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THE POLITICAL ECONOMY OF COLLECTIVE BARGAINING

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Abstract

We construct a political equilibrium in which employers and labour unions bargain over labour contracts, wage-earners and profit-earners lobby the government for taxation and labour market regulation, and labour market legislation must be accepted by the majority of voters. We show that the voters rule out profit sharing, because otherwise the government would capture all the gain. Furthermore, if it is much easier to tax wages than profits, then the government protects union power by regulation in the labour market. In such a case, the political equilibrium is characterized by strong union power and right-to-manage bargaining, which causes involuntary unemployment.

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1 Introduction

This paper seeks to explain the political equilibrium with labour unions and collective bargaining. The equilibrium of this type is common in many European countries and it can characterized as follows. The employers and labour unions bargain over the wages and other working conditions, the government determines taxation and regulates the labour market, interest groups influence the government for the types of policy being carried out, and labour market legislation must satisfy the majority of the voters. This paper attempts to find the political equilibrium by a common agency model in which the government is self-interested and interest groups make offers that relate prospective contributions to the government's policy.

In the traditional models of collective bargaining, the relative bargaining power of the labour unions is taken as fixed. The microfoundations of this approach[1] are that when two players are making alternating offers to each other, they behave so as to maximize a weighed geometric average – the Generalized Nash product – of their utilities. The weights of such an average, which reflect relative bargaining power of the parties, are determined by the parameters of the model. The government controls the bargaining power of the labour unions in many ways. First, it can make it hard or easy to form unions, so that in the extreme there can be a choice of two equilibria: one with full employment and no union power, and the other with sufficient union power to cause unemployment. There can also be more specific tools, such as compulsory mediation of labour market disputes, to affect the outcome of collective bargaining. This paper follows the common practice in the literature concerning regulation in the labour market and assumes that the government can make smooth and continuous changes in union power.[2] The results can then be generalized for discrete changes in union power.

The literature of labour economics acknowledges two basic forms of collective bargaining agreement: the ordinary wage system, in which the employees and employers bargain over the wage, and the share system, in which they bargain over both the wage and the profit-sharing ratio. Efficient bargains concerning both the wage and the level of employment are shown to

[1] Cf. Osborne and Rubinstein (1990), Chapter 4, or Palokangas (2000), Chapter 1.
[2] Cf. Blanchard, O. and Giavazzi, F. (2001).

be equivalent to the share system.[3] The legislation in the country determines which form of agreement is stable and dominant.

Both of these examples show that the choice between the ordinary wage and share systems as well as the strength of the labour unions in collective bargaining are both matters of public policy. It follows that they must be considered together with taxation in a common-agency framework where wage-earners and profit-earners may lobby the government in collective bargaining.[4] It is assumed that profit sharing or efficient bargains cannot be implemented if they harm the majority of the voters since otherwise, there would be no stable equilibrium in the political process. This paper is organized as follows. Section 2 summarizes the institutional background of the model and forms a game of political economy with collective bargaining. Section 3 presents the behaviour of a firm, and section 4 develops the collective bargaining model. The government's behaviour is endogenized in section 5. The political equilibrium of the economy is constructed in section 6. Finally, section 7 presents policy rules that explain regulation in the labour market.

2 The structure of the model

Output is produced from labour through decreasing returns to scale. There are three separate groups: capitalists, who earn profits but do not supply labour; workers, who supply labour and earn wages; and the political elite, who run the government and receive political contributions from the other two groups. Because the workers comprise a vast majority of voters, we assume that the representative voter has the same utility function as the representative worker. Workers join in labour unions if this increases their welfare. The self-interested government cares not only about aggregate welfare, but also about political contributions from the lobby groups. The workers and capitalists lobby the incumbent government by offering prospective contribution schedules that are contingent on the policy implemented. The government selects the policy that maximizes its own welfare.

It is assumed, for simplicity, that all firms and households are price takers,

[3] Cf. Pohjola (1987), or Palokangas (2000), Chapter 2.

[4] Bernheim and Whinston (1986), Grossman and Helpman (1994), and Dixit, Grossman and Helpman (1997).

the labour supply is constant L, and the employment of labour yields constant marginal disutility b in terms of consumption. We can then, without losing any generality, focus on the case where there is one good, one firm, one capitalist, and one worker in the economy. Two particular agents, the labour union and the employer, represent the worker and the capitalist in collective bargaining, respectively. We normalize the price of the good at one.

