



A “Managerial” trade union and economic growth

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Abstract

By setting up a simple Romer-type [Romer, P.M., 1989. Capital accumulation in the theory of long-run growth. In: Barro, R.J. (Ed.), *Modern Business Cycle Theory*. Harvard University Press, Cambridge, MA] endogenous growth model embodying a *political trade union* (rather than the traditional *economic* labor union), this paper explores the effects of unionization on unemployment, growth and welfare by highlighting the essence of *internal conflict* within the union. It is shown that the conflicting interests between the leadership and membership within the union play a decisive role in the unemployment, growth and welfare effects of unionization. Given the fact that taxation is another potential candidate besides unions in explaining the poor performance of a macro-economy, we re-examine the taxation effects within the growth model with equilibrium unemployment caused by the presence of the trade union and compare our findings with those for the traditional full-employment growth model. In general, we find that the taxation effects of income and consumption crucially depend not only on the institutional arrangements for taxing unemployment benefits, but also on the way the government budget is balanced.

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1. Introduction

While unemployment and economic growth are two central issues in macroeconomics, and a large number of studies have been devoted to each of them, only a few papers have jointly studied them in relation to each other. The main reason for this dichotomy is that unemployment is usually viewed as a pure business cycle phenomenon that will disappear in the long run, whereas economic growth is definitely seen as a long-term trend. In recent years, economists have increasingly recognized that this dichotomy between unemployment and growth may be too sharp. As stressed by [Bean \(1994\)](#); [Daveri and Tabellini \(2000\)](#), a large part of the existing unemployment, particularly in Europe, may be attributed to equilibrium unemployment. With this understanding, [Bean and Pissarides \(1993\)](#), [Aghion and Howitt \(1994\)](#), and [Bräuning \(2000\)](#), among others, have investigated the relationship between unemployment and growth in a growing economy with equilibrium unemployment.

A popular explanation for equilibrium unemployment is the collective bargaining that takes place between unions and employers. Indeed, in practice, while labor markets in most economies are far from being perfectly competitive, trade unions play an important role in many countries and union wage bargaining is the common means of determining wages, especially in continental Europe. In this paper, we therefore build a simple *endogenous growth* model in which the labor market is dominated by an economy-wide trade union. Since the trade union is able to capture rents and bargain over a wage that exceeds the market-clearing level, the growth model that we will set up is characterized by equilibrium unemployment.

The objectives of this study are very simple and can be roughly divided into two parts: (i) given a *managerial* trade union, we explore the effects of unionization (namely, increasing the bargaining power of the labor union) on unemployment, economic growth, and social welfare; and (ii) within the endogenous growth model characterized by equilibrium unemployment, we re-examine the effects of taxation, fully comparing them with those in the traditional full-employment growth model. The first objective is similar to that in several other papers, e.g., [Palokangas \(1996\)](#), [Irmen and Wigger \(2000\)](#), [Lingens \(2002\)](#), and [Ramos-Parreño and Sánchez-Losada \(2002\)](#). However, our emphasis is distinctive. [Palokangas \(1996\)](#) and [Lingens \(2002\)](#) shed light on the role of intersectoral interaction and labor mobility in the growth effect of unionization, while [Irmen and Wigger \(2000\)](#) and [Ramos-Parreño and Sánchez-Losada \(2002\)](#) develop an OLG model that focuses on the role of intergenerational resource allocation and *altruism* in relation to that same effect. In departing from their analysis, this paper sets up a simple *Romer-type (1989)* endogenous growth model and uses it to explore the effects of unionization on unemployment, growth and welfare by highlighting the essence of *internal conflict within a political union*.

There was a famous debate between Dunlop and Ross. [Dunlop \(1944\)](#) argued (as in most of the economic literature) that a trade union aimed to rationally maximize “something,” say, either a *utilitarian objective* function or an *expected utility* function. This viewpoint, which may have been standard in economics, was challenged by [Ross \(1948\)](#). He claimed that trade unions were *political institutions* in their own right, and that economists’ use of such a maximization approach ignored their vital political dimension. In the Ross sense, the behavior of a political trade union should have reflected internal conflicts between different factions, especially the leadership and membership, rather than

a simple maximization of choice. [Pemberton \(1988\)](#) side-stepped Ross's point and developed a *managerial* model which could, on the one hand, identify the so-called "something" that Dunlop argued unions maximized, and also, on the other hand, capture the essence of internal conflicts within trade unions. By following [Pemberton \(1988\)](#), the present paper specifies that in a growing economy there is a "managerial" trade union, whose policy is influenced by both leadership (management) and membership preferences. Specifically, the leadership desires to strengthen the union by building up membership and hence employment (we are easily convinced that the leadership is interested in union size, on the basis of the common notion that bureaucrats prefer large organizations). Under such a situation, we can refer to the union's policy as "employment-oriented." However, the membership has a conflicting interest in light of this and desires to extract higher excess wages from employers. The "wage-oriented" policy implies that the union is more *democratic* or *populist*.

Given such a political trade union, we show that the conflicting interests between the leadership and membership within the union play a decisive role in the unemployment, growth and welfare effects of unionization. To be specific, the higher relative bargaining power of the union will result in a lower (higher) unemployment rate and a higher (lower) balanced-growth rate if the union is employment-oriented (wage-oriented), i.e. the leadership (membership) within the union has the dominant power. If the union is neutral, unionization will have no impact on either unemployment or economic growth. As a consequence, we also point out that a higher degree of unionization will have a positive (negative) effect on social welfare if the union is employment-oriented (wage-oriented). This implies that, somewhat surprisingly, when the union is more *democratic* and more aggressively extracts higher *wages* from firms, unionization will instead give rise to a negative effect on welfare.

Besides unions, taxation may be another potential candidate for explaining the poor performance of employment and economic growth (see, for example, [Nickell and Layard, 1999](#); [Daveri and Tabellini, 2000](#)). Perhaps due to the dichotomy we mentioned earlier, so far the growth effect of taxation has been explored mostly in the context of competitive labor markets that are characterized by full employment. Therefore, the second aim of this paper is to re-examine the taxation effects within the growth model with equilibrium unemployment (caused by the presence of the trade union) and compare our findings with those in the traditional full-employment growth models.

The literature on endogenous growth predicts that different taxes affect growth in diverse ways. In models of exogenous labor supply, whilst an income tax is harmful to economic growth, a consumption tax does not affect an individual's incentive to accumulate capital and therefore leaves growth unaffected (see, e.g., [Rebelo, 1991](#), for the consumption tax neutrality). The models with endogenous labor supply, such as [Turnovsky \(2000\)](#), indicate that an increase in either income or consumption tax leads to a decrease in the supply of labor, resulting in a substitution of leisure for labor, and further leads to a reduction in the growth rate.¹ In our endogenous growth model with equilibrium unemployment, two institutional elements: (i) arrangements for taxing unemployment benefits; and (ii) the way in which the government budget is financed by

¹Brief discussions concerning the effects of taxation in models of endogenous labor supply are provided by [Devereux and Love \(1994\)](#), [Stokey and Rebelo \(1995\)](#), and [Milesi-Ferretti and Roubini \(1998\)](#).

adjusting lump-sum taxes or unemployment benefits, are highlighted and they will jointly affect the unemployment and growth effects of taxation.

