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Trade Unions and the Incidence of the Corporation Income Tax

by

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CENTRE OF PLANNING AND ECONOMIC RESEARCH

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ABSTRACT

The purpose of this paper is to investigate the incidence of the corporation income tax in a general equilibrium framework, with a unionized sector. The wage differential is set endogenously in contrast with most of the existing literature. The main findings of our analysis suggest that the presence of trade unions may affect significantly the tax incidence, depending on factor substitutability, factor intensities, and the elasticity of optimal wage differential with respect to wage-rental ratio in the unionized sector.

1. INTRODUCTION

Since the publication of the seminal work by Harberger (1962), considerable work has been directed at extending his model to accomodate a number of market imperfections, such as imperfect factor mobility, factor market distortions, monopoly power, monopolistic competition, etc.[1] Although the literature on tax incidence is by now quite voluminous, little has been done in examining the tax incidence in the presence of trade unions. This ommission in the literature seems to be rather serious since collective bargaining between firms and unions is the dominant form of wage determination in all democratic countries.

It is true that some work has been done in this area, for example Atkinson and Stiglitz (1980), Oswald (1982) and Hersoug (1984). This work does not change, however, the standard conclusions but only marginally. More specifically, Atkinson and Stiglitz (1980), extend the well-known Harberger's (1962) model by introducing a constant wage differential between the unionized and the non-unionized sector. The work of Oswald (1982) is partial equilibrium, and studies the impact of changes in unemployment benefits on the employment, the revenue being raised by various taxes. Hersoug (1984) employs the same framework, and deals only with changes in the progressivity of the income tax. It is only very recently that Lockwood (1990) has attempted a systematic analysis of the implications for tax incidence of differing bargaining structures in the labour market. It seems to us though, that two of his assumptions are rather restrictive. First, labour is immobile between sectors, and second, the influence of the non-unionized sector(s) is rather neglected.

The purpose of this paper is to investigate the effects of trade unions on tax incidence in the framework of the Harberger's model, with intersectoral labour mobility, and with a unionized and a non-unionized sector. In particular, we shall assume that there is a trade union in the corporate sector of the economy, and that the wage rate is determined endogenously. This assumption helps us to focus on the effects of the trade union on tax incidence. In order to make things simple and the model tractable, we retain all other assumptions made by Harberger although some of them have been criticized as rather unrealistic. In the second part of the paper the basic features of the model are laid out and the basic relations are derived. In the third part, we examine the tax incidence, i.e. the

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[1]. For a comprehensive review of the literature see Atkinson and Stiglitz (1980), and more recently Kotlikoff and Summers (1987).

changes in factor and commodity prices. In the fourth part we look at the effects of the corporate taxation on sectoral employment. In the last part we conclude by summarising our main findings and draw some of the policy implications that our analysis may have.

2. THE MODEL

Consider a closed economy in which there are two sectors, the corporate producing good X_1, and the non-corporate which produces the good X_2. All firms are price takers and each sector is subject to constant returns to scale. Each sector uses labour, L, and capital, K, which are both intersectorally mobile, and in fixed total supply. Initially there are no distortions in the economy, and the only one that is introduced by the government is the corporate income tax.

Following Hill (1984), we assume that labour is unionized in sector 1. The union's objective function is developed using an approach similar to that of MacDonald and Solow (1981). The members of the union are assumed to be fully aware of the tradeoff between the union wage w_1 and union employment L_1. If union membership is an exogenous number M, then each union member faces a probability of not securing a job in sector 1, equal to $(M-L_1)/M$. Those who are not employed in the unionized sector must work in the non-unionized (unincorporated) sector at a given wage w_2. Under the assumption that union members are risk neutral, Hill (1984) concludes that the objective function of the union can be collapsed to an expression involving the difference between the total wages paid to members employed in the unionized sector and their opportunity cost, as measured by the prevailing non-union wage, i.e.

$$U = w_1L_1 - w_2L_1 \qquad (1)$$

The optimal wage differential derived from equation (1) can be written as follows:[1]

$$(w_1/w_2) = (e/e-1) \qquad (2)$$

where e is the elasticity of demand for labour in sector 1. As is clear from condition (2), w_1/w_2 and e must exceed unity at optimum. If the union takes as given not only the wage rate in sector 2 but also the capital employed by firms in sector 1, then, as Jones (1971) has shown, $e = \sigma_1/\Theta_{K1}$, where σ_1 is the elasticity of factor substitution and Θ_{K1} the