In the theory of optimal taxation it is widely known that if the government has the opportunity to tax pure profits at no cost, it would optimally impose a 100% tax on profits. To eliminate such an unrealistic case from the model we assume that the capitalists can hide their profits at some cost. The workers observe the same amount of profits as the government.

The analysis is based on the following sequence of moves. At the first stage, the voter decides on whether profit sharing (or the use of efficiency wages) is allowed. At the second stage, the lobbies (i.e. the worker and the capitalist) choose their contribution schedules. At the third stage, the government decides on taxes, determines how the labour market will be regulated and collects the associated lobbying contributions. Regulation in the labour market specifies the form of the labour contract and the relative bargaining power of the parties. At the fourth stage, the labour union and the employer bargain over the wage and the workers' profit share. At the final stage, the firm decides on output and employment. The model is solved by backward induction.

3 Production and income

Output y is produced from labour l only through a strictly concave production function $y = f(l)$ with $f' > 0$ and $f'' < 0$. In this one-good and one-input model, a linear income tax structure can be characterized by two instruments only, the profit tax θ and the labour tax t. These may also have negative values. Because the consumption tax would be fully dependent on the the two taxes, it can be abolished. Output y, the producer wage w and total profit Π are then functions of the level of employment, l, as follows:

$$y = f(l), \quad w = f'(l), \quad \Pi(l) \doteq y - wl = f(l) - lf'(l), \quad \Pi' = -lf'' > 0. \tag{1}$$

The capitalist conceals the share a of profit Π and reveals the rest $1 - a$

to the worker and the government. We suppose furthermore that the scale of profits does not affect the ability to conceal profits, but that such activity is subject to increasing costs. The administrative cost of hiding profit, Φ, is therefore linear homogeneous with respect to total profit Π but increasing and strictly convex with respect to the ratio a of hidden to total profit. It is obvious that with all profits revealed, $a = 0$, there is no cost, $\Phi = 0$. Given these assumptions, we obtain the cost function

$$\Phi = \phi(a)\Pi(l), \quad \phi' > 0, \quad \phi'' > 0, \quad \phi(0) = 0, \tag{2}$$

where ϕ is the ratio of administrative cost to total profit.

Let S be the share of revealed profit $(1 - a)\Pi$ distributed to the worker. Because the worker cannot subsidize the firm, inequality

$$S \geq 0 \tag{3}$$

must obtain. Reducing the worker's profit share $S(1 - a)\Pi$, profit taxes $\theta(1 - a)\Pi$ and administrative cost (2) from total profit Π, and noting (1), we obtain the capitalist's income, π, as a function of the profit tax θ, the sharing ratio S and the level of employment, l, as follows:

$$\pi(\theta, S, l) = \max_a [1 - (S + \theta)(1 - a) - \phi(a)]\Pi(l), \quad \partial\pi/\partial\theta = \partial\pi/\partial S < 0,$$
$$\partial\pi/\partial l > 0, \quad \partial^2\pi/(\partial l \partial S) = (\Pi'/\Pi)\partial\pi/\partial S. \tag{4}$$

From the first-order condition $(1/\Pi)\partial\pi/\partial a = S + \theta - \phi'(a) = 0$ it follows that the share of profit escaped from taxation and profit sharing, a, is a increasing function of the sum of the worker's profit share S and the profit tax θ:

$$a(S + \theta) \text{ with } a' \doteq 1/\phi'' > 0. \tag{5}$$

The demand for labour, l, cannot exceed the labour supply, L:

$$L \geq l. \tag{6}$$

The labour supply L is assumed to be fixed. We define, for convenience, the worker's income v so that it takes also the total disutility of employment, bl, into account. Given (1), (4) and (5), we then obtain[5]

$$\begin{aligned} v(S,l,t,\theta) &\doteq (1-t)[wl + S(1-a)\Pi] - bl \\ &= [(1-t)f'(l) - b]l + (1-t)S[1-a(S+\theta)]\Pi(l), \end{aligned} \qquad (7)$$

where wl is total wages, $S(1-a)\Pi$ the worker's profit share, t the labour tax rate, and bl disutility of employment. Given (1), (3) and (7), we obtain

$$\begin{aligned} &\partial v/\partial l = (1-t)[f' + lf'' + (1-a)S\Pi'] - b, \ \ \partial v/\partial t = -lf' - S(1-a)\Pi' < 0, \\ &\partial v/\partial S = (1-t)(1-a-Sa')\Pi > 0, \quad \partial^2 v/(\partial l \partial S) = (\Pi'/\Pi)\partial\pi/\partial S, \\ &\partial v/\partial\theta = -Sa'\Pi \leq 0, \quad \partial^2 v/(\partial l \partial t) = -f' - lf'' - S(1-a)\Pi''. \end{aligned} \qquad (8)$$

