begin{aligned} \Lambda_t^4 &= \frac{\kappa}{1 - \varphi} \frac{V_t}{M_t} \\ \Lambda_t^5 &= (1 - \rho_x) N_{t-1} \underline{\varepsilon}_t \\ \Lambda_t^3 &= -F - z_t \underline{\varepsilon}_t \\ \Lambda_t^2 &= \Lambda_t^4 \end{aligned}$$

Substituting in equations (44) and (45) provides :

$$\begin{aligned} &-\frac{\kappa}{1 - \varphi} \frac{V_t}{M_t} - \beta E_t \left\{ (z_{t+1} (\bar{\varepsilon} - \underline{\varepsilon}_{t+1}) - F) \right\} = 0 \\ &(z_t \underline{\varepsilon}_t + F - h) - \kappa \frac{\varphi}{1 - \varphi} \frac{V_t}{1 - N_t} \\ &+ \beta (1 - \rho_x) E_t \left\{ \left(z_{t+1} \int_{\underline{\varepsilon}_{t+1}}^{\bar{\varepsilon}} (\varepsilon - \underline{\varepsilon}_{t+1}) dG(\varepsilon) - F \right) \right\} = 0 \end{aligned}$$

The above equations are exactly equations (38) and (37). We thus have verified that the Ramsey allocation corresponds to the Pareto one.

References

- ABOWD, J., AND L. ALLAIN (1996): “Compensation structure and product market competition,” *Annales d’Economie et Statistiques*, 41/42, 207–217.
- ALGAN, Y. (2004): “La protection de l’emploi : des vertus stabilisatrices ?,” working paper.
- ANDOLFATTO, D. (1996): “Business cycles and labor market search,” *The american economic review*, 86(1), 112–132.
- BLANCHARD, O., AND J. TIROLE (2003): “Protection de l’emploi et procédure de licenciement,” in *Rapport pour le Conseil d’Analyse Economique*. La documentation française.
- (2008): “The joint design of unemployment insurance and employment protection. A First Pass,” *Journal of European Economic Association*, 6(1), 45–77.
- CAHUC, P. (2003): “Pour une meilleure protection de l’emploi,” Document de travail 63, COE.
- CAHUC, P., D. GOUX, C. GIANELLA, AND A. ZYLBERBERG (2000): “Equalizing wage difference and bargaining power: Evidence from a panel of French firms,” Document de travail.
- CAHUC, P., AND F. MALHERBET (2004): “Unemployment compensation finance and labor market rigidity,” *Journal of Public Economics*, 88, 481–501.
- CAHUC, P., AND A. ZYLBERBERG (2007): “Optimum income taxation and layoff taxes,” *Journal of Public Economics*, Forthcoming.
- CARD, D., AND P. LEVINE (1994): “Unemployment insurance taxes and the cyclical and seasonal properties of unemployment,” *Journal of Public Economics*.
- DEN HAAN, W., G. RAMEY, AND J. WATSON (2000): “Job Destruction and Propagation of Shocks,” *American economic review*, 90(3), 482–498.
- FELDSTEIN, M. (1976): “Temporary Layoffs in the Theory of Unemployment,” *Journal of political economy*, 84(5), 937–957.
- JOSEPH, G., O. PIERRARD, AND H. SNEESSENS (2004): “Job turnover, unemployment and market institutions,” *Labour economics*, 11(4), 451–468.
- L’HARIDON, O., AND F. MALHERBET (2008): “Employment protection reform in search economies,” *European economic review*, Forthcoming.

- MORTENSEN, D., AND C. PISSARIDES (1994): “Job creation and job destruction in the theory of unemployment,” *The review of economic studies*, 61(3), 397–415.
- (1999): “Job reallocation, employment fluctuations and unemployment,” in *Handbook of Macroeconomics*, vol. 1, chap. 18, pp. 1171–1228. Elsevier Science, New York.
- SCHMITT-GROHÉ, S., AND M. URIBE (2004): “Solving dynamic general equilibrium models using a second-order approximation to the policy function,” *Journal of economic dynamics and control*, 28, 755–775.
- SHIMER, R. (2005): “The Cyclical Behavior of Equilibrium Unemployment and Vacancies,” *American Economic Review*, 95(1), 25–49.
- TOPEL, R. (1983): “On Layoffs and Unemployment Insurance,” *American economic review*, 73(4), 541–559.
- (1984): “Experience Rating of Unemployment Insurance and the Incidence of Unemployment,” *Journal of Law and Economics*, 27(1), 61–90.
- TRIGARI, A. (2004): “Equilibrium unemployment job flows and inflation dynamics,” Working paper.
- VERACIERTO, M. (2008): “Firing Costs and Business Cycle Fluctuations,” *International Economic Review*, 49(1).
- ZANETTI, F. (2007): “Labor market institutions and aggregate fluctuations in a search and matching model,” working paper 333, Bank of England.