A particular emphasis is placed on the role of institutional arrangements for taxing unemployment benefits. According to a summary by *Koskela and Schöb (1999)*, there exist various institutional arrangements for taxing unemployment benefits in the 15 EU member countries. In some countries (e.g., the United Kingdom, France, Belgium, and Sweden) unemployment benefits are subject to income taxation, but in other countries (e.g., Germany, Austria, and Portugal) unemployment benefits are exempted from taxation.² Even in the presence of institutional differences in arrangements with respect to unemployment benefits, with few exceptions (see *Pissarides, 1998; Koskela and Schöb, 1999*), these institutional features are largely neglected in the literature on both trade unions and endogenous growth.

By taking these institutional features into account, our study shows that, if the government budget is financed by adjusting lump-sum taxes and unemployment is subject to income taxation, the consumption tax has no impact on unemployment and economic growth, while income tax reduces the balanced-growth rate even though it also has no effect on unemployment. However, if income tax is targeted at labor earnings, but excludes benefits, an increase in the income tax rate has ambiguous effects on unemployment and growth and a higher consumption tax rate is favorable to unemployment and economic growth. These results obviously stand in sharp contrast to those in the existing endogenous growth models that are characterized by either a fixed or flexible labor supply. On the other hand, if the government budget is financed by adjusting unemployment benefits, we show that both income and consumption taxes are harmful to unemployment and economic growth, due to an additional distortionary effect. In such a case, the taxation effects in the unionized model with equilibrium unemployment are qualitatively similar to the full employment models, where the labor supply is endogenously determined.

The remainder of this paper proceeds as follows. In Section 2, we set up a simple endogenous growth model with a managerial trade union in which we lay particular emphasis on the essence of internal conflicts between the leadership and membership within the union and on various institutional arrangements for taxing unemployment benefits. In Section 3, the dynamic properties of the unionized economy are analyzed. In Section 4, we investigate the effect of unionization on unemployment, growth and welfare, and re-examine the taxation effects within an endogenous growth model characterized by equilibrium unemployment. Finally, concluding remarks are provided in Section 5.

2. The model

Consider a unionized economy consisting of four types of agents: Households, firms, a (national) trade union and a government. To shed light on the role of the trade union in the labor market, we assume, for simplicity, that the product market is perfectly competitive. The firms produce goods from labor and physical capital through Cobb–Douglas technology, and an economy-wide trade union engages in centralized bargaining with one economy-wide federation, which represents employers. In contrast to

²The updated information is available by referring to OECD's Benefits and Wages publication series (the address of the web site: http://www.oecd.org/document/0/0,2340,en_2649_34633_34053248_1_1_1_1,00.html), where detailed descriptions of tax and benefit rules in a consistent format across countries are provided.

the common “economic” (i.e. utilitarian) models of trade unions, we adopt a Ross-type approach in which a union is a “political” organization in the sense that its behavior reflects the internal conflict between its leadership (or management) and its membership, rather than simply involving a rational maximization of choice. Accordingly, as we will make clearer later, there exists a political conflict within the union: The leadership is interested in employment (and hence union size) and the membership is more concerned with the excess wage. Households derive utility from consumption and (if employed) provide their labor inelastically to firms. As in the common growth models, the population growth rate is normalized to zero. Finally, the government levies taxes, including an income tax, a consumption tax, and a lump-sum tax, to finance the expending of unemployment benefits b and, accordingly, balances its budget in each period.

2.1. Firms, the trade union, and collective bargaining

2.1.1. Firms

Firms hire physical capital k and labor l to produce a single good y which can be consumed or invested. In line with Romer (1989), production is subject to the following technology:

$$y = f(k, l, \bar{k}) = A(\bar{k})k^\alpha l^\beta, \quad 0 < \alpha < 1, \quad 0 < \beta < 1, \quad (1)$$

where \bar{k} is the average economy-wide stock of capital. In (1) we impose the restriction that the individual firm’s production technology exhibits decreasing returns to scale in its *internal* capital k and labor l factors, i.e. $0 < \alpha + \beta < 1$. This specification leads firms to have a positive profit when the employers’ federation owns some degree of bargaining power, which can be justified by implicitly assuming that there exists another fixed factor (for example, land) that earns rent. In addition, as indicated by Wu and Zhang (1998), the production function is subject to a productivity externality, which is captured by $A(\bar{k})$. The external effect refers to the spillovers of knowledge that operate at the average level of the overall economy. For convenience, we specify that $A(\bar{k}) = A \cdot \bar{k}^{1-\alpha}$, implying that the aggregate production function exhibits constant returns to scale, thereby generating perpetual growth.

Given the production technology (1), the representative firm attempts to maximize its profit π as follows:

$$\pi = y - wl - rk, \quad (2)$$

where w and r are the wage rate and the rental rate of capital, respectively.

2.1.2. Trade union

Following Pemberton (1988), we assume that the trade union is a “managerial” one whose policies are influenced by both leadership (management) and membership preferences. The leadership desires to strengthen the union by building up its membership. Given the assumption of a *closed shop union*, the desire for a higher membership is equivalent to the desire for a higher level of employment.³ However, this conflicts with the membership preference: The median worker is interested in the excess wage. Given the

³In the closed shop union, only union members are eligible for employment; hence the level of membership is equivalent to the level of employment.

conflict between the leadership and membership preferences, we specify, in line with Pemberton (1988), that the managerial trade union's objective function has the following Stone–Geary form:⁴

$$U = (\hat{w} - \hat{b})^\delta l^v, \quad (3)$$

where \hat{w} and \hat{b} are the after-tax wage rate and unemployment benefits in terms of the real variables, respectively. The wage income is subject to lump-sum taxation \tilde{T} and income taxation at the rate τ . By defining τ_c as the consumption tax rate, the real after-tax wage is thus $\hat{w} = [(1 - \tau)w - \tilde{T}]/(1 + \tau_c)$. However, the real unemployment benefits crucially depend on the institutional arrangements. As stated in the Introduction, there exist various institutional arrangements for taxing unemployment benefits in the 15 EU member countries. In some countries, for instance, unemployment benefits are subject to income taxation, but in the other countries unemployment benefits are exempted from taxation. To capture the institutional differences, in this paper we distinguish two relevant scenarios with respect to the unemployment compensations and specify⁵

$$\hat{b} = \frac{(1 - \varepsilon\tau)b - \varepsilon\tilde{T}}{1 + \tau_c}. \quad (4)$$

In (4) ε is a dummy variable; specifically, if $\varepsilon = 1$, the unemployment benefits are taxable and if $\varepsilon = 0$, the unemployment benefits are exempted from taxation.⁶ One point should be noted here. Given that wages and unemployment benefits may be taxed asymmetrically, under alternative scenarios taxation will give rise to different effects on (un)employment and economic growth when the government balances its budget. This point will be discussed in more detail below.

As shown in (3), the parameters $\delta \geq 0$ and $v \geq 0$ correspond to the excess wage ($\hat{w} - \hat{b}$) and to the employment level l elasticities of the union's objective U , respectively. Following our earlier discussion, v and δ can be thought of as the distribution of the internal power of leadership and membership, respectively. The larger the difference ($\delta - v$), the more the union approaches the extreme of a “democratic” (or “populist”) union. When $\delta = v$, these two parties have an identical discretionary power in formulating policies. In a strategic trade model, Mezzetti and Dinopoulos (1991) state that the union is “wage oriented” if $\delta > v$, while it is “employment oriented” if $\delta < v$.