4 Collective bargaining

We compare two systems of bargaining: the *ordinary wage system*, in which the worker receives no share of profit, $s = 0$, and only the wage w is used as the bargaining instrument, and the *share system*, in which both the wage w and the profit share s are used as such instruments. The government chooses the bargaining system. In order to put the two bargaining systems into the same framework, we assume that the government imposes an upper limit s for the worker's profit share S. The union attempts to maximize the worker's income v, while the employer attempts to maximize the capitalist's income π. We assume asymmetric Nash bargaining over w and S. The outcome such bargaining is obtained through the maximization of the product $v^\alpha \pi^{1-\alpha}$ by w and S subject to constraints $S \leq s$, (3) and (6), where constant $\alpha \in [0,1]$ is the union's relative bargaining power. Because $w = f'(l)$ by (1), the wage w can be replaced by the level of employment, l, as the instrument of maximization. Given this, (1) and (7), the outcome of bargaining is the pair (l, S) that maximizes the logarithm of the product

$$\Psi(S,l,t,\theta,\alpha) = \log[v^\alpha \pi^{1-\alpha}] = \alpha \log v + (1-\alpha)\log \pi \qquad (9)$$

[5] We assume here, for convenience, that the worker's profit share is taxed at the same rate t as wages. The results would nevertheless be the same even if the worker's profit share were taxed at any other rate since, in equilibrium, there will be no profit sharing $S = 0$ (see proposition 1).

subject to $S \leq s$, (3) and (6). The Lagrangean for this maximization is

$$\mathcal{H} = \Psi(S, l, t, \theta, \alpha) + \nu_1[L - l] + \nu_2 S + \nu_3[s - S], \tag{10}$$

where the multipliers ν_1 and ν_2 satisfy the Kuhn-Tucker conditions

$$\nu_1[L - l] = 0, \ \ \nu_1 \geq 0, \quad \nu_2 S = 0, \ \ \nu_2 \geq 0, \quad \nu_3[s - S] = 0, \ \ \nu_3 \geq 0. \tag{11}$$

Given (4), (7), (9), (11) and (10), we obtain the first-order conditions

$$\begin{aligned} \frac{\partial \mathcal{H}}{\partial l} &= \frac{\alpha}{v(S, l, t, \theta)} \frac{\partial v}{\partial l}(S, l, t, \theta) + \frac{1-\alpha}{\pi(S+\theta, l)} \frac{\partial \pi}{\partial l}(S+\theta, l) - \nu_1 = 0, \\ \frac{\partial \mathcal{H}}{\partial S} &= \frac{\alpha}{v} \frac{\partial v}{\partial S} + \frac{1-\alpha}{\pi} \frac{\partial \pi}{\partial S} + \nu_2 - \nu_3 = 0. \end{aligned} \tag{12}$$

If the government's upper limit for the worker's profit share is not binding, $S < s$, then $\nu_2 = 0$ by (11) but otherwise the Lagrangean (10) is maximized by ν_1, ν_3, l and S subject to (11). This maximization leads to the optimal value $S^o(t, \theta, \alpha)$ for S. This means that the parties in collective bargaining are willing to increase S up to the level $S^o(t, \theta, \alpha)$ but not over it, and the government can effectively choose its instrument s only within the range

$$0 \leq s \leq S^o(t, \theta, \alpha). \tag{13}$$

Assume now $s < S^o(t, \theta, \alpha)$, which means that the worker's profit share is fixed by $S = s$. Relations (4), (7), (8), (11) and (12) then yield $\nu_2 = 0$ and

