

**ON THE IMPACT OF LABOR TAX  
REFORMS ON UNEMPLOYMENT  
IN TUNISIA**

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## 1. Introduction

In recent years, labor taxation has come to the fore in policy discussions as one of the major determinants of the significant increase in unemployment over the past quarter century. This partly reflects the simultaneous rise in both unemployment and labor taxes across a large variety of developed and developing countries. So, tax relief on labor appears as one of the main tools which policymakers can use to decrease unemployment, since it lowers the cost of labor and, consequently, it enhances the firms' demand for workers. However, there is considerable debate about the extent of labor taxation reforms in alleviating unemployment.

The evaluation of the effects on unemployment of alternative tax policies is made easier when adopting an approach based on the concept of market equilibrium rooted in micro-foundations. Since an equilibrium outcome is determined by the optimizing behavior of economic agents responding to cost-benefit incentives, all tax reforms which affect such incentives (directly or indirectly) will have an impact on the equilibrium outcome. The equilibrium outcome can be sensitive not only to the tax burden modification on employers, but also to the structure change of labor taxation, even revenue-neutrally.

A growing literature based on theoretical modeling and empirical estimation is addressed to the question of labor taxation mainly in developed countries. Whilst negative impact of benefit on unemployment get unanimous support from analysts,<sup>1</sup> the studies on the incidence of employment taxes is mixed. For instance, in a study of 10 OECD countries, Turvainen (1994) indicates that in some countries, like the USA and UK, real wage resistance is low, so that taxes do not significantly affect labor costs and thus unemployment. Moreover, Calmfors and Nymoen (1990) find only a short-run impact of the tax wedge on wages in Denmark, Sweden, and Norway, and Eriksson et al. (1990) find only a weak long-run link between the tax wedge and wages for Finland. Dolado et al. (1986) and Browne and McGettigan (1993) find, nevertheless, that rise in tax wedge explains to some extent the increase in unemployment respectively for Spain and Ireland. In addition, Andersen and Risager (1990) find a significant effect of payroll taxes on wages in Denmark while Noghadam (1994) argues that a reduction in employers' payroll taxes in France will reduce unemployment.

In developing countries, few empirical investigations about the link between taxation and unemployment have been fulfilled, mainly because data limitation. However, three areas of taxation are commonly regarded as having an important impact on labor market developments: capital taxes, agricultural taxes, and consumption taxes. Zee (1996) notes the existence of a tax policy environment often biased toward the utilization of capital relative to labor, and in some cases against the agricultural sector.

The purpose of this paper is to apply, while extending to some extent, Pissarides's (1998) study who work out the effects of employment tax cuts on unemployment and wages in different equilibrium models. Unlike Pissarides (1998), who simulates only labor tax cuts, we calibrate the impact of various revenue-neutral tax reforms on unemployment, wages, and production in Tunisia using three equilibrium models: competitive, union bargaining, and efficiency wages. These reforms affect alternatively labor taxation structure, value added tax, and unemployment benefits. The interest of this research is multiple, such as:

- revenue-neutral tax reforms which rise labor taxation progressivity is more feasible than a general tax relief, the adoption of which is always excluded regarding to public deficit, and can sometimes generate a bigger impact on employment;
- unemployment is perhaps the most important concern in Tunisia and it is appealing to assess the extent to which some tax instruments can be used as a tool to fight against this problem;
- as the characterization of labor market is always a problematic issue, it is relevant to test the effects of tax reforms in different equilibrium models and to estimate how much quantitative difference it really makes to have one model rather than another;
- since not all consumption is financed from labor income, a revenue-neutral shift from labor taxes to a consumption one has to alleviate the overall tax burden on labor and, so, could promote employment;

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<sup>1</sup> For instance, see Alba-Ramirez and Freeman (1990).

- because generous unemployment benefits increase the duration of unemployment, it is useful to predict how much unemployment could be fallen if cuts in these benefits will finance labor taxation relief, so as to increase progressivity of this latter.

The three models calibrated in this study are partial equilibrium ones in the sense that capital market is ignored and the disincentives of taxation in other areas of economic activity, such as the emergence of an informal sector or the migration of skilled work to low tax countries when labor taxation is more progressive, are ignored. Nevertheless, there are equilibrium models in the sense that wages, employment, the price of a composite good, and the supply and demand of this latter are determined within the models at the micro level. A useful common framework that links the three models is one where employment and wages are determined at the intersection of two curves, a downward sloping labor demand curve and an upward sloping wage-setting curve, which in the competitive model is a labor supply curve. This intersection is at a point to the left of maximum desired supply, hence there is unemployment in equilibrium. Further, the intersection of a downward sloping demand curve for the composite good and its upward supply curve determine the quantity and the price in the commodity market.

The rest of this paper is structured as follows. Section 2 describes the labor taxation structure currently in force in Tunisia. Section 3 discusses the demand for labor and the market good equilibrium, which is similar across the three models. Section 4, 5, and 6 study labor market equilibrium under respectively a competitive, union, and efficiency wage model. Numerical values of some key parameters are also calibrated so as to produce the current unemployment ratio, that is 17.5 percent.<sup>2</sup> Section 7 reports the outcomes of simulated reforms and focus on the role of unemployment benefits in employment determination. Finally, section 8 offers some concluding observations.