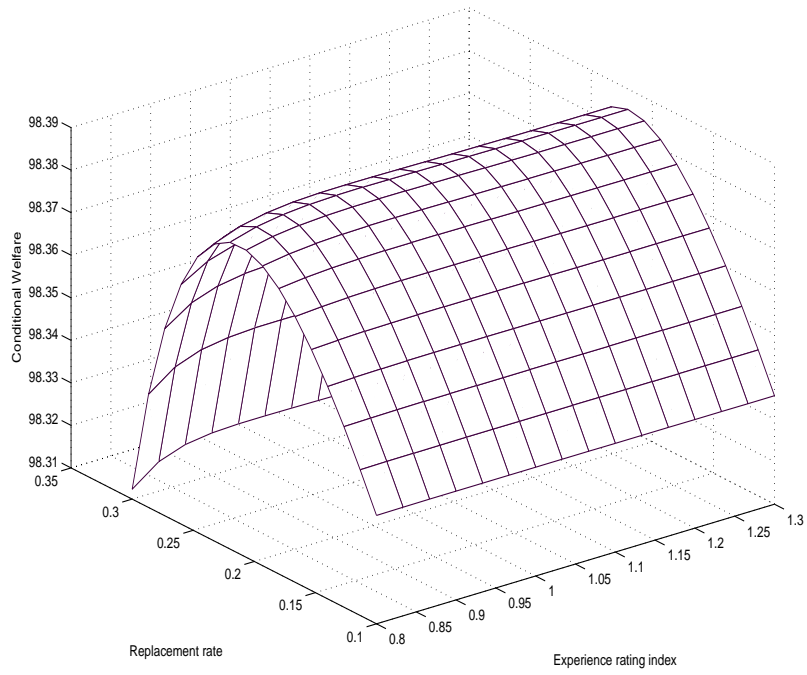


Figure 1: *Conditional welfare (US Economy).*

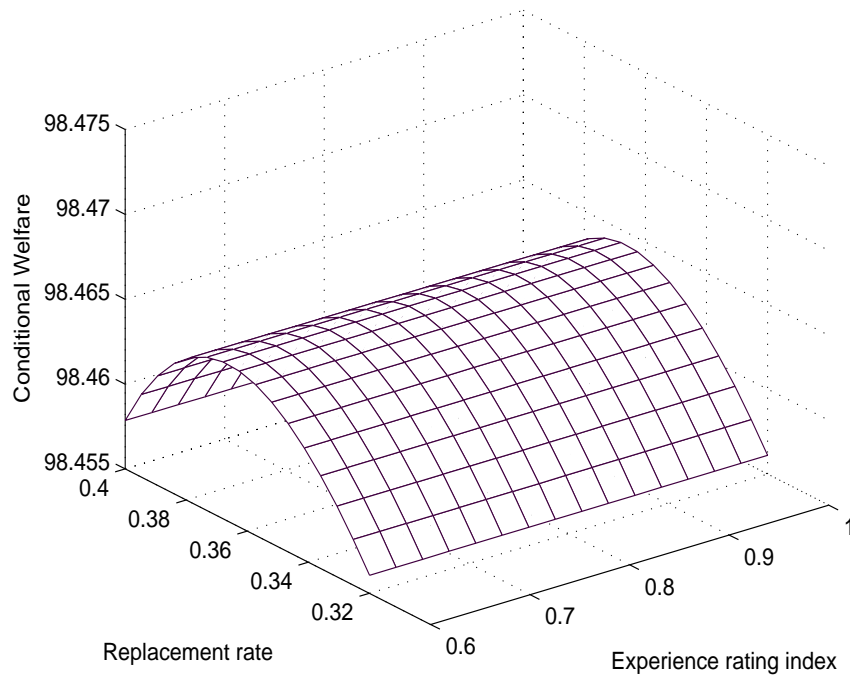


Figure 2: *Conditional welfare (French Economy).*