$$\begin{aligned} &\frac{\partial v}{\partial l}\bigg|_{L>l} = \Big(1 - \frac{1}{\alpha}\Big)\frac{v}{\pi}\frac{\partial \pi}{\partial l} < 0, \quad \frac{\partial^2 \mathcal{H}}{\partial l \partial \alpha}\bigg|_{L>l} = \frac{1}{v}\frac{\partial v}{\partial l}\bigg|_{L>l} - \frac{1}{\pi}\frac{\partial \pi}{\partial l} < 0, \\ &\frac{\partial^2 \mathcal{H}}{\partial l \partial t}\bigg|_{L>l,\ s=0} = \frac{\alpha}{v^2}\Big[v\frac{\partial^2 v}{\partial l \partial t} - \frac{\partial v}{\partial l}\frac{\partial v}{\partial t}\Big]_{L>l,\ s=0} \\ &= \frac{\alpha}{v^2}\big\{[(1-t)(f' + lf'') - b]lf' - [(1-t)f' - b]l(f' + lf'')\big\} = \alpha b f''\frac{l^2}{v^2} < 0, \\ &\frac{\partial^2 \mathcal{H}}{\partial l \partial s}\bigg|_{L>l} = \frac{\alpha}{v^2}\Big[v\frac{\partial^2 v}{\partial l \partial S} - \frac{\partial v}{\partial l}\frac{\partial v}{\partial S}\Big]_{L>l} + \frac{\alpha}{\pi^2}\Big[\pi\frac{\partial^2 \pi}{\partial l \partial S} - \frac{\partial \pi}{\partial l}\frac{\partial \pi}{\partial S}\Big] \\ &> \frac{\alpha}{v}\frac{\partial^2 v}{\partial l \partial S} + \frac{1-\alpha}{\pi}\frac{\partial^2 \pi}{\partial l \partial S} = \frac{\Pi'}{\Pi}\Big[\frac{\alpha}{v}\frac{\partial v}{\partial S} + \frac{1-\alpha}{\pi}\frac{\partial \pi}{\partial S}\Big] = \frac{\Pi'}{\Pi}\nu_3 \geq 0. \end{aligned} \tag{14}$$

Given these results and the second-order condition $\partial^2\mathcal{H}/\partial l^2 < 0$, the level of employment, l, can now be defined as the following function of (t, θ, α, s):

$$l(t,\theta,\alpha,s) \text{ with } l_s \doteq \frac{\partial l}{\partial s} = -\frac{\partial^2\mathcal{H}}{\partial l \partial s}\bigg/\frac{\partial^2\mathcal{H}}{\partial l^2} > 0 \text{ for } L > l,$$
$$l_\alpha \doteq \frac{\partial l}{\partial \alpha} = -\frac{\partial^2\mathcal{H}}{\partial l \partial \alpha}\bigg/\frac{\partial^2\mathcal{H}}{\partial l^2} < 0 \text{ for } L > l \text{ and}$$
$$l_t \doteq \frac{\partial l}{\partial t} = -\frac{\partial^2\mathcal{H}}{\partial l \partial t}\bigg/\frac{\partial^2\mathcal{H}}{\partial l^2} < 0 \text{ for } L > l \text{ and } s = 0. \tag{15}$$

5 Public policy

We denote the worker's and the capitalist's political contributions by R^w and R^c respectively. Reducing R^c from the capitalist's income (4) yields the capitalist's consumption C^c. Reducing R^w from the worker's total income (7) yields the worker's consumption C^w. Inserting the employment function (15) into these definitions, we can specify the functions

$$C^w(t,\theta,\alpha,s,R^w) \doteq v(s,l,t,\theta) - R^w, \quad \partial C^w/\partial R^w = -1,$$
$$C^c(t,\theta,\alpha,s,R^c) \doteq \pi(s+\theta,l) - R^c, \quad \partial C^c/\partial R^c = -1. \tag{16}$$

The worker's and capitalist's utility functions are now given by

$$U^i(C^i), \ (U^i)' > 0, \ (U^i)'' < 0, \ \lim_{C^i \to 0} U^i = -\infty \text{ for } i = w, c. \tag{17}$$

Following Grossman and Helpman (1994), and given (7), (16) and (17), the government's objective function is defined by

$$G(t,\theta,\alpha,s,R^w,R^c) = R^w + R^c + \beta U^c(C^c) + \gamma U^w(C^w), \tag{18}$$

where parameters $\beta \geq 0$ and $\gamma \geq 0$ are the weights given to the capitalist's and the worker's welfare, respectively. One might claim that there is a wholly 'labour' government for $\beta = 0$, and a wholly 'capitalist' government for $\gamma = 0$, but even in these extreme cases both classes can maintain their influence by their political contributions R^w and R^c to the ruling elite.