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[1]. For a detailed exposition of the optimizing process followed by the trade union, see Hill (1984).

distributive share of capital in sector 1. Assuming further that the production function is of the CES variety, we obtain by differentiation of (2) the following:[1]

$$w_1^*-w_2^* = [(\sigma_1-1)/(\sigma_1-\Theta_{K1})]\Theta_{K1}\Theta_{L1}(w_1^*-r_1^*) = \phi(w_1^*-r_1^*) \tag{3}$$

where r_1 denotes the gross return to capital in sector 1, an asterisk (*) over a variable denotes percentage change, i.e. $x^* = dx/x$, and ϕ can be interpreted as the elasticity of the optimal wage differential with respect to the wage-rental ratio in the first sector. It can be either positive or negative depending upon whether σ_1 exceeds or falls short of unity. It is clear that if the production function in the unionized sector is Cobb-Douglas, the optimal wage differential remains invariant to changes in the wage-rental ratio in that sector. Finally, it is worth noting that ϕ is unbounded from below, as σ_1 approaches Θ_{K1}, and that it is bounded from above by Θ_{K1}, and since at optimum $e>1$, it implies that $\sigma_1 > \Theta_{K1}$.

Following Jones (1965, 1971) and Hill (1984), we can derive the basic relations of our model as follows:[2]

If we consider commodity 2 as the numeraire, i.e. $P_2 = 1$, we obtain by differentiation of the zero profit conditions the following relationships:

$$\Theta_{L1}w_1^* + \Theta_{K1}r^* = p_1^* - \Theta_{K1}T^* \tag{4}$$

$$\Theta_{L2}w_2^* + \Theta_{K2}r^* = p_2^* = 0 \tag{5}$$

where Θ_{ij} is the distributive share of factor i in the output of sector j ($j=1,2$), $T = 1+t$, where t is the tax rate imposed on the profits of the corporate sector, r is the net (of tax) return to capital ($r_1 = rT$), and p_j is the price of the jth output. Linear homogeneity implies that $\Theta_{Kj} + \Theta_{Lj} = 1$.

Total differentiation of the full employment conditions yields:

$$\lambda_{L1}X_1^* + \lambda_{L2}X_2^* = L^* - (\lambda_{L1}a_{L1}^* + \lambda_{L2}a_{L2}^*) \tag{6}$$

$$\lambda_{K1}X_1^* + \lambda_{K2}X_2^* = K^* - (\lambda_{K1}a_{K1}^* + \lambda_{K2}a_{K2}^*) \tag{7}$$

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[1]. For a detailed derivation of (3) see Appendix or Hill (1984), footnote 6.

[2]. The basic relations of our model, although well-known, are given in the Appendix.

where λ_{ij} is the fraction of factor i employed in sector j, (i = K,L; j = 1,2), and a_{ij} is the ratio of input i with respect to the output of sector j. We also have that $\lambda_{i1} + \lambda_{i2} = 1$.

Defining the elasticity of substitution between capital and labour in sector j (j = 1,2) as:

$$\sigma_j = (a_{Kj}^{\cdot} - a_{Lj}^{\cdot})/(w_j^{\cdot} - r_j^{\cdot}) \tag{8}$$

and taking into account the fact that cost minimization implies $\Theta_{Lj} a_{Lj}^{\cdot} + \Theta_{Kj} a_{Kj}^{\cdot} = 0$, we obtain:

$$a_{Lj}^{\cdot} = -\Theta_{Kj}\sigma_j(w_j^{\cdot} - r_j^{\cdot}) \tag{9}$$

$$a_{Kj}^{\cdot} = \Theta_{Lj}\sigma_j(w_j^{\cdot} - r_j^{\cdot}) \tag{10}$$

Substituting (9) and (10) into (6) and (7) we can obtain after some manipulations the following relationship:

$$\lambda(X_1^{\cdot} - X_2^{\cdot}) = \beta_1(w_1^{\cdot} - r^{\cdot}) + \beta_2(w_2^{\cdot} - r^{\cdot}) - \beta_1 T^{\cdot} \tag{11}$$

where $\beta_j = (\lambda_{Lj}\Theta_{Kj} + \lambda_{Kj}\Theta_{Lj})\sigma_j$, and $\lambda = \lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1} = \lambda_{L1} - \lambda_{K1}$. Making use of equation (3), we can rewrite (11) as follows:

$$\lambda(X_1^{\cdot} - X_2^{\cdot}) - [\beta_1 + \beta_2(1-\phi)](w_1^{\cdot} - r^{\cdot}) = (\beta_2\phi - \beta_1)T^{\cdot} \tag{12}$$