## 2. General Structure of Labor Taxation

A general structure of labor taxation that includes proportional, progressive, and regressive taxation is the linear tax system :

$$T = a + t_w w, \quad (1)$$

where  $T$  represents the tax levied on the firm per worker,  $w$  is the worker's wage rate and the couple  $(a, t_w)$  is the labor tax instruments. It is assumed that  $t_w$  is always positive but  $a$  can also be either equal to zero or negative. If it is positive, it implies that the overall labor taxation is regressive. If  $a$  is equal to zero, the tax is proportional to wages and if it is negative, it is equivalent to an employment subsidy and the overall tax becomes progressive.

Since 1990, the number of salary ranges was reduced from 18 to 6 with a top tax rate of 35 percent.<sup>3</sup> The structure of labor taxation currently in force in Tunisia is summarized in table 1.

It is now instructive to compute the couple  $(a, t_w)$  characterizing the better the Tunisian structure of labor tax. For this purpose, we make use of the micro-data from the 1990 Tunisian households' expenditures survey. This is a multipurpose household survey which provides information on expenditures as well as on many other dimensions of 7734 households behavior including education, demographic information, and economic activities.

Since this survey does not provide any information about the households' income, we assume that total expenditure is an appropriate *proxy* of (the net) income distribution. After eliminating from this survey households with non-salary head, we calibrate  $T$  for each household remaining in the survey using the appropriate tax rate, and we estimate equation (1) by ordinary least square regression. The two estimated tax instruments are significant at 1 percent level with  $a = -0.9$  and  $t_w = 0.21$ .

Because estimation results reveal that the taxation of employment, i.e. the parameter  $a$ , is negative, we can argue that the current labor taxation is progressive. Since we aim to understand to what extent more progressive labor taxation could alleviate unemployment, we need first a brief description of the link between the different markets, the presentation of which is the aim of the next section.

<sup>2</sup> This is another distinction with Pissarides's (1998) research, who calibrates key parameters of the different models such that the equilibrium unemployment rate in the absence of labor taxation is 6%.

<sup>3</sup> For a detailed description of the tax system currently in force in Tunisia, see Nsouli et al. (1993) and La Banque Mondiale (1999).

### 3. The Equilibrium of Market Good and the Demand for Labor

This section develops the common elements of the three small general equilibrium models to be used for simulations of revenue neutral tax reforms. The key elements of these models are the supply of the composite good, labor demand, and wage formation. The supply of the composite good and the labor demand are deduced from the profit maximization under price-taking behavior. We assume that firms produce the composite good according to a CES production function, which has the next form:

$$y^s = [\alpha k^{\frac{\sigma-1}{\sigma}} + (1-\alpha)(l^d)^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}, \quad (2)$$

where  $y^s$  represents the output supply,  $k$  is the capital stock supposed constant,  $l^d$  is employment demand,  $\alpha$  is a parameter between zero and one and  $\sigma$ , which is always positive, stands for the elasticity of substitution between labor and capital. If  $\sigma = 1$ , the production function becomes Cobb-Douglas. It is appealing to set  $k = 1$ , since we do not endogenize capital demand, and to think of  $l^d$  as constrained from above by unity so that at zero unemployment,  $y^s = l^d = 1$ .

Normalizing the producer price of the composite good to unity and since the firm has to pay taxes  $T$  per worker, the maximization of profit with respect to  $l^d$  gives:

$$(1-\alpha)\left(\frac{y^s}{l^d}\right)^{\frac{1}{\sigma}} = (1+t_w)w + a. \quad (3)$$

For a given wage, employment demand is then determined by the usual marginal productivity condition and equation (3) can be alternatively expressed as follows:

$$l^d = \frac{(1-\alpha)^{\sigma} y^s}{[(1+t_w)w + a]^{\sigma}}. \quad (3')$$

The equations (2) and (3) is solved for the supply of the output and the demand for labor for a given wage and is referred to as the demand side of labor market and the supply side of the composite good market.

Like any other tax, the labor tax opens up a tax wedge between wages net of tax received by the workers,  $w$ , and wages gross of tax paid by the firm,  $a + (1+t)w$ . The labor demand curve locus is then shifted downwards as a result of labor taxes that increase wage costs. Equation (3) reveals that the structure of labor taxation does not matter for the labor demand, once the wage has been determined. Hence, if such is also the case for wage-setting function, a revenue-neutral tax reform, which only alters the labor tax instruments, will be ineffective in alleviating unemployment. Nevertheless, if the revenue-neutral tax reform leads to labor tax relief, the outcome of this design depends on the parameters that determine the shift of labor demand curve, that is the wage elasticity of the labor demand.

As it is shown by equation (3), the key parameters which determine the wage elasticity are  $\alpha$  and  $\sigma$ . Since the share of capital in Tunisia is close to 60 percent, value of  $\alpha$  is set to 0.6. For  $\sigma$ , the value of 0.7 is adopted as the benchmark.