Given (1), (5) and (15), we define total tax revenue X, which consists of labour taxes twl and profit taxes $\theta(1-a)\Pi$, as a function of the government's instruments:

$$X(t,\theta,\alpha,s) \doteq twl + \theta(1-a)\Pi = tlf'(l) + \theta[1-a(s+\theta)]\Pi(l)$$
$$\text{with } \frac{\partial X}{\partial \alpha} = \begin{cases} [t(f'+lf'') - (1-a)\theta lf'']l_\alpha & \text{for } l < L, \\ 0 & \text{for } l = L. \end{cases} \tag{19}$$

We assume that government spending E is fixed, for simplicity. Because this must be covered by taxes, the government's budget constraint is given by[6]

$$E \leq X(t,\theta,\alpha,s). \tag{20}$$

The voter decides on the implementation of profit sharing, which can be modeled as follows. The voter chooses the set of the feasible profit sharing ratios $\mathcal{J} \in \big\{\{0\},[0,1]\big\}$, where choice $\mathcal{J} = \{0\}$ bans profit sharing while $\mathcal{J} = [0,1]$ allows it. Given $s \in \mathcal{J}$, (6), (15) and (13), the government chooses its vector of policy parameters from the set

$$\Gamma \doteq \big\{(t,\theta,\alpha,s)\big|\ 0 \leq \alpha \leq 1,\ \ s \in \mathcal{J} \cap [0, S^o(t,\theta,\alpha)], \\ l(t,\theta,\alpha,s) \leq L,\ \ (20)\ \text{holds}\big\}. \tag{21}$$

Now we explore the effects of lobbying by the capitalist and the worker on taxation and labour market regulation, i.e. on variables t, θ, α and s. The political contribution schedule of the worker is given by $R^w(t,\theta,\alpha,s)$, and that of the capitalist by $R^c(t,\theta,\alpha,s)$. The government maximizes its welfare (18) by choosing $(t,\theta,\alpha,s) \in \Gamma$. Following proposition 1 of Dixit, Grossman and Helpman (1997), a subgame perfect Nash equilibrium for this game is a set of contribution schedules $R^{w*}(t,\theta,\alpha,s)$ and $R^{c*}(t,\theta,\alpha,s)$ and public policy $(t^*,\theta^*,\alpha^*,s^*)$ such that the following conditions are satisfied: (i) contributions are non-negative;[7] (ii) the policy $(t^*,\theta^*,\alpha^*,s^*)$ maximizes the government's welfare (18) taking the contribution schedules as given,

$$(t^*,\theta^*,\alpha^*,s^*) \in \underset{(t,\theta,\alpha,s)\in\Gamma}{\text{argmax}} \big\{G\big(t,\theta,\alpha,s,R^w(t,\theta,\alpha,s),R^c(t,\theta,\alpha,s)\big)\big\}; \tag{22}$$

[6]Since $E < X$ would be pure waste, any rational government will choose $E = X$. We define the budget constraint in the form of inequality to obtain $\lambda \geq 0$ in (31).

[7]In this connection, it is in general required that contributions are less than the income of the contributing lobby. Because in (16) the worker's or the capitalist's utility approaches $-\infty$ when her consumption approaches zero, this condition is here always satisfied.

(*iii*) the worker (capitalist) cannot have a feasible strategy $R^w(t,\theta,\alpha,s)$ $\big(R^c(t,\theta,\alpha,s)\big)$ that yields her a higher level of utility than in equilibrium, given the government's anticipated decision rule,[8]

$$\big(t^*,\theta^*,\alpha^*,s^*,R^i(t^*,\theta^*,\alpha^*,s^*)\big) \in \underset{(t,\theta,\alpha,s)\in\Gamma}{\text{argmax}}\, U^i\big(C^i\big(t,\theta,\alpha,s,R^i(t,\theta,\alpha,s)\big)\big)$$
$$\text{for } i=w,c; \tag{23}$$

and (*iv*) the worker (capitalist) provides the government at least with the level of utility than this could get when the worker (capitalist) offers nothing $R^w=0$ ($R^c=0$) and the government responds optimally given the capitalist's (worker's) contribution function,

$$G(t,\theta,\alpha,s,R^w(t,\theta,\alpha,s),R^c(t,\theta,\alpha,s)) \geq \sup_{(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s})\in\Gamma} G(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s},R^w(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s}),0)),$$
$$G(t,\theta,\alpha,s,R^w(t,\theta,\alpha,s),R^c(t,\theta,\alpha,s)) \geq \sup_{(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s})\in\Gamma} G(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s},0,R^c(\tilde{t},\tilde{\theta},\tilde{\alpha},\tilde{s})). \tag{24}$$