2.1.3. Collective bargaining

The efficient bargaining model as proposed by McDonald and Solow (1981) has been an important framework in the trade union literature. The central feature of such a model is the requirement that the negotiated wage–employment contract should be *efficient* for both the employer and the union. With this feature, we follow Clark (1990) and assume, without loss of generality, that both the union and the employers' federation bargain over (nominal) wages and employment through the *generalized Nash bargaining solution*, subject

⁴See Pemberton (1988) for detailed derivations. Such a Stone–Geary utility function of the trade union is also supported by the empirical studies of Dertouzos and Pencavel (1981).

⁵For simplicity, wage incomes and unemployment benefits are taxed at the same rate τ .

⁶The $\varepsilon = 0$ case can also be thought of as that where taxes paid on unemployment benefits are lower than the tax credit (which is implicit in our model) and, accordingly, the unemployed do not pay any taxes.

to the firms’ demand for capital.⁷ Given that the bargaining disagreement point results in a zero employment level, this optimization problem can be expressed as

$$\begin{aligned} \max_{w,l} \Omega &\equiv [(\hat{w} - \hat{b})^\delta l^\nu]^\theta \cdot [A(\bar{k})k^\alpha l^\beta - wl - rk]^{1-\theta}, \\ \text{s.t. } k &= \arg \max_k \pi, \end{aligned}$$

where $\theta \in (0, 1)$ is a parameter that denotes the relative bargaining strength of the union.

By some simple manipulations, the optimal conditions for the wages and employment are given by

$$\hat{w} - \hat{b} = \frac{\delta}{v} \frac{1 - \tau}{1 + \tau_c} [w - \beta A(\bar{k})k^\alpha l^{\beta-1}], \tag{5}$$

$$w = \left[\beta + \frac{\theta v(1 - \alpha - \beta)}{1 - \theta + \theta v} \right] A(\bar{k})k^\alpha l^{\beta-1}, \tag{6}$$

and the firm’s capital demand function is

$$r = \alpha A(\bar{k})k^{\alpha-1} l^\beta. \tag{7}$$

As in the traditional theory of union bargaining, (5) describes the *contract curve* in the (w, l) space and (6) depicts the *rent division curve* (see Booth, 1995, for details). The contract curve is upward (downward) sloping if and only if the union is employment- (wage-) oriented $\delta < v$ ($\delta > v$).⁸ This result obviously differs from the traditional union bargaining theory which predicts that, if the union is risk-averse (i.e. its preference is characterized by a concave utility of income function), the slope of the contract curve is positive; while if it is risk-loving, the contract curve turns out to be negatively sloped. This distinction, as we will see in Section 4, will play a prominent role in our analysis. In addition to this, we can also see from (5) that the specification as to whether unemployment benefits are subject to taxation or not will affect the contract curve via the union’s fallback \hat{b} ($= [(1 - \varepsilon\tau)b - \varepsilon\tilde{T}]/(1 + \tau_c)$), and hence will further influence the determination of the bargained wage and employment.

The *rent division curve* shown in (6) is in conformity with the common characteristics of the traditional efficient bargaining models. Generally speaking, given a particular level of employment, as the union’s bargaining power θ increases, the negotiated wage rate will rise. Eq. (7) is a standard $r = MPK$ condition. To simplify the analysis and also conform to the standard trade union models, we do not incorporate the union’s preference concerning physical capital into its utility function as reported in (3).⁹ Given this simplicity, we can easily realize that the level of k satisfying (7) will be the same as that under an efficient wage–employment–capital contract (under which the wage, employment, and capital are simultaneously determined from the negotiation between the employers’ federation and the

⁷It is important to emphasize that in a model characterized by pure wage bargaining, for example the right-to-manage model and its special case, the monopoly union model, our result concerning the mixed relationship between growth and unionization still holds. Although the detailed analysis is omitted from this paper due to the considerations of space, the mathematical derivation is available from the authors upon request.

⁸From (5), we have $\partial w / \partial l = \delta(1 - \beta)\beta A(\bar{k})k^\alpha l^{\beta-2} / (v - \delta) \geq 0$ iff $v \geq \delta$.

⁹Some researchers, e.g., Clark (1990), introduce the so-called “manning ratio” (by which is meant the capital–labor or output–labor ratio) into the negotiation between unions and employers. See Booth (1995, pp. 121–122) for details.

trade union). Such a result is consistent with Clark (1990) and Ulph and Ulph (1990, p. 109). This also allows us to avoid the consequence of inefficiency, whereby unionization leads to underinvestment.¹⁰

Because the labor market is characterized by unionization, market imperfection will result in a positive profit for firms. By substituting (5)–(7) into (2), the representative firm's profit function is given by

$$\pi = \frac{(1 - \theta)(1 - \alpha - \beta)}{1 - \theta + \theta v} A(\bar{k})k^\alpha l^\beta \geq 0. \quad (8)$$

Eq. (8) indicates that, given the assumption of $0 < \alpha + \beta < 1$, the firm's profit is positive as long as the employers' federation has a positive bargaining power, i.e. $0 < \theta < 1$. In the extreme case where the union's bargaining power is absolute ($\theta = 1$), the firm's profit is reduced to zero.

2.2. Households

The economy is populated by a unit measure of identical, infinitely lived households. Each household is endowed with one unit of time and has an instantaneous CRRA utility function with respect to consumption c .¹¹ Accordingly, the individual household chooses c so as to maximize the discounted sum of future instantaneous utilities. Specifically, with an intertemporal elasticity of substitution $1/\sigma$, the household's optimization problem is

$$\max \int_0^\infty \frac{c^{1-\sigma} - 1}{1 - \sigma} e^{-\rho t} dt, \quad (9)$$

subject to the following flow budget constraint:

$$\text{s.t. } \dot{k} = (1 - \tau)(rk + \pi + wl) + (1 - \varepsilon\tau)b(1 - l) - (1 + \tau_c)c - [l + \varepsilon(1 - l)]\tilde{T}, \quad (10)$$

and a positive capital endowment $k_0 > 0$. The sources of income of a representative individual, as shown in (10), consist of capital income rk , labor income wl , and the profits π transferred from firms. For simplicity and to focus our point, the same income tax rate τ is imposed on all types of income. It is worth noting that, in a unionized economy, the labor market may be characterized by an equilibrium unemployment rate, say, $1 - l$. When the worker is unemployed, he will receive unemployment benefits b from the government. However, to avoid an unnecessarily complicated derivation, we follow Van der Ploeg (1987), Palokangas (1996), and Lingens (2002) and assume that the number of households is continuous and infinite. Therefore, $wl + b(1 - l)$ can be thought of as the "average" labor income of an individual household. As a result, the "average" tax imposed on labor is given by $(\tilde{T} + \tau w)l + \varepsilon(\tilde{T} + \tau b)(1 - l)$, as indicated in (10).