We assume that the economy is populated by three agents: workers, capitalists, and government. Saving behavior is ignored in the three models. The workers supply labor and so their budget for consumption is determined by labor income and unemployment benefits:

$$(1+t_y)y_w = wl^s + bu, \quad (4)$$

where  $t_y$  is the rate of consumption tax,<sup>4</sup>  $y_w$  is the composite good demanded by the worker,  $l^s$  is the labor supply of the worker that will be determined in the following sections,  $u$  is time off work (unemployment),  $w$  is the wage rate received by the worker, and  $b < w$  is the level of unemployment benefit. The unemployment compensation can be either indexed to wage,  $b = \rho w$  where  $\rho$  is the replacement ratio, or constant in nominal terms,  $b = \bar{b}$ .

<sup>4</sup> According to the report of La Banque Mondiale (1999), the indirect taxes represent 14.5% of the GDP in Tunisia in 1997. Thus, we set  $t_y = 0.145$  in the benchmark situation.

The capitalists do not supply labor but receive profit income from their ownership of the capital stock,  $k$ . Their budget constraint is summarized by the next equation:

$$(1+t_y)y_k = \frac{y^s - [(1+t_w) + a]l^d}{1+t_k}, \quad (5)$$

where  $t_k$  is the rate of tax on capital and  $y_k$  is the composite good demanded by the owner.<sup>5</sup>

Government behavior is largely exogenous. In particular, government collects public revenues from taxing labor, capital, and consumption. These revenues are used to finance expenditures on unemployment benefits and consumption of the composite good. Hence, the budget constraint of government can be given by:

$$(1+t_y)y_G + bu = t_y(y_w + y_k + y_G) + \frac{t_k}{1+t_k}[y^s - (1+t_w)wl^d - al^d] + (t_w w + a)l^d. \quad (6)$$

The intersection of a downward sloping demand curve for the composite good and its upward supply curve will determine the equilibrium of the market good:

$$y^s = y_w + y_k + y_G. \quad (7)$$

Besides, the intersection of the labor demand curve and the wage-setting curve will determine the equilibrium of the labor market:

$$l^s = l^d. \quad (8)$$

This intersection is at a point to the left of maximum desired supply, hence there is unemployment in equilibrium. Because labor supply is constrained from above by unity, the unemployment ratio is given by:

$$u = 1 - l^s. \quad (9)$$

As it is noted above, the wage-setting curve corresponds to the labor supply curve in the competitive model, the presentation of which is the aim of the next section.

#### 4. The Competitive Labor Market

The basic assumption in the competitive model is that all economic agents are price takers. As regards labor market, equilibrium wage is determined so that the aggregate demand for labor is equal to aggregate supply. The model is also a static equilibrium one. Hence, the period of analysis is long enough so that adjustment to the desired equilibrium is complete.

Unemployment is treated as the part of the endowment of time for works (the level of potential labor supply) during which the worker gets some return that is less important than the wage rate. Following Pissarides (1998), we assume that the difference between the endowment of time and the effective labor supply gives some leisure value as well as some income, which we refer to as the unemployment benefit,  $b$ . Yet leisure generates an opportunity cost to the worker because it yields lower income.

We assume that the workers maximize utility ( $v^w$ ) subject to their budget constraint, summarized by equation (4), and a time constraint, i.e.  $l^s \leq 1$ . Utility features the single composite good,  $y_w$ , and leisure,  $(1 - l^s)$ , as its arguments. The CES utility function is assumed characterizing the best the worker's system of preferences:

$$v^w = [\beta y_w^{\frac{\delta-1}{\delta}} + (1-\beta)(1-l^s)^{\frac{\delta-1}{\delta}}]^{\frac{\delta}{\delta-1}}, \quad (10)$$

<sup>5</sup> As the tax rate on capital income is 35% in Tunisia, regardless of the income level, we set  $t_k = 0.35$  in the benchmark situation.

where  $\beta$  and  $\delta$  are all positive parameters, with  $0 < \beta < 1$ . Its value is set when calibrating the competitive model such that the equilibrium unemployment rate is 17.5 percent. This value, given the current labor taxation structure and the other parameters of the model, is  $\beta = 0.871$ .

The Substitution of  $y_w$  in expression (10) by the demand function of worker, which can easily deduced from his budget constraint summarized by equation (4), and the differentiation of  $v$  with respect to  $l^s$  give the first-order maximization condition:<sup>6</sup>

$$\beta(1+t_y)^{\frac{1-\delta}{\delta}}(w-b)(wl^s+bu)^{\frac{1}{\delta}}-(1-\beta)u^{\frac{1}{\delta}}=0. \quad (11)$$