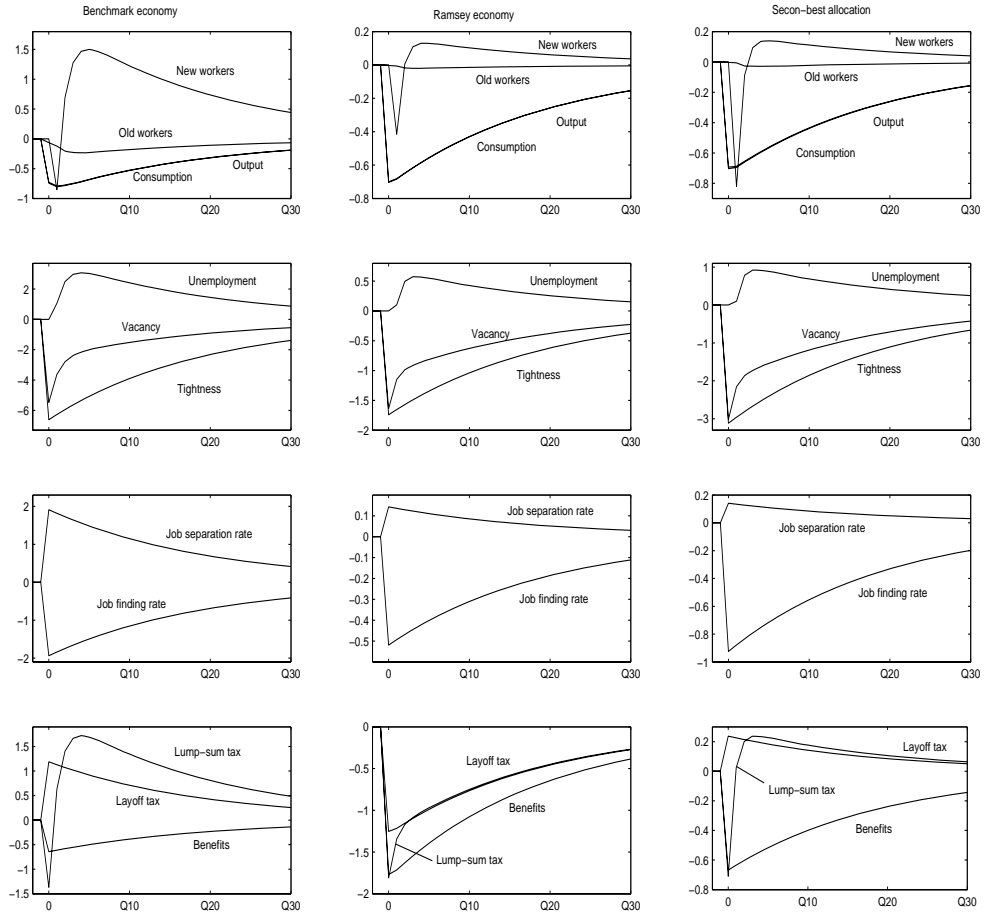


Figure 3: *Impulse response functions (US Economy)*. One percent negative aggregate productivity shock. The vertical correspond to the percentage deviation from the steady state.