Appropriate substitutions and manipulations of equations (3), (4), and (5) yield:

$$(\Theta + \Theta_{L2})(w_1^{\cdot} - r^{\cdot}) = p_1^{\cdot} - p_2^{\cdot} + (\Theta_{L2}\phi - \Theta_{K1})T^{\cdot} \tag{13}$$

where $\Theta = \Theta_{L1}\Theta_{K2} - \Theta_{L2}\Theta_{K1} = \Theta_{L1} - \Theta_{L2}$.

The production structure of our economy is adequately described by equations (12) and (13). On the consumption side, we assume that the tax revenue is redistributed to consumers in a lump-sum way, and that consumers have identical and homothetic preferences which implies that:

$$X_1^{\cdot} - X_2^{\cdot} = -\sigma_D(p_1^{\cdot} - p_2^{\cdot}) = -\sigma_D p_1^{\cdot} \tag{14}$$

where σ_D is the elasticity of substitution between X_1 and X_2 in consumption.

We have, therefore, three equations (12), (13), and (14) in three unknowns, $X_1^{\cdot}$-$X_2^{\cdot}$, $p_1^{\cdot}$-$p_2^{\cdot}$, and $w_1^{\cdot}$-$r^{\cdot}$, and we can proceed to their solution, for some comparative static exercises.

3. TAX INCIDENCE

Let us consider first the effects of taxes on w_1-r. Solving simultaneously equations (12)-(14) we obtain:

$$w_1^*-r^* = (1/D)[-\lambda\Theta_{K1}\sigma_D + \beta_1 + \phi(\Theta_{L2}\lambda\sigma_D-\beta_2)]T^* \qquad (15)$$

where $D = \lambda(\Theta + \Theta_{L2}\phi)\sigma_D + \beta_1 + \beta_2(1-\phi)$. Following Hill (1984), it is assumed throughout the paper that the long-run equilibrium is stable and, therefore, the sigh of λ is the same with the sign of $\Theta + \Theta_{L2}\phi$. Stability, however, requires that $D>0$, which means that for D to be positive, it is also required that $(1-\phi)>0$. As we have already noted ϕ is bounded from above by Θ_{K1}, which is less than one, and therefore $1-\phi$ is always positive irrespective of whether ϕ is positive or negative. Thus $D>0$. With the denominator positive, the sigh of (15) depends on the sign of the numerator. In the latter we can distinguish three terms. Following Mieszkowski (1967), we can call the term $(-\lambda\Theta_{K1}\sigma_D)$ as the output effect. and the second term β_1 as the substitution effect. These two terms are present in the Harberger's analysis. In equation (15) there is, however, a third term, $\phi(\Theta_{L2}\lambda\sigma_D-\beta_2)$, which we can call as the **trade-union effect.**

As in Harberger (1962) the substitution effect is always positive, while the sign of the output effect depends on whether the corporate (and unionized) sector is labour or capital intensive, i.e. on whether λ is positive or negative. With regard to the trade-union effect, it is more difficult to determine the sign, since it depends not only on λ, but also on ϕ. To make things simpler, for the rest of our analysis, we shall assume that λ is positive,that is the corporate (unionized) sector is relatively labour intensive, and that ϕ is negative, that is σ_1 is less than one, two assumption that seem rather realistic. With $\lambda>0$ the output effect is negative, but the trade-union effect will be negative if $\Theta_{L2}\lambda\sigma_D>\beta_2$, and vice versa.