Expression (11) enables us to derive two labor supply functions, one for fixed nominal unemployment benefits,  $\bar{b}$ , and one for fixed ratio of benefits to wage,  $\rho$ . Thus, if the policy parameter is  $\bar{b}$ , the labor supply function,  $l^s$ , can be derived from the following expression:

$$l^s = \frac{\left(\frac{\beta}{1-\beta}\right)^{\delta}(1+t_y)^{1-\delta}(w-\bar{b})^{\delta}-\bar{b}}{\left(\frac{\beta}{1-\beta}\right)^{\delta}(1+t_y)^{1-\delta}(w-\bar{b})^{\delta}+(w-\bar{b})}. \quad (12)$$

Yet, if the policy parameter is  $\rho$ , by substituting  $\bar{b}$  to  $\rho w$  in expression (12) we obtain:

$$l^s = \frac{\left(\frac{\beta}{1-\beta}\right)^{\delta}(1+t_y)^{1-\delta}(1-\rho)^{\delta}w^{\delta-1}-\delta}{\left(\frac{\beta}{1-\beta}\right)^{\delta}(1+t_y)^{1-\delta}(1-\rho)^{\delta}w^{\delta-1}+(1-\rho)}. \quad (13)$$

We can effortlessly note that these two labor supply curves locus are not affected by labor taxation. Since the structure of labor taxation does not matter for the labor demand, once the wage has been determined, then the first important result is that revenue-neutral reforms which alter only labor taxation parameters are ineffective in alleviating unemployment in competitive labor market. However, if the revenue-neutral tax reforms lead to labor tax relief, the extent to which cuts in labor tax affect employment depend on whether unemployment benefit is fixed in nominal terms or fixed to wage. When the policy parameter is  $\bar{b}$ , labor supply function is flatter at all wage levels than the function with fixed ratio of unemployment benefits to wage. Thus, a shift upwards in the labor demand will generate a bigger impact on employment and a smaller impact on wage when policy parameter is  $\bar{b}$  than when the policy parameter is  $\rho$ . The intuition behind this result is straightforward. If the replacement ratio is the policy parameter, unemployment benefits are going to go up as wage rises, reducing the incentive to substitute work for unemployment at the new higher wage. Yet, if income out of work is fixed in nominal terms, ratio of unemployment compensation to wage decreases as wage rises, making unemployment a relatively less attractive situation than previously.

The impact of labor tax relief described above holds particularly when  $\delta > 1$ . Indeed,  $\delta > 1$  implies that the substitution effect dominates the income effect and the labor supply curve is upward bending. Labor tax cuts will also have a positive impact on employment if  $\delta = 1$  and the policy parameter is  $\bar{b}$ . But, if  $\delta = 1$  and the policy parameter is  $\rho$ , the income effect on labor supply will be exactly balanced by the substitution one, and the labor supply curve is vertical. Finally, if  $\delta < 1$ , the labor supply curve will always have a negative slope when policy parameter is  $\rho$ . If  $\bar{b}$  is the policy parameter, however, labor supply will remain an increasingly function as long as  $\delta > 1 - \rho$ .

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<sup>6</sup> We can note that the second-order conditions are satisfied at all values of  $l$  between 0 and 1, which we impose as a time constraint.

Empirical investigation show that  $\delta$  is always above 1 for women but such is seldom the case for men.<sup>7</sup> So, for the whole economy, the value of  $\delta$  in the competitive model has to be close to 1. For the purpose of having an upward-bending labor supply curve, regardless the policy parameter, the competitive model is calibrated with  $\delta=1.1$ .<sup>8</sup>

The main result in competitive model is that revenue-neutral reforms which change only labor tax instruments, by making labor taxation more progressive, are ineffective in alleviating unemployment. This result characterizes also the model with efficiency wages, the illustration of which is the aim of the next section.

## 5. Efficiency Wages

A more elaborate view of endogenous wage determination incorporates efficiency wages theory, which can explain a profit maximizing firm's decision to pay more than the competitive wage.<sup>9</sup> In contrast to the traditional neoclassical theory, efficiency wage theories assume causal links running not just from productivity to wages, but also from wages to productivity. Therefore, these theories recognize that a worker's productivity depends not only on human endowments, but also on the perceived reward for effort.<sup>10</sup>

Originally, the efficiency wage assumption was formulated by Leibenstein (1957) to characterize linkages between wages, nutrition, and health in less-developed countries. Then Solow (1978) adapts the concept of efficiency wage to the developed economies context with a model in which increased wages improve morale and so directly affect productivity through an increase in worker effort.

In the efficiency wages theory, workers have the opportunity to shirk, an action assumed to increase their utility. The production technology makes difficult for producers to monitor workers and thereby ensure that they do not shirk. Since shirking detection is uncertain, the firms attempt to pay wages in excess of market clearing to induce workers not to shirk. If caught, workers are fired. Considering the threat of firing a worker as a method of discipline has been considered, among others, by Shapiro and Stiglitz (1984) to stress the moral hazard problem underlying the employer and worker relationship.<sup>11</sup> They develop a model introducing a 'non-shirking constraint'. For the purpose to study the perspectives of tax reforms as a tool to fight against unemployment, we follow Pissarides (1998) by adopting this model to assess the likely effects of labor tax reform when the role of unemployment is to discipline workers into not shirking on job.