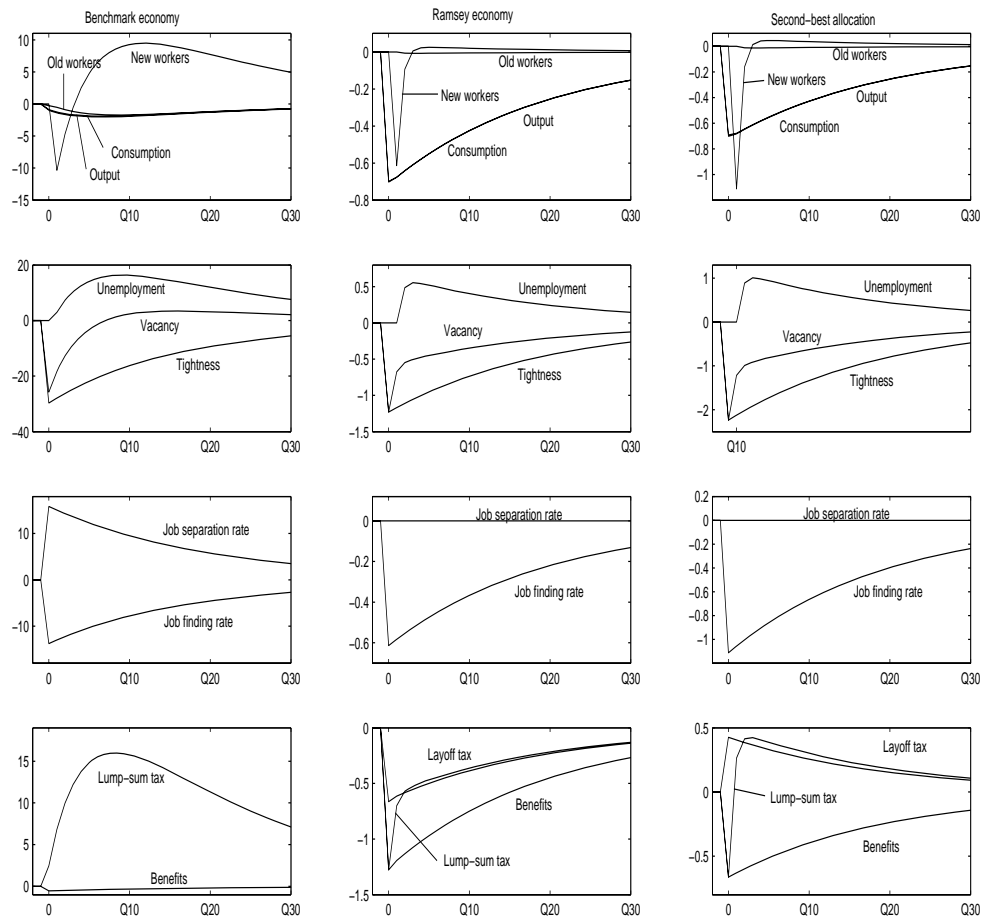


Figure 4: *Impulse response functions (French Economy)*. One percent negative aggregate productivity shock. The vertical correspond to the percentage deviation from the steady state.

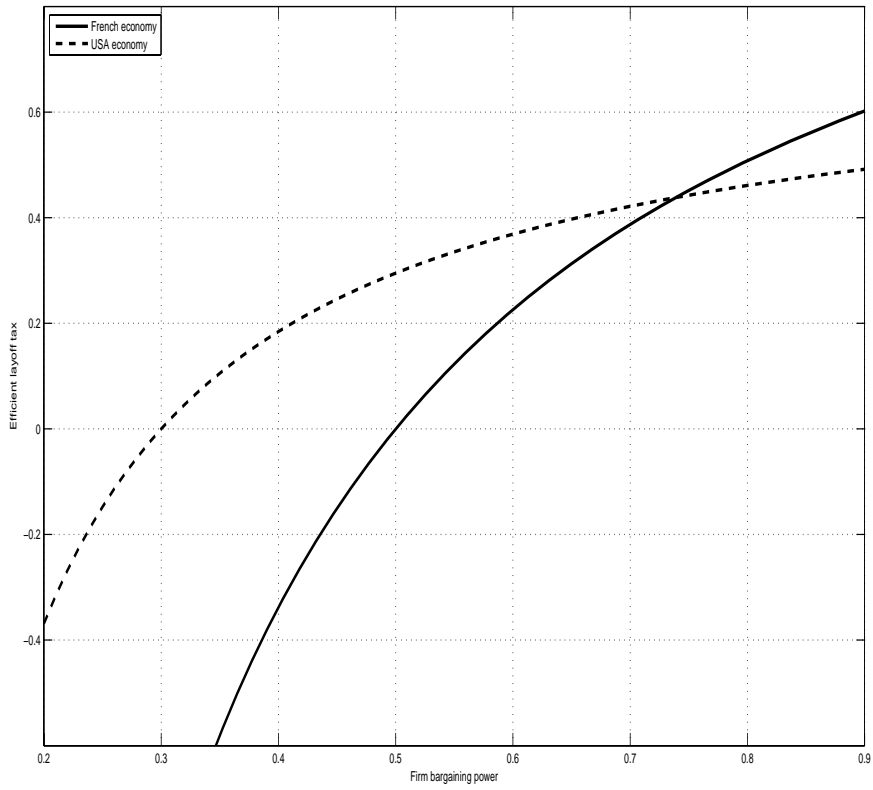


Figure 5: *The optimal layoff tax.* The optimal layoff tax is obtained by varying the firms' bargaining power in the Ramsey allocation.