From (9) and (10), a simple manipulation yields the standard Keynes–Ramsey rule:

$$\frac{\dot{c}}{c} = \frac{1}{\sigma} [(1 - \tau)r - \rho]. \quad (11)$$

¹⁰Grout (1984) shows that, given that the firm is a monopoly, under "the non-binding contracts" the presence of a union will lead to underinvestment if the resale price of capital is less than its purchase price. Van der Ploeg (1987) incorporates the adjustment costs of investment into a dynamic model and finds that unionization may also be associated with lower investment.

¹¹The case of log-linear utility is excluded to maintain the homogeneity of the preferences.

Let γ_c^{\max} be the maximum sustainable rate of consumption growth. To ensure that the lifetime utility is bounded, we impose the Brock–Gale condition as follows:

Condition B (bounded utility): $\rho > (1 - \sigma)\gamma_c^{\max}$.

2.3. The government and the resource constraint

The government collects taxes, including income taxes $\tau(rk + \pi + wl)$, consumption taxes $\tau_c c$, and lump-sum taxes $[l + \varepsilon(1 - l)]\tilde{T}$ to finance the expending of unemployment benefits $b(1 - l)$. To have an ongoing growth rate, we should specify $b = sy$, where s is the unemployment benefit–GDP ratio in the endogenous growth model.¹² Moreover, to simplify the notation, we further specify the *aggregate revenue* levied from lump-sum taxes as $T = [l + \varepsilon(1 - l)]\tilde{T}$. This implies that under the $\varepsilon = 1$ case $T = \tilde{T}$ and under the $\varepsilon = 0$ case $T = l \cdot \tilde{T}$. Thus, at any instant of time, the government budget constraint can be expressed as

$$b(1 - l) = \tau(rk + \pi + wl) + \varepsilon\tau b(1 - l) + \tau_c c + T. \tag{12}$$

In line with the common specification in the endogenous growth models, we assume that the government balances its budget (12) in each period by adjusting lump-sum taxes. Nevertheless, to have a more complete picture of the taxation effects, in Section 4 we will extend our model to include the case where the government balances its budget by adjusting unemployment benefits b . Since unemployment benefits will give rise to an additional distortionary effect, the assumption that b serves as the balancing item will result in distinctive taxation effects on economic growth.

Putting the government’s budget constraint (12), the household’s budget constraint (10), the firm’s production function (1) and the profit function (2) together yields the aggregate resource constraint of the economy:

$$\dot{k} = y - c = A(\bar{k})k^\alpha l^\beta - c. \tag{13}$$

2.4. Equilibrium

In a symmetric equilibrium, all firms make the same choices, so that $k = \bar{k}$ applies. Equipped with this, we rewrite (5)–(8), (11)–(13) and, accordingly, summarize the equilibrium conditions of the economy as follows:

$$\hat{w} - \hat{b} = \frac{\delta}{v} \frac{1 - \tau}{1 + \tau_c} (w - \beta Ak l^{\beta-1}), \tag{5a}$$

$$w = \frac{\theta v(1 - \alpha) + (1 - \theta)\beta}{1 - \theta + \theta v} Ak l^{\beta-1}, \tag{6a}$$

$$r = \alpha A l^\beta, \tag{7a}$$

$$\pi = \frac{(1 - \theta)(1 - \alpha - \beta)}{1 - \theta + \theta v} Ak l^\beta, \tag{8a}$$

¹²It follows from (6) that wage incomes are proportional to output. Therefore, to some extent, the term s can be viewed as the replacement rate.

$$T = b(1 - l) - \tau(rk + \pi + wl) - \varepsilon\tau b(1 - l) - \tau_c c, \tag{12a}$$

$$\dot{k} = Ak l^\beta - c, \tag{13a}$$

and the Keynes–Ramsey rule as

$$\frac{\dot{c}}{c} = \frac{1}{\sigma} [(1 - \tau)\alpha Al^\beta - \rho], \tag{11a}$$

recalling that in (5a) $\hat{w} = [(1 - \tau)w - \tilde{T}]/(1 + \tau_c)$ and $\hat{b} = [(1 - \varepsilon\tau)b - \varepsilon\tilde{T}]/(1 + \tau_c)$ and in (12a) $T = [l + \varepsilon(1 - l)]\tilde{T}$.

3. Stability analysis

Define a transformed variable $x = c/k$. Thus, from (5a)–(8a) and (12a) with $b = sy = sAk l^\beta$, we can easily obtain the following relationship:

$$\left\{ s(1 - \varepsilon\tau) - \left[\Theta \left(1 - \frac{\delta}{v} \right) + \frac{\delta}{v} \beta \right] (1 - \tau)(1 - \varepsilon) - (1 - \varepsilon)\tau \right\} Al^\beta - \left[\Theta \left(1 - \frac{\delta}{v} \right) + \frac{\delta}{v} \beta \right] (1 - \tau)\varepsilon Al^{\beta-1} = (1 - \varepsilon)\tau_c x, \tag{14}$$

where $\Theta = [\theta v(1 - \alpha) + (1 - \theta)\beta]/(1 - \theta + \theta v)$ (accordingly, $\Theta_\theta = v(1 - \alpha - \beta)/(1 - \theta + \theta v)^2 > 0$). Eq. (14) allows us to solve employment l for the instantaneous relationship. Specifically, in the $\varepsilon = 1$ case, the employment function can be implicitly expressed as

$$l = l(\theta, s), \tag{15a}$$

where $l_s = -l/s < 0$ and $l_\theta = \Theta_\theta[1 - (\delta/v)]/s \geq 0$, iff $v \geq \delta$. On the other hand, in the $\varepsilon = 0$ case, (14) is reduced to

$$l = l(x; \theta, \tau, \tau_c, s), \tag{15b}$$

where $l_x = l/\beta x > 0$, $l_\tau = -\{\Theta[1 - (\delta/v)] + (\beta\delta/v) - 1\}Al^{\beta+1}/(\beta\tau_c x) \geq 0$, $l_{\tau_c} = l/(\beta\tau_c) > 0$, $l_s = -Al^{\beta+1}/(\beta\tau_c x) < 0$, and $l_\theta = \Theta_\theta[1 - (\delta/v)](1 - \tau)Al^{\beta+1}/(\beta\tau_c x) \geq 0$, iff $v \geq \delta$.

It is worthwhile briefly discussing the employment function. First, as noted earlier, the contract curve is upward (downward) sloping if and only if the union is employment- (wage-) oriented. Therefore, it is quite straightforward to deduce that a higher relative bargaining power θ will boost the employment rate when the union is employment-oriented (i.e. $v > \delta$). Moreover, (15a) and (15b) indicate that more generous unemployment benefits are harmful to employment, which is consistent with the standard result in the theory of trade unions. It is important to remind the reader that these two results hold true in both cases where $\varepsilon = 1$ and 0, regardless of whether unemployment benefits are subject to income taxation or not.