In this model, the firms try to offer a premium over what other firms are paying for their workers. Acting so, they rise average wages too high, and generate unemployment which disciplines workers by increasing the opportunity cost of a lay-off in the case of detection. To characterize this idea, assume that there is exogenous job destruction at the constant rate  $s$ . In stationary equilibrium, the hiring rate in the economy has to be equal to  $sl^s$ , and since the newly-employed take place from the pool  $u$ , the probability of unemployed workers to find jobs is  $sl^s/u$ . Therefore, the returns of an employed worker,  $U$ , fulfil:

$$rU = b + \frac{sl^s}{u}(E - U), \quad (14)$$

where  $E$  denotes the expected returns from a job and  $r$  is a constant rate of discount.

Consider the expected returns a worker receives under each of the two available options, shirking and not shirking, where  $r$  is the common discount rate. If the worker does not shirk and then supplies

<sup>7</sup> For instance, using British data, Zabalza et al. (1980) find  $\delta = 0.25$  for the men and  $\delta = 1.3$  for women.

<sup>8</sup> In 1997, Tunisian ratio of women and men in employment force are 0.24 and 0.76, respectively [La Banque Mondiale (1999)]. Thus, the assumed value of elasticity of substitution should be considered with caution.

<sup>9</sup> For a survey of works on efficiency wage theories, see Yellen (1984), Katz (1986), Blanchard and Fischer (1989), Murphy and Topel (1990), and Phelps (1994).

<sup>10</sup> For Phelps (1994), the term 'incentive wages' is a more accurate description of the role of wages in this models than the more conventional 'efficiency wages'.

<sup>11</sup> See also Bulow and Summers (1986) and Calvo (1979, 1985). In this type of models, unemployment is involuntary in the sense that unemployed workers agree to work at the market wage but cannot credibly signal not to shirk at this wage. Further discussion on this issue can be found in Nalebuff et al. (1993).



effort  $e$  or if he shirks but is not detected, he gets wage  $w_i$ . The worker will supply effort if the wage he earns rises the returns from supplying it beyond those from shirking. The returns from supplying effort,  $E_i^{ns}$ , fulfil:<sup>12</sup>

$$rE_i^{ns} = w_i - e - s(E_i^{ns} - U). \quad (15)$$

Yet, if the worker does not supply any effort, he could be detected and fired with a probability  $q$ . The returns from shirking,  $E_i^s$ , fulfil:

$$rE_i^s = w_i - (s + q)(E_i^s - U). \quad (16)$$

The firms have to pay a wage that leads workers to supply effort, but in this environment, they have no incentive to pay more than the minimum required. Therefore, the following condition has to be fulfilled:

$$E_i^{ns} = E_i^s \equiv E. \quad (17)$$

After substituting equations (15) and (16) into (17), and imposing symmetry, it is possible to deduce the next wage-setting equation:

$$w = rU + \frac{r + s + q}{q} e. \quad (18)$$

The premium awarded to the worker over his reservation wage is not related to his productivity. This premium exists only because the firm is unable to monitor perfectly workers so that there is no opportunity to shirk. For our purpose, equation (18) shows that the wage-setting curve locus is not altered by labor taxation. Since the structure of labor taxation does not matter for the labor demand, once the wage has been determined, then the most important implication is that revenue-neutral reforms which only modify labor taxation structure are ineffective in reducing unemployment, as in competitive labor market.

The specification of the efficiency wage model is achieved as soon as the return from unemployment,  $U$ , is appropriately resolved. Substituting from equations (14) and (15) into equation (18) we can deduce the final form of the wage-setting equation:

$$w = b + \frac{r + s + q}{q} e + \frac{l^s}{u} \frac{se}{q} \quad (19)$$

The new parameters in the efficiency wage model are  $q$  and  $e$ . There is no empirical evidence on either. This is a serious restriction of the model because with two free parameters, the condition that we used in the competitive mode, i.e. a 17.5 percent unemployment rate at the benchmark equilibrium, is not sufficient to calibrate the model. Since we have to decide on the value of one of these two parameters, the efficiency model is calibrated for  $e=0.1$ . The value of  $q$ , given the other parameters of the model, turns out to be  $q = 0.346$ .<sup>13</sup>

With the two previous models, revenue-neutral reforms which alter only labor tax instruments, by making labor taxation more progressive, are inefficient to fight against unemployment. Nevertheless, when wages are determined by bargaining, such reforms have a positive effect on employment, the illustration of which is the aim of the next section.

<sup>12</sup>  $s$  can be also considered as the probability that a non-shirking worker will be fired.

<sup>13</sup> Because sensitivity analysis shows that the simulation results are sensitive to the values of  $e$  and, hence,  $q$  chosen, they should be treated yet with caution.