6 The political equilibrium

Because U^w and U^c are increasing functions, conditions (23) take the form

$$\frac{\partial C^w}{\partial i}+\frac{\partial C^w}{\partial R^w}\frac{\partial R^w}{\partial i}=\frac{\partial C^c}{\partial i}+\frac{\partial C^c}{\partial R^c}\frac{\partial R^c}{\partial i}=0 \text{ for } i=s,\theta,t,\alpha. \tag{25}$$

Given (16), these equations are are equivalent to

$$\partial C^w/\partial i=\partial R^w/\partial i \text{ and } \partial C^c/\partial i=\partial R^c/\partial i \text{ for } i=s,\theta,t,\alpha, \tag{26}$$

which says that in equilibrium the change in the worker's (capitalist's) contribution due to a change in the instrument equals the effect of the instrument on the worker's (capitalist's) consumption. Thus the political contribution schedules are locally truthful. As in Bernheim and Whinston (1986) or in Grossman and Helpman (1994), this concept can be extended to a globally truthful contribution schedule. This type of schedule accurately represents

[8] In this model, the worker's (capitalist's) utility is independent of the capitalist's (worker's) contribution schedule.

the preferences of the worker (capitalist) at all policy points. From (16), (24) and (26) it follows that the truthful contribution functions take the form

$$R^w = \max[0, v - v_0], \quad R^c = \max[0, \pi - \pi_0], \tag{27}$$

where v_0 (π_0) is the worker's (capitalist's) income when she does not pay political contributions but the government chooses its best response given the capitalist's (worker's) contribution schedule.

The voter chooses the set $\mathcal{J} \in \big\{\{0\}, [0,1]\big\}$ to maximize the worker's utility (17). Given (16), she can equivalently maximize the worker's consumption $C^w = v - R^w$. Assume first that $\mathcal{J} = [0,1]$, which means that the government can freely choose $s \in [0, S^o(t, \theta, \alpha)]$. Now from (7) it follows that if the worker does not pay political contributions, $R^w = 0$, then the government sets $s = 0$ to obtain $v_0 = v|_{s=0} = (W - b)l = [(1-t)f'(l) - b]$. Inserting this, (7) and $S = s$ into (27) yields that the worker pays all her profit share to the government as political contributions, $R^w = v - v_0 = s(1-a)\Pi$. Given (14) and (15), the worker's remaining income $v = v_0$ falls with the increase in the profit share, $dv_0/ds = (\partial v_0/\partial l)\partial l/\partial s = (\partial v/\partial l)\partial l/\partial s < 0$. Because the voter does not accept this, she eliminates the share system by choosing $\mathcal{J} = \{0\}$, which implies $s = 0$. This result can be summarized as follows:

Proposition 1 *In the political equilibrium, profit sharing is abolished,* $s = 0$.

It is widely known in the literature of labour economics that the use of profit-sharing in the right-to-manage bargaining, where the level of employment is unilaterally determined by the employer, is equivalent to efficient bargaining, where the wage and the level of employment are simultaneously negotiated over. Given this, the earlier result can be rephrased also as follows:

Proposition 2 *In the political equilibrium, right-to-manage bargaining over the wage only is the only stable outcome.*

These propositions can be explained as follows. Because the government can ban profit sharing at any time without any cost, it can claim contributions that are equal to the whole of the worker's profit share. Hence, the worker will earn only wages. Because profit sharing decreases wages and the worker's consumption, the voter abolishes profit sharing from the economy. When the government observes the marginal product of labour, the same result holds also for efficiency wages. The government can then claim contributions that are equal to the worker's total income minus the marginal product of labour times the level of employment. It is again in the voter's interest to abolish this possibility.

7 Policy rules

Without profit sharing, $s = 0$, the government's choice set (21) becomes

$$\Gamma \doteq \{(t, \theta, \alpha) \big| \ \alpha \in [0, 1], \ \ l(t, \theta, \alpha, 0) \le L, \ \ X(t, \theta, \alpha, 0) \ge E\}. \tag{28}$$

We assume that the economy is on the increasing part of the Laffer curve. Given this and (1), we obtain the following properties for function (19):

$$\begin{aligned} &X_\theta \doteq \partial X/\partial \theta > 0; \quad X_t \doteq \partial X/\partial t > 0; \\ &X_\alpha \doteq \frac{\partial X}{\partial \alpha} = \begin{cases} [t(f' + lf'') - (1-a)\theta l f'']l_\alpha & \text{for } l < L, \\ 0 & \text{for } l = L. \end{cases} \end{aligned} \tag{29}$$