Second, the taxation effect on employment crucially depends, however, upon institutional arrangements for taxing unemployment benefits. If unemployment payments are taxable and are subject to the same tax rate as labor earnings ($\varepsilon = 1$), an increase in either the income tax rate τ or the consumption tax rate τ_c will not drive any wedge between the after-tax incomes of employed and unemployed workers. As a result, changes in the taxation will have no impact on negotiated employment. By contrast, when

unemployment benefits are exempted from taxation ($\varepsilon = 0$), the institutional arrangement itself will generate distortions in terms of affecting the union’s behavior. It follows from (3) and (4) that, in the case of $\varepsilon = 0$, a higher tax rate τ will drive a wedge between income if employed and income if unemployed (to be specific, it will decrease the magnitude of the excess wage $\hat{w} - \hat{b}$). Once the internal power of the membership is sufficiently large, namely $\delta > v$ (i.e. the union is wage-oriented), this distortion will lead the trade union to accept a lower level of employment in exchange for a higher bargained excess wage. However, to balance the budget, a higher τ allows the government to reduce the lump-sum tax imposed on wage incomes. This tends to dissuade the union from raising wages and, accordingly, alleviates the negative distortionary effect on employment. Given these two opposing effects, we have $l_\tau \geq 0$. In addition, by referring to (3) and (4), we learn that a tax on consumption generates an overall impact on consumers regardless of whether they are employed or unemployed workers. In the absence of the distortion effect of consumption taxes, a rise in τ_c will lead the government to reduce the lump-sum tax, thus boosting the level of employment, i.e. $\partial l / \partial \tau_c > 0$. To sum up, taxes affect employment only to the extent that they alter the relationship between income while employed and income while unemployed.

By substituting (15a) or (15b) into the Keynes–Ramsey rule (11a) and the aggregate resource constraint (13a), the dynamic system of the macro model can be represented by

$$\frac{\dot{c}}{c} = \frac{1}{\sigma} [(1 - \tau)\alpha A l^\beta - \rho], \tag{16}$$

$$\frac{\dot{k}}{k} = A l^\beta - x. \tag{17}$$

To obtain an endogenous growth rate, we further use (16) and (17) to transform the dynamic system in terms of the variable x as follows:

$$\frac{\dot{x}}{x} = \frac{\dot{c}}{c} - \frac{\dot{k}}{k} = \frac{(1 - \tau)\alpha - \sigma}{\sigma} A l^\beta + x - \frac{\rho}{\sigma}. \tag{18}$$

Note that in (18) $l = l(\theta, s)$ (reported in (15a)) under the $\varepsilon = 1$ case, while $l = l(x; \theta, \tau, \tau_c, s)$ (reported in (15b)) under the $\varepsilon = 0$ case.

A non-degenerate balanced-growth-path (BGP) equilibrium is characterized by $\dot{x} = 0$ in (18) and in the BGP equilibrium consumption and capital grow at a common growth rate and the level of employment is a steady state constant. To ensure a non-degenerate BGP, we assume:

Condition G (Positive growth): $(1 - \tau)\alpha A l^\beta > \rho$.

We are ready to deal with the problem of the existence and uniqueness of the BGP equilibrium. For both cases where $\varepsilon = 1$ and 0, we utilize Figs. 1 and 2 to identify the existence and uniqueness of the BGP equilibrium, respectively. Thus, we establish:

Theorem 1. (Existence and uniqueness of the non-degenerate BGP). Under conditions B and G there exists a unique balanced growth equilibrium in the unionized economy.

Proof. At the steady-growth equilibrium, the economy is characterized by $\dot{x} = 0$ and x is at its stationary value, namely, \tilde{x} . Under condition B, from (14) and (18) with $\dot{x} = 0$, the

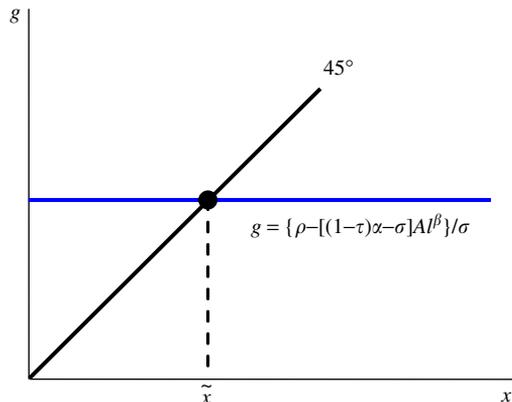


Fig. 1. The $\varepsilon = 1$ case.

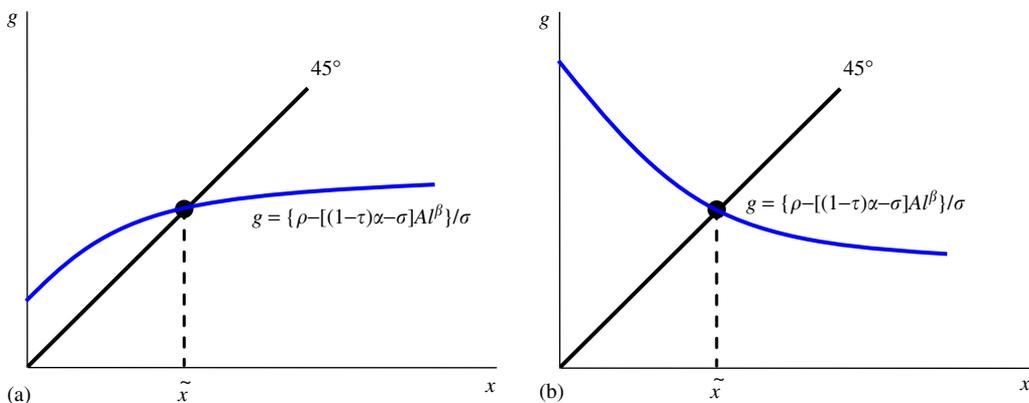


Fig. 2. The $\varepsilon = 0$ case with (a) $(1 - \tau)\alpha - \sigma < 0$; (b) $(1 - \tau)\alpha - \sigma > 0$.

steady-state consumption–capital ratio \tilde{x} is determined by

$$x = \frac{\rho}{\sigma} - \frac{(1 - \tau)\alpha - \sigma}{\sigma} Al^\beta > 0, \tag{19}$$

where $l = l(\theta, s)$ in the $\varepsilon = 1$ case and $l = l(x; \theta, \tau, \tau_c, s)$ in the $\varepsilon = 0$ case. Define the RHS of (19) as a function $g(x)$. The function $g(x)$ is a horizontal line under case $\varepsilon = 1$ (shown in Fig. 1), whereas it may be either monotonically increasing and concave (shown in Fig. 2a) or decreasing and convex in \tilde{x} (shown in Fig. 2b) under case $\varepsilon = 0$, crucially depending on $(1 - \tau)\alpha - \sigma \gtrless 0$. By referring to Figs. 1 and 2, the fixed point theorem immediately leads to a stationary \tilde{x} that exists and is unique.