## 6. Union Wage Bargaining

Another variation of the basic model is to delegate wage-setting to trade unions instead of the firm.<sup>14</sup> When workers are organized to negotiate the terms of employment, wage may be above and employment below their competitive levels. There exist two broad categories of wage bargaining models, namely the monopoly union model and the right-to-manage model.<sup>15</sup> Basically, there is a trade-off between wages and employment. We assume a right-to-manage model in which a single union bargains over wages while firms determine employment.<sup>16</sup> The union assumes that it is too small to influence the labor market equilibrium. In particular, collective wage bargaining involves the following Nash function:

$$\text{Max}_{w_i} \Omega_i = \Gamma_i^\theta \Pi_i^{1-\theta} \quad 0 \leq \theta \leq 1, \quad (20)$$

where  $\Gamma_i$  and  $\Pi_i$  denote the utilities of the union and the firm, respectively, and  $\theta$  represents the relative bargaining power of the union. If  $\theta = 1$ , we have the simple monopoly union, with the union choosing the wage and the firm choosing employment.

The utility of each firm equals revenues minus wage gross of tax paid by it:

$$\Pi_i = y_i^s - [(1 + t_w)w + a]l_i^d. \quad (21)$$

Concerning the utility of the union, there are many views of union behavior. This is because there is still no unanimity about the function, which characterize the best the union preferences, to use.<sup>17</sup> We follow the utilitarian approach, which has proved the most popular one in the analysis of labor market equilibrium with unions. Some of the results deduced when this utility function is adopted are yet too restrictive, and further work on union preferences is likely to improve the labor market characterization. The functional form of the union utility,  $v^u$ , following the utilitarian approach can be given by:

$$v_i^u = l_i^s \frac{w_i^{1-\gamma}}{1-\gamma} + (m_i - l_i^s) \left[ \frac{w^{1-\gamma}}{1-\gamma} (1-u) + \frac{b^{1-\gamma}}{1-\gamma} u \right], \quad (22)$$

where  $u$  and  $b$  are as defined above,  $l_i^s$  denotes the union employment,  $m_i$  is the union membership, assumed for convenience to be always greater than union employment,  $w_i$  is the wage rate negotiated by the union,  $w$  is the wage rate elsewhere, and  $\gamma$  is a coefficient of risk aversion, which is strictly greater than zero when union is assumed to be risk aversion.<sup>18</sup>

The assumption behind the specification (22) is that the union members who do not get employment in the union firm seek for a job elsewhere with a probability to find one paying  $w$  equal to the employment rate,  $(1 - u)$ , and a probability to fail and getting only  $b$  equal to the unemployment rate,  $u$ .

A decentralized union cannot influence either  $u$  or  $w$ . In equilibrium, nevertheless, all decentralized unions will negotiate the same wage and employment for their members, so  $w_i = w$  and  $u = 1 - l_i^s$ . The wage rate which results from the union and the firm bargain maximizes  $\Omega_i$ , given by expression (20), where  $\Gamma_i = v_i^u - v^u$  and  $v^u$  is the utility reached by union members if employment at the firm is zero [obtained by substituting  $l_i^s = 0$  in equation (22)]. After maximizing the expression (20) subject to equations (2) and (3) and imposing symmetry on the outcome, we arrive at the following wage equation:

<sup>14</sup> For a simplified presentation of standard wage bargaining models, see Blanchard and Fischer (1989). An extensive survey of work on the economic theory of union behavior is found in Oswald (1985).

<sup>15</sup> This latter category of models is also referred to as the efficient bargaining model.

<sup>16</sup> The monopoly union model is a special case where the firm has no bargaining power in wage setting and the union has no power in employment.

<sup>17</sup> See Farber (1986) for a discussion of union behavior.

<sup>18</sup> If  $\gamma = 0$ , risk neutrality of the firm is assumed and if  $\gamma = 1$ , i.e. risk aversion is assumed, the utility function of the union becomes logarithmic.

$$\theta[y^s - (1 + t_w)wl^s - al^s]w^{-\gamma} - \left[ \frac{\theta\sigma(1 + t_w)u}{(1 + t_w)w + a} + (1 - \theta)(1 + t_w)l^s u \right] \frac{w^{1-\gamma} - b^{1-\gamma}}{1 - \gamma} = 0. \quad (23)$$

Unemployment exists in equilibrium, above any competitive level, because it acts as a discipline on union wage requirements; unlike the efficiency wages model where the role of unemployment was to discipline workers into not shirking on job. When they seek to increase wage, unions create more unemployment, which would rise the probability that their members who do not find a job within their own firm will remain on benefit to such a level that makes any higher wage unattractive.

In contrast to the competitive model and efficiency wages one, employment tax reforms shift the wage-setting curve as well as the labor demand curve. Labor tax shifts the wage-setting curve because both firms and unions are conscious that the tax they bear is function of their wage choices: by not conceding a wage increase of one unit to the union, firm and union save  $t_w$  units. Because they are conscious of this saving, unions accept to settle for a lower wage. This saving does not arise with respect to the intercept  $a$ , so a given tax relief through this instrument of the labor tax is likely to have a larger effect on employment than through the  $t_w$  part. That's why the structure of labor taxation matters for equilibrium wages and unemployment in the presence of wage bargaining. Hence, in contrast to both competitive model and efficiency wages model, altering the structure of labor taxation by switching from the taxation of employment to the taxation of wages, i.e. by switching from  $a$  to  $t_w$ , lessens unemployment even revenue-neutrally.