Assume first $f' + lf'' \ge 0$. Because both remaining taxes t and θ are needed to finance government spending, these must be positive. From (1), (15) and (29) it then follows that $\partial X/\partial \alpha \le 0$. Next assume $f' + lf'' < 0$. Given (1), (15) and (29), we then obtain a subresult that is later useful:

$$\begin{aligned} &\text{If } \ X_\alpha \doteq \partial X/\partial \alpha = [t(f' + lf'') - (1-a)\theta l f'']l_\alpha > 0, \\ &\text{then } \ t > (1-a)\theta \big/ \big[1 + f'(l)/(lf'')\big] > (1-a)\theta \ \text{ for } L > l. \end{aligned} \tag{30}$$

This says that if union power increases tax revenue, $X_\alpha > 0$, then the labour tax rate t must be higher than the effective tax rate on profits, $(1-a)\theta$, where $1 - a$ is the share of the tax base in profits.

The conditions (22) take the form that the government's objective function (18) must be maximized by α, θ and t subject to the set (28). Given $s = 0$, (17) and (25), this is equivalent to the maximization of the function

$$\begin{aligned} \mathcal{L} =& R^w(t, \theta, \alpha, 0) + R^c(t, \theta, \alpha, 0) + \beta U^c(C_*^c) + \gamma U^w(C_*^w) \\ &+ \lambda[X(t, \theta, \alpha, 0) - E] + \mu[L - l(t, \theta, \alpha, 0)], \end{aligned} \tag{31}$$

where, by envelope theorem, C_*^w and C_*^c can be taken to be independent of t, θ and α, and where multipliers λ satisfy the Kuhn-Tucker conditions

$$\lambda[X(t,\theta,\alpha,0)-E]=0,\ \ \lambda\geq 0,\quad \mu[L-l(t,\theta,\alpha,0)],\ \ \mu\geq 0. \tag{32}$$

In equilibrium, the government's budget constraint must be binding, $X=E$, which implies $\lambda>0$. The worker's and capitalist's total consumption $C\doteq C^w+C^c$ must be equal to output y minus the total disutility of employment, bl, minus the total cost of hiding profit, Φ. Given (1), (2), (5), (15) and $s=0$, this yields

$$\begin{aligned}&C(t,\theta,\alpha)\doteq C^w+C^c=y-bl-\Phi=f(l)-bl-\phi\Pi(l),\\ &C_t\doteq\partial C/\partial t=(f'-b-\phi\Pi'')l_t<0\ \Leftrightarrow\ C_\alpha\doteq\partial C/\partial\alpha=(f'-b-\phi\Pi')l_\alpha<0.\end{aligned} \tag{33}$$

Noting (26), (29), (31), (32) and (33) and assuming $l<L$, we obtain the first-order conditions for taxes t and θ:

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial t}\Big|_{l<L}&=\frac{\partial(R^w+R^c)}{\partial t}+\lambda\frac{\partial X}{\partial t}=\frac{\partial(C^w+C^c)}{\partial t}+\lambda\frac{\partial X}{\partial t}=C_t+\lambda X_t=0,\\ \frac{\partial\mathcal{L}}{\partial\theta}\Big|_{l<L}&=\frac{\partial(R^w+R^c)}{\partial\theta}+\lambda\frac{\partial X}{\partial\theta}=\frac{\partial(C^w+C^c)}{\partial\theta}+\lambda\frac{\partial X}{\partial\theta}=C_\theta+\lambda X_\theta=0.\end{aligned} \tag{34}$$

This yields the following Ramsey rule:

Proposition 3 *In the case of unemployment, $l<L$, a rational government sets the profit and labour taxes to minimize the deadweight loss in public finance. This means that for the increase in each tax instrument, the decrease in the worker's and capitalist's total consumption C must be in proportion to the increase in tax revenue X.*

In the model, there are two sources of the deadweight loss in public finance: the capitalists evade taxation by hiding profit, which makes the tax base elastic with respect to the profit tax, and employment yields disutility, which makes the tax base elastic with respect to the labour tax. According proposition 3, in equilibrium the labour tax t and the effective tax rate on total profits, $(1-a)\theta$, can differ, even substantially. Finally, we examine how this difference affects regulation and collective bargaining.