Based on (19), from (15) and (16) we can further solve the common balanced-growth rate $\tilde{\gamma}$:

$$\tilde{\gamma} = \tilde{\gamma}_c = \tilde{\gamma}_k = \tilde{\gamma}_y = \frac{1 - \tau}{\sigma} \alpha A \tilde{l}^\beta - \frac{\rho}{\sigma}. \tag{20}$$

The corresponding steady-state employment \tilde{l} under case $\varepsilon = 1$ is

$$\tilde{l} = \tilde{l}(\theta, s), \tag{21a}$$

and under case $\varepsilon = 0$ is

$$\tilde{l} = l(\tilde{x}(\theta, \tau, \tau_c, s); \theta, \tau, \tau_c, s) = \tilde{l}(\theta, \tau, \tau_c, s). \tag{21b}$$

Since the non-degenerate property is guaranteed by condition G, \tilde{y} and \tilde{l} are also unique. \square

We now turn to the investigation of dynamic stability. According to (18), we have the following lemma:

Lemma 1. (Dynamic determinacy). *Given Theorem 1 equilibrium of the unionized economy is locally determinate in both cases $\varepsilon = 1$ and 0.*

Proof. Linearizing (18) around the steady state \tilde{x} gives

$$\dot{x} = D(x - \tilde{x}),$$

where $D = \tilde{x} + \{[(1 - \tau)\alpha - \sigma]/\sigma\}\beta A \tilde{l}^{\beta-1} l_x \tilde{x}$. As addressed in the literature on dynamic rational expectations models, e.g., [Buiter \(1984\)](#), the dynamic system will have a unique perfect-foresight equilibrium path if the number of (positively) unstable roots equals the number of jump variables. Given that there is one jump variable x in this system, the dynamic equilibrium will be locally determinate if $D > 0$. By contrast, there exists a continuum of equilibrium trajectories that converges to the steady state and, accordingly, local indeterminacy emerges in the economy if $D < 0$. By focusing on the case where $\varepsilon = 1$ and referring to (15a), we have $l_x = 0$ and, as a result, $D = \tilde{x} > 0$ is true. On the other hand, in the case where $\varepsilon = 0$, substituting l_x reported in (15b) and the equilibrium condition (19) into D gives

$$D = \frac{\rho}{\sigma} > 0.$$

These results imply that the equilibrium of the unionized economy is locally determinate in both cases where $\varepsilon = 1$ and 0.¹³ \square

4. Unemployment, growth and welfare effects

In this section we explore the employment, growth, and welfare effects of unionization (an increase in the union’s bargaining power θ) under both scenarios where $\varepsilon = 1$ and 0.

¹³It may be interesting to remark that if the government budget is financed by adjusting unemployment benefits, rather than lump-sum taxes (such a case will be discussed in the next section), dynamic indeterminacy may occur when the household’s intertemporal elasticity of substitution and the union’s bargaining power are substantially high. See [Chang et al. \(2004\)](#) (an earlier version of this article) for a more complete discussion. The mathematical deduction is also available upon request.

4.1. The unemployment and growth effects of unionization

Given that the unionized economy is characterized by dynamic determinacy, we have the following interesting proposition:

Proposition 1. (*The effects of unionization*). Under Theorem 1 and Lemma 1, a higher relative bargaining power θ will result in a lower (higher) unemployment rate and a higher (lower) balanced-growth rate if the union is employment-oriented $v > \delta$ (wage-oriented $v < \delta$), i.e. the leadership (membership) within the union has dominant power. When the union is neutral $v = \delta$, unionization has no impact on either unemployment or economic growth. These results hold true regardless of whether unemployment benefits are subject to taxation or not.

Proof. From (20) and (21), we immediately have

$$\frac{\partial(1 - \tilde{l})}{\partial\theta} = -\tilde{l}_\theta \leq 0 \quad \text{iff } v \geq \delta, \quad (22)$$

$$\frac{\partial\tilde{\gamma}}{\partial\theta} = \frac{(1 - \tau)\alpha}{\sigma} \beta A l^{\beta-1} \tilde{l}_\theta \geq 0 \quad \text{iff } v \geq \delta, \quad (23)$$

where $\tilde{l}_\theta = \Theta_\theta[1 - (\delta/v)]/s$ in the $\varepsilon = 1$ case and $\tilde{l}_\theta = \sigma\Theta_\theta[1 - (\delta/v)](1 - \tau)A l^{\beta+1}/(\rho\tau_c\beta)$ in the $\varepsilon = 0$ case. \square

When the union is employment-oriented, an increase in its bargaining power will result in not only a higher negotiated wage rate but also a higher level of employment (recalling that, when the union is employment-oriented, an upward-sloping contract curve guarantees a positive relationship between wages and the employment level). As a result, the unemployment rate $(1 - l)$ will fall. The main reason for this is that an employment-oriented union will more aggressively force the firms to hire more workers. Given that under the Cobb–Douglas production technology labor and capital are technical complements, (7a) indicates that a higher level of employment will increase the productivity of capital and hence the interest rate. Given the Keynes–Ramsey rule, we then infer that the economic growth rate will increase in response to a higher bargaining power of the union. On the contrary, a wage-oriented union will be more aggressive in extracting the excess wage for its members. In exchange for a higher bargained wage, it will be willing to incur a loss in terms of the reduction in employment (note that the wage is negatively correlated with employment when the union is wage-oriented). Once the unemployment rate rises, the rate of economic growth will also fall in response. In other words, when the union is more *democratic*, unionization is more likely to result in an increase in unemployment and a slowdown in growth. More importantly, this result is robust in both cases where $\varepsilon = 1$ and 0.

Proposition 1 contributes to an important macro implication: Unionization will not necessarily be bad for unemployment and growth, but rather, when contrasted with the common notion, may not only alleviate the short-run (or medium-term) problem of unemployment, but may also speed up the long-run economic growth. In the endogenous growth context where there are two goods markets (the final and R&D sectors) and two labor sectors (the skilled and unskilled sectors), Palokangas (1996) also provides an example to propound the possibly positive relationship between unionization and

economic growth. He shows that, given that skilled and unskilled workers are *complements* in the final goods sector and that the R&D sector employs only skilled labor, unionization in the unskilled labor market will increase the wages of unskilled labor and decrease their employment, and this will in turn decrease the demand for skilled workers (due to the complementary relationship between skilled and unskilled workers). This fall in the demand for skilled labor will decrease the wage for skilled labor and, consequently, will reduce the firm's R&D costs. Accordingly, the production of new designs will speed up the rate of economic growth.

Irmen and Wigger (2000) develop an OLG model with a trade union, in which they demonstrate that if a union formed by the working young succeeds in raising the aggregate wage bill and effectively transfers resources from the dissaving old to the saving young, unionization may lead to higher aggregate savings and per capita income growth. A similar result is found by Ramos-Parreño and Sánchez-Losada (2002) who use a two-sector OLG model with intergenerational altruism and unions. In a way that differs from theirs, we abstract the interaction between sectors and the allocation of resources between generations from our analysis and show that the nature of internal conflict within a political union is sufficient to create a mechanism resulting in a positive relationship between unionization and economic growth.

In the Introduction, we mentioned that in endogenous growth models with exogenous labor supply, an income tax is harmful to economic growth and a consumption tax leaves growth unaffected. In the models with endogenous labor supply, both income and consumption taxes have adverse growth effects.¹⁴ However, these results are confined to the context of a competitive labor market. In what follows, we will make a further investigation by re-examining the effects of taxation on both unemployment and economic growth in the unionized economy with equilibrium unemployment. In particular, we will show that the effects of income taxes and consumption taxes crucially depend not only on institutional arrangements for taxing unemployment benefits, but also on the way in which the government budget is financed by adjusting lump-sum taxes or unemployment benefits. Although the specification that the government adjusts unemployment benefits to balance its budget is not particularly appealing in the endogenous growth literature, as argued by Oswald (1982), in a general equilibrium framework unemployment benefits must be paid from tax revenue and, accordingly, the union's behavior and market equilibrium are affected.¹⁵ To have a more complete picture of the taxation effects, this section includes this possible scenario.