Under the above assumptions it is clear that the output effect works against the unionized labour relative to capital, the substitution effect in favour of it, and the trade union effect in favour of it if $\Theta_{L2}\lambda\sigma_D<\beta_2$, and vice versa. If we assume that σ_2 is very small, which implies that β_2 is also small, then the trade-union effect will be negative, and it will work against the unionized wages relative to capital. What about the relation between unionized and non-unionized wages? Making use of equations (3) and (15), we obtain:

$$w_1^*-w_2^* = -(1/D)\phi(\lambda\Theta_{K2}\sigma_D + \beta_2)T^* \qquad (16)$$

It is clear that, under the above stated assumptions, the presence of the trade union benefits the unionized workers relative to the non-unionized ones. An explanation for this outcome may be the following. The imposition of the tax on capital in the unionized sector will tend to increase Θ_{K1}, and thereby will reduce e. As the elasticity of the demand for labour becomes less elastic in the neighbourhood of the original optimum, the union will respond by increasing the wage differential.

In addition to relative factor-price changes, it is also interesting to examine the factor price changes in terms of the numeraire.[1] By combining (3), (5) and (15) we obtain:

$$r^{\cdot} = (\Theta_{L2}/D)[\lambda\sigma_D(\Theta_{K1}-\phi)-\beta_1]T^{\cdot} \tag{17}$$

$$w_1^{\cdot} = (1/D)(-\sigma_D\lambda\Theta_{K1}\Theta_{K2} + \Theta_{K2}\beta_1-\phi\beta_2)T^{\cdot} \tag{18}$$

$$w_2^{\cdot} = (-\Theta_{K2}/D)[\lambda\sigma_D(\Theta_{K1}-\phi)-\beta_1]T^{\cdot} \tag{19}$$

It is obvious from the above relationships that we cannot determine the changes in factor prices unambigously. With regard to the presence of trade-union it is clear that it favours capital and unionized labour and works against the wage of the non-unionized labour.

Besides the effects of taxation on factor prices, it is worth examining its effects on commodity prices and, therefore, its effects on real factor prices. Since we have assumed that p_2 is the numeraire, we can now examine the effect of the corporate tax on the price of the first commodity, p_1. From (12), (13), and (14) we obtain that:

$$p_1^{\cdot} = (1/D)[\beta_1\Theta_{K2} + \beta_2(\Theta_{K1}-\phi)]T^{\cdot} \tag{20}$$

that is the price of the commodity produced by the corporate sector rises as a result of the tax. Moreover, this increase is greater in the presence of the trade union than otherwise, as can be seen by the presence of factor ϕ. The question that now arises is what are the changes in factor prices in terms of p_1? Combining equations (17)-(19) with (20) we obtain:

$$r^{\cdot}-p_1^{\cdot} = (1/D)[\Theta_{L2}\lambda\sigma_D\Theta_{K1}-\beta_1-\Theta_{K1}\beta_2 + \phi(\beta_2-\Theta_{L2}\lambda\sigma_D)]T^{\cdot} \tag{21}$$

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[1]. The relative change of w_2 with respect to r, i.e. w_2-r, can be easily derived by combining equations (3) and (15). The interpretation of this relationship is straightforward.

$$w_1^{\cdot}-p_1^{\cdot} = -(\Theta_{K1}/D)(\lambda\Theta_{K2}\sigma_D + \beta_2)T^{\cdot} \quad (22)$$

$$w_2^{\cdot}-p_1^{\cdot} = [(\phi-\Theta_{K1})/D](\lambda\Theta_{K2}\sigma_D + \beta_2)T^{\cdot} \quad (23)$$

These relationships reveal very clearly that labour, either unionized or non-unionized, loses in terms of the commodity produced by the corporate sector, while the change in the return to capital depends on the magnitudes of relative factor intensities and factor and commodity substitutability. It is interesting to note that the change in the wage in the unionized sector does not depend at all on the presence of the trade union. This can be explained by the fact that the presence of the trade union benefits the unionized labour by a factor $\phi\beta_2$, but the price of the corporate sector output also rises by the same factor. In other words the presence of the trade union increases equally the wage in the unionized sector and the price of the output produced by that sector, which is also the corporate one. With regard to the effect of the presence of trade union on the wage of the nono-unionized labour, it is certainly negative, but its effect on the rental to capital cannot be determined without knowing the values of the parameters of the model.

4. EMPLOYMENT EFFECTS

As we noted in section 2, the union seeks an optimal union-employment policy. Having