Interestingly, however, when the tax policy parameter is  $\rho$ , proportional labor taxation (i.e.  $a = 0$ ) does not affect equilibrium unemployment, regardless of whether  $\sigma = 1$  or  $\sigma \neq 1$ . The labor demand curve locus and wage-setting one are both shifted upwards in this case by the same amount, and so labor tax relief are absorbed by wages with no effect on employment. Otherwise, when wages rise in response to labor tax relief, benefits are not adjusted upwards, unemployment is lower when labor taxes are lower even when labor taxation is proportional.

The union bargain model introduces two new parameters,  $\gamma$  and  $\theta$ . As in Pissarides (1998), the value of 0.8 is adopted for the first parameter. For the second parameter, its value is calibrated to give 17.5 percent unemployment in the presence of the current labor tax structure. This value, given the other parameters of the model, turns out to be  $\theta = 0.166$ .

## 7. Simulation Results

The three models are simulated for the parameters displayed in the previous sections. Two scenarios are considered. First, the different models are simulated assuming a constant replacement ratio with  $\rho = 0.3$ . Second, we assume a constant unemployment benefits (in nominal term) with  $\bar{b} = 0.126$ . The value of  $\bar{b}$  is obtained assuming that  $\rho = 0.3$  in the benchmark situation<sup>19</sup>.

For didactic reason, we have foremost simulated the impact of the labor tax elimination. Indeed, our models become inappropriate if they explain unemployment exclusively by labor tax. Simulations results are appealing since, as tables 2 and 3 reveal, labor tax explains at most 5.4 points of percentage of unemployment ratio. Hence, labor tax reforms are not the panacea to alleviate consistently the unemployment problem.

Three kinds of tax reforms revenue-neutrally are simulated within each scenario. The first ones alter only the labor tax instruments ( $a$ ,  $t_w$ ) to compute the effect of a more progressive structure of labor taxation. The second variety of reforms lessen the tax on labor (through the instrument  $a$ ) financed by a rise in consumption tax. The third category of reforms finance the labor taxes relief (through the decrease of the instrument  $a$ ) by an equivalent reduction in unemployment benefits. The simulations

<sup>19</sup> In reality, there is no unemployment benefit in Tunisia. Yet, as reported in La Banque Mondiale (1999), there is generous severances pay that are, in average, more important than the opportunity cost of the unemployment period. This is mainly the case in the public sector which employs almost the quarter of the labor force. Hence, we assume that severances pay yield a behavior that is very close to that adopted under unemployment benefits.

results of the different tax reforms are reported in table 2, for the case of a constant replacement ratio, and in table 3, for the case of a constant unemployment benefits.

As showed above, simulations results reported in both tables 2 and 3 confirm that the first kind of reforms are ineffective to fight against unemployment in competitive labor market and under the efficiency wage assumption. A more progressive labor tax has then no employment or wage effects in the competitive and efficiency wage models, no matter how the unemployment benefits are fixed. However, when wages are determined by bargaining, such reforms have only a small impact on employment and wages. The unemployment reduction does not exceed 1.1 points, with practically no change in the wage level.

Because the consumption expenditures are financed both by labor and capital income, the second kind of reforms relieve the tax burden on labor mainly in the efficiency wage model and, to some extent, in the union model. With constant unemployment benefits assumption, the unemployment fall is larger and could reach 2.1 percentage points, moving from 17.5 percent to 15.4 percent, in the efficiency wage model as table 2 shows. As for the competitive model, there is no really impact of such reforms on employment with constant replacement ratio as revealed in table 1. Indeed, the rise of the composite good price is virtually balanced by the increase in wages and so unemployment benefits, leaving real wage and employment unchanged. Yet with constant unemployment benefits, the purchasing power loss of workers is more important, prompting them to increase to some extent their labor supply.

The positive impact on employment is more important with the third kind of reforms, mainly under the efficiency wage model and the union wage bargaining model. The labor demand curve locus is shifted upwards as a result of labor taxation relief financed by equivalent cuts in unemployment benefits. Such reforms generate, to some extent, a bigger impact on employment and a smaller impact on wage when policy parameter is  $\bar{b}$  than when the policy parameter is  $\rho$ , as tables 2 and 3 report. For instance, the unemployment fall is equal to 4.3 percentage points, decreasing from 17.5 percent to 13.2 percent, in the union wage model with constant unemployment benefits, as table 2 shows, while this fall is only of 4.1percentage points, lowering from 17.5 percent to 13.4 percent, in the same model with constant replacement ratio, as table 1 reports.

## 8. Observations and Extensions

This study aims to assess the likely effects of tax reforms as a tool to fight against unemployment. Whilst many similar studies look for the impacts of cuts in labor taxation, we restrict here our simulations to the tax reforms revenue-neutrally, which are more plausible under budget deficit. The simulations are undertaken in three equilibrium models, namely a competitive model, an efficiency wage model, and a union model. We mainly find that reforms which alter only the structure of labor taxation are ineffective in alleviating unemployment in competitive and efficiency models. Yet such reforms decrease marginally unemployment when wages are determined by a bargain between firms and unions. The positive impact on employment is more important with reforms that reduce both labor taxation and unemployment benefits. For instance, simulations show that the unemployment fall could even reach 4.3 percentage points in the union wage model with constant unemployment benefits.