Proposition 2. (*The effects of taxation*). Under Theorem 1 and Lemma 1:

- (i) *If the government budget is financed by adjusting lump-sum taxes,*
 (1) *in the case where $\varepsilon = 1$, a consumption tax has no impact on unemployment and economic growth, whereas income tax will reduce the balanced-growth rate even though it leaves unemployment unchanged;*

¹⁴The growth effect of taxation, in effect, is very debatable. One of the main criticisms of the endogenous growth model is that its implications for the effectiveness of tax policy do not seem to be supported by the empirical evidence. For example, Jones (1995) develops a "non-scale" approach and uses the lack of a large, persistent change in growth rates to impose a strong restriction on the endogenous growth models. For more empirical evidence, the reader can refer to footnote 16. This point was brought to our attention by an anonymous referee, to whom we are grateful.

¹⁵We are grateful to an anonymous referee for bringing this point to our attention.

(2) in the case where $\varepsilon = 0$, an increase in the income tax rate has ambiguous effects on unemployment and growth and a higher consumption tax rate is favorable to unemployment and economic growth.

(ii) If the government budget is financed by adjusting unemployment benefits, both income and consumption taxes are harmful to unemployment and economic growth, regardless of whether $\varepsilon = 1$ or 0.

Proof. If the government budget is financed by adjusting lump-sum taxes, from (20) and (21) we can show that in the case where $\varepsilon = 1$

$$\frac{\partial(1 - \tilde{l})}{\partial\tau} = \frac{\partial(1 - \tilde{l})}{\partial\tau_c} = \frac{\partial\tilde{y}}{\partial\tau_c} = 0 \quad \text{and} \quad \frac{\partial\tilde{y}}{\partial\tau} = -\frac{\alpha A\tilde{l}^\beta}{\sigma} < 0,$$

whereas in the case where $\varepsilon = 0$

$$\frac{\partial(1 - \tilde{l})}{\partial\tau} = \frac{\sigma A\tilde{l}^{\beta+1}}{\tau_c \rho \beta} \left[\frac{\theta(1 - \alpha - \beta)(v - \delta)}{1 - \theta + \theta v} - \frac{\alpha\tau_c}{\sigma} - (1 - \beta) \right] \geq 0,$$

$$\frac{\partial(1 - \tilde{l})}{\partial\tau_c} = \frac{-\sigma\tilde{x}\tilde{l}}{\tau_c \rho \beta} < 0,$$

$$\frac{\partial\tilde{y}}{\partial\tau} = \frac{\alpha}{\sigma} A\tilde{l}^\beta \left\{ \left[\frac{\alpha\tau_c}{\sigma} + 1 - \beta - \frac{\theta(1 - \alpha - \beta)(v - \delta)}{1 - \theta + \theta v} \right] \frac{\sigma(1 - \tau)A\tilde{l}^\beta}{\tau_c \rho} - 1 \right\} \geq 0 \quad \text{and}$$

$$\frac{\partial\tilde{y}}{\partial\tau_c} = \frac{(1 - \tau)\alpha A\tilde{l}^\beta \tilde{x}}{\rho \tau_c} > 0.$$

On the other hand, if the government adjusts unemployment benefits to balance the budget, we then have

$$\frac{\partial(1 - \tilde{l})}{\partial\tau} = \frac{\tilde{l}^2}{\Delta\Phi} \left[1 + \frac{\Theta(v - \delta) + \delta\beta(1 - \tilde{l}) + \alpha\tau_c}{v\tilde{l}} + \frac{\alpha\tau_c}{\sigma} \right] > 0,$$

$$\frac{\partial\tilde{y}}{\partial\tau} = -\frac{\alpha}{\sigma} A\tilde{l}^\beta \left\{ \left[1 + \frac{\Theta(v - \delta) + \delta\beta(1 - \tilde{l}) + \alpha\tau_c}{v\tilde{l}} + \frac{\alpha\tau_c}{\sigma} \right] \frac{(1 - \tau)\beta\tilde{l}}{\Delta\Phi} + 1 \right\} < 0,$$

$$\frac{\partial(1 - \tilde{l})}{\partial\tau_c} = \frac{\tilde{x}}{\Delta\Phi A\tilde{l}^{\beta-2}} > 0 \quad \text{and} \quad \frac{\partial\tilde{y}}{\partial\tau_c} = \frac{-(1 - \tau)\alpha\beta\tilde{x}\tilde{l}}{\sigma\Delta\Phi} < 0,$$

where $\Delta = 1 - \{[(1 - \tau)\alpha - \sigma]\beta\tau_c\tilde{l}/\sigma\Phi\} > 0$ and $\Phi = \{\Theta[1 - (\delta/v)] + \delta\beta/v\}(1 - \tau)(1 - \beta + \beta\tilde{l}) + \tau\beta\tilde{l} > 0$. \square

As mentioned previously, it follows from (15a) that, in the case where $\varepsilon = 1$, if the government budget is financed by lump-sum taxes, neither the income tax rate τ nor the consumption tax rate τ_c will alter the relationship between income while employed and income while unemployed. As a result, unemployment is independent of taxation. This result conforms to that in the static model. In their earlier analysis, provided that unemployment compensation was given based on a fixed replacement rate of labor earnings and that earnings and benefits were taxed at the same rate, [Calmfors and Holmlund \(2000\)](#) also found that labor taxes were neutral with respect to equilibrium

unemployment. With regard to economic growth, since the after-tax marginal productivity of capital decreases with τ , but is independent of τ_c , the balanced-growth rate falls as the income tax increases and remains unchanged as the consumption tax increases.

In our endogenous growth model, labor and capital are technical complements. Therefore, the employment rate determined by negotiation between the union and the employer federation will play a prominent role in affecting capital accumulation and hence the balanced-growth rate. With this understanding, as is evident from (15b) in that where $\varepsilon = 0$ a higher income tax has an ambiguous effect on employment, the relationship between growth and income taxation will also be mixed. Moreover, to balance the budget, a higher τ_c allows the government to reduce the lump-sum tax imposed on labor earnings. This, on the one hand, decreases unemployment and, on the other hand, speeds up economic growth. In spite of this result obviously standing in sharp contrast to the effect in the existing endogenous growth models with either a fixed labor supply (which indicates that $\partial\tilde{y}/\partial\tau < 0$ and $\partial\tilde{y}/\partial\tau_c = 0$, see Rebelo, 1991) or a flexible labor supply (which indicates that $\partial\tilde{y}/\partial\tau < 0$ and $\partial\tilde{y}/\partial\tau_c < 0$, see Turnovsky, 2000), a large body of empirical research (e.g., Easterly and Rebelo, 1993; Mendoza et al., 1994; Widmalm, 2001) supports our comparative statics case where $\partial\tilde{y}/\partial\tau \geq 0$ and $\partial\tilde{y}/\partial\tau_c > 0$.¹⁶

Proposition 2(ii) demonstrates that if the government adjusts unemployment benefits to balance the budget, regardless of the case where $\varepsilon = 1$ or the case where $\varepsilon = 0$, an increase in either the income tax or the consumption tax will increase unemployment and, accordingly, a decrease in the economic growth rate will follow. The intuition behind this result is straightforward. When the government budget is balanced by adjusting unemployment benefits, increasing either the income tax or the consumption tax will lead to a higher level of unemployment benefits. This will give rise to an additional distortionary effect that will harm unemployment and the balanced-growth rates.¹⁷ In such a case, the taxation effects in the unionized model with equilibrium unemployment are qualitatively similar to those in the full-employment models, where the labor supply is endogenously determined.

4.2. Welfare analysis

In this sub-section, we attempt to study the impact of unionization on social welfare. In line with the common approach, an appropriate measurement of welfare is the utility obtained by the representative household. Given the balanced-growth rate \tilde{y} , we have $\tilde{k}(t) = k_0 e^{\tilde{y}t}$, $\tilde{c}(t) = c_0 e^{\tilde{y}t}$, and $c_0 = \tilde{x} \cdot k_0$ (due to $x = c/k$). With this information, computing the utility obtained by means of the integral in (6) is straightforward, and

¹⁶With regard to the growth effect of income taxes, the empirical studies reveal conflicting results and many of them suggest that the effect is insignificant. Harberger (1964) uses U.S. data and conjectures that, although theory predicts that changes in the tax rates affect economic growth in the long run, in practice tax policy is an ineffective instrument for influencing growth, this conjecture being dubbed the so-called “Harberger’s superneutrality conjecture.” Easterly and Rebelo (1993) re-examine the growth implications of aggregate tax measures and provide ambiguous evidence on the growth effects of tax policy. In the light of the endogenous growth theory, Mendoza et al. (1997) also provide empirical evidence in favor of Harberger’s conjecture. In the light of the growth effect of consumption taxes, the empirical studies of Wang and Yip (1992), Mendoza et al. (1994), Wynne (1997), and Widmalm (2001) all suggest that the consumption tax is growth enhancing, though in some situations, it may be statistically insignificant.

¹⁷From (20) and (21), it is easy to show that $\partial(1 - \tilde{l})/\partial s > 0$ and $\partial\tilde{y}/\partial s < 0$, meaning that more generous unemployment benefits increase unemployment and slow down growth.

yields the following (aside from a constant):

$$\tilde{W} = \frac{k_0^{1-\sigma}}{1-\sigma} \left[\frac{\tilde{x}^{1-\sigma}}{[\rho - (1-\sigma)\tilde{\gamma}]} \right]. \tag{24}$$

Condition B ensures that $(1-\sigma)\tilde{\gamma} < \rho$ and guarantees that the social welfare is bounded.

Given the welfare function (24), we establish Proposition 3 as follows:

Proposition 3. (*Welfare effect*). *Under Theorem 1 and given that the equilibrium is locally determinate, regardless of the case where $\varepsilon = 1$ or the case where $\varepsilon = 0$, a higher bargaining power θ has a positive (negative) effect on the social welfare if the union is employment-oriented $v > \delta$ (wage-oriented $v < \delta$). That is, if the union is more democratic, unionization will more likely harm the social welfare.*

Proof. Differentiating (24) with respect to θ , we have

$$\frac{\partial \tilde{W}}{\partial \theta} = \left[\frac{1}{\tilde{x}} \frac{\partial \tilde{x}}{\partial \theta} + \frac{1}{\rho - (1-\sigma)\tilde{\gamma}} \frac{\partial \tilde{\gamma}}{\partial \theta} \right] \frac{k_0^{1-\sigma} \tilde{x}^{1-\sigma}}{\rho - (1-\sigma)\tilde{\gamma}}. \tag{25}$$

Recalling that $\partial \tilde{x} / \partial \theta = -[(1-\tau)\alpha - \sigma] \beta A l_0^{\beta-1} \tilde{x} / (\sigma D) \geq 0$ and $\partial \tilde{\gamma} / \partial \theta = (1-\tau)\alpha \beta A l_0^{\beta-1} \tilde{x} / (\sigma D) \geq 0$ were derived from (19)–(21), (25) can thus be re-expressed as

$$\frac{\partial \tilde{W}}{\partial \theta} = \left\{ \frac{(1-\tau)\alpha[1 - (1-\tau)\alpha] A l_0^{\beta}}{\rho - (1-\sigma)\tilde{\gamma}} + \sigma \right\} \frac{k_0^{1-\sigma} \tilde{x}^{1-\sigma} \beta A l_0^{\beta-1} \tilde{x}}{[\rho - (1-\sigma)\tilde{\gamma}] \sigma D} \geq 0 \quad \text{iff } v \geq \delta,$$

where $D = \tilde{x}$ in the $\varepsilon = 1$ case and $D = \rho/\sigma$ in the $\varepsilon = 0$ case and $\text{sgn}(l_0) = \text{sgn}(v-\delta)$. \square

As noted earlier, when the trade union is wage-oriented, its stronger bargaining power will result in a lower consumption–capital ratio and rate of growth. As a result, the social welfare will be reduced as well. Although the reasoning behind this result is straightforward, somewhat surprisingly, if the union is more democratic and more aggressively extracts higher wages from firms, unionization will have a negative effect on welfare.

5. Concluding remarks

In most of the economics literature, the function of a trade union, in line with the argument of Dunlop (1944), is to rationally maximize “something,” say, either a utilitarian objective function or an expected utility function. In this paper, we instead follow Ross (1948) and incorporate a so-called political trade union into the endogenous growth model. By borrowing from Pemberton’s (1988) managerial model, we show that the conflicting interests between the leadership and membership within the union play a decisive role in the unemployment, growth and welfare effects of unionization. A higher degree of unionization will result in a lower unemployment rate and a higher balanced-growth rate if the union is employment-oriented. However, when the union is wage-oriented, an opposite result emerges: Unionization becomes harmful to both unemployment and growth. These results also lead us to conclude that a higher degree of unionization has a positive (negative) effect on the social welfare if the union is employment-oriented (wage-oriented). This implies that, somewhat surprisingly, when the union is more *democratic* and more

aggressively extracts higher *wages* from firms, unionization instead gives rise to a negative effect on welfare.

Taxation effects, besides unions, are another interesting issue investigated in this study. In this endogenous growth model with equilibrium unemployment, we point out that both the effects of an income tax and a consumption tax crucially depend not only on institutional arrangements for taxing unemployment benefits, but also on the way in which the government budget is financed by adjusting lump-sum taxes or unemployment benefits. If the government budget is financed by adjusting lump-sum taxes and unemployment is subject to taxation, a consumption tax has no impact on unemployment and economic growth. By contrast, an income tax reduces the balanced-growth rate even though it also has no effect on unemployment. However, when unemployment benefits are exempted from taxation, an increase in the income tax rate has ambiguous effects on unemployment and growth and a higher consumption tax rate is favorable to unemployment and economic growth. These results obviously stand in sharp contrast to those in the existing endogenous growth models that are characterized by either a fixed or flexible labor supply.

It is also found that when the government budget is financed by adjusting unemployment benefits, both income and consumption taxes are harmful to unemployment and economic growth. This result indicates that even though the labor market is characterized by equilibrium unemployment, the taxation effects are still qualitatively consistent with the common argument in endogenous growth models with full employment.

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