From (29), (33), (34) and $\lambda > 0$ it follows that $C_t = -\lambda X_t < 0$ and $C_\alpha < 0$. Given (25), (30), (31) and (33), we obtain the first-order condition for regulation in the labour market:

$$\frac{\partial \mathcal{L}}{\partial \alpha} = \frac{\partial (R^w + R^c)}{\partial \alpha} + \lambda \frac{\partial X}{\partial \alpha} - \mu l_\alpha = \frac{\partial (C^w + C^c)}{\partial \alpha} + \lambda \frac{\partial X}{\partial \alpha} - \mu l_\alpha$$
$$= C_\alpha + \lambda X_\alpha - \mu l_\alpha = 0. \tag{35}$$

Assume first unemployment $l < L$. Since $C_\alpha < 0$ and $\lambda > 0$, given (15) and (32), $0 = \mu = (C_\alpha + \lambda X_\alpha)/l_\alpha > 0$ holds for $X_\alpha \leq 0$, which cannot be true. Hence, there is full employment $l = L$ for $X_\alpha \leq 0$. Given this and (30), we conclude that when there is unemployment $L > l$, tax revenue must be an increasing function of union power, $X_\alpha > 0$, and the labour tax t must be higher than the effective tax rate for total profits, $(1 - a)\theta$. We summarize these results as follows:

Proposition 4 *If tax revenue is a non-increasing function of union power, $X_\alpha \leq 0$, then a rational government establishes full employment $l = L$ by deregulation in the labour market (i.e. decreasing α low enough). Only if the labour tax is above the effective tax rate on profits so that tax revenue increases with the increase in union power, $X_\alpha > 0$, then there can be a political equilibrium at which a rational government maintains union power by regulation in the labour market.*

This proposition can be explained as follows. Because deregulation in the labour market (the decrease in α) decreases union power and wages but increases output and the worker's and capitalist's total consumption, it is in the government's interests to implement deregulation as long as this does not decrease tax revenue, $X_\alpha \leq 0$. If deregulation decreases but regulation (i.e. the increase in α) increases tax revenue, then the government attempts to use regulation together with taxes t and θ as a means of evening out deadweight loss in public finance. Then, in equilibrium, the decrease in worker's and capitalist's total consumption C must be in the same proportion to the decrease in tax revenue X for all policy instruments $i = t, \theta, \alpha$.

8 Conclusions

The paper examined the political economy in the following five stage game. First, the workers decide as a majority of voters on whether profit sharing or efficiency wages should be allowed. Second, the wage-earners' and profit earners' lobbies offer political contributions to the government to influence the exercise of public policy. Third, the government decides on taxation and regulation in the labour market. Fourth, the labour unions and the employers bargain over wages and labour conditions. Fifth, firms decide on production. The results and the interpretation of these are the following.

In economies where the ownership of firms and the participation in labour are diversified, there is political pressure to make income transfers from the owners of the firms (capitalists) to those who supply labour (workers). Ideally such transfers could be non-distorting, but the problem is the political elite who runs the government and whom lobbies pay political contributions that are related to public policy. Because this elite can claim contributions that are equal to non-distorting transfers, the voters abolish such transfers in the political process and the distribution of income is mainly carried out by collective bargaining. The role of the government is to make rules for this bargaining and to finance public expenditure by distorting taxes.

Because the government can drop the workers' profit share equal to zero at no cost by banning profit sharing agreements, the profit share is a non-distorting transfer. The same is true also for efficiency wages when the government is able to observe the marginal product of labour. It is therefore in the workers' (and also the voters') interests to eliminate such arrangements and impose right-to-manage bargaining. Regulation (deregulation) in the labour market strengthens (weakens) union power and transfers income from profits to wages (from wages to profits). If wages are not taxed heavier than profits, then deregulation does not decrease tax revenue and it is in the government's interests to establish full employment by deregulation. If wages are taxed more heavily than profits, then regulation increases tax revenue. In such a case, there a smalled deadweight loss of public finance with a larger income share of wages and it is in the interests of the government to support union power by regulation.

While a great deal of caution should be exercised when a highly stylized game-theoretic model is used to draw conclusions about the political process in the economy, the following judgement nevertheless seems to be justified. High concentration of profits to the non-working population together with difficulty in taxing profits relative to wages can lead to a system where the power of labour unions is protected by government. In such a case, right-to-manage bargaining is the stable form of wage settlement.

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