The above models assume that labor is homogenous, so they cannot be used to simulate the likely effect of targeted reduction in labor tax. The employment effects of labor taxes are somewhat more complicated if labor is differentiated by skill level. Nevertheless, when labor tax relief is focused on the low-paid, the labor tax structure becomes more progressive, when wages are determined by bargaining the model with union implies that a labor tax relief targeted on low incomes could have a higher employment effect than a general labor tax relief.

In the open economy context, nevertheless, labor and income taxes, whose effective burden is at least partially levied by workers, would also have implications for labor migration. As it enjoys better employment opportunities abroad, skilled labor are likely to be much more mobile than unskilled labor. Hence, revenue-neutral reforms that make labor tax more progressive should be reconsidered in the light of this constraint in a future research.

Another priority for a future study is to improve the capital market behavior. The models simulated in this study do not consider the capital supply and demand, the taxation of which can indirectly impinge on the labor market as well. In the short run, a decrease in the taxes on capital tends to raise the relative cost of labor. So, the capital-labor ratio would be increased at any production level pushing down the labor demand, the extent of which would depend on the elasticity of substitution between the production factors. In the long run, however, such a tax relief on capital is likely to promote investment and generate a favorable effect on economic growth and employment prospects. Thus, there may be a trade-off between short run costs and long run gains that it is worthy to model. All these issues should make up the subject of the extended investigations that this study will comprise.

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**Table 1: Labor Taxation Structure**

<b>W</b>	<b>tw</b>
$0 < w \leq 1\,500$	0
$1\,500 < w \leq 5\,000$	0.15
$5\,000 < w \leq 10\,000$	0.20
$10\,000 < w \leq 20\,000$	0.25
$20\,000 < w \leq 50\,000$	0.30
$w > 50\,000$	0.35

Source: Nsouli et al. (1993).



**Table 2: Simulation of tax change with constant replacement ratio ( $b = \rho w$  with  $\rho = 0.3$ )**

Scenarios	Tax instruments			Competitive			Efficiency			Union		
	a	tw	ty	u	w	ys	u	w	ys	u	w	ys
Labor tax removal.	0	0	0.145	0.173	0.470	0.925	0.141	0.455	0.940	0.188	0.477	0.918
Labor tax instruments	0	0.126	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.188	0.423	0.918
(progressivity) are altered for a	<b>-0.09</b>	<b>0.210</b>	<b>0.145</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>
constant consumption tax.	-0.135	0.252	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.169	0.419	0.927
	-0.180	0.300	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.164	0.414	0.929
Rising consumption tax to lower	-0.135	0.210	0.160	0.175	0.435	0.924	0.166	0.432	0.928	0.169	0.433	0.927
labor tax.	-0.180	0.210	0.177	0.174	0.451	0.924	0.158	0.445	0.932	0.164	0.447	0.929
Reducing unemployment benefits	-0.135	0.210	0.90*b	0.167	0.432	0.928	0.157	0.429	0.933	0.158	0.429	0.932
and labor tax.	-0.180	0.210	0.72*b	0.154	0.443	0.934	0.135	0.436	0.942	0.134	0.436	0.943

Notes: The benchmark situation is written in a bold format.

**Table 3: Simulation of tax change with constant, in nominal terms, unemployment benefits ( $b = \bar{b} = 0.126$ )**

Scenarios	Tax instruments			Competitive			Efficiency			Union		
	a	tw	ty	u	w	ys	u	w	ys	u	w	ys
Labor tax removal.	0	0	0.145	0.152	0.460	0.935	0.121	0.446	0.949	0.161	0.464	0.931
Labor tax instruments	0	0.126	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.186	0.422	0.919
(progressivity) are altered for a	<b>-0.09</b>	<b>0.210</b>	<b>0.145</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>	<b>0.175</b>	<b>0.420</b>	<b>0.924</b>
constant consumption tax.	-0.135	0.252	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.169	0.419	0.927
	-0.180	0.300	0.145	0.175	0.420	0.924	0.175	0.420	0.924	0.167	0.416	0.928
Rising consumption tax to lower	-0.135	0.210	0.160	0.172	0.434	0.926	0.164	0.431	0.929	0.166	0.432	0.928
labor tax.	-0.180	0.210	0.177	0.169	0.449	0.927	0.154	0.443	0.934	0.158	0.445	0.932
Reducing unemployment benefits	-0.135	0.210	0.90*b	0.165	0.432	0.929	0.155	0.428	0.933	0.156	0.428	0.933
and labor tax.	-0.180	0.210	0.72*b	0.152	0.442	0.935	0.134	0.436	0.943	0.132	0.435	0.944

Notes: The benchmark situation is written in a bold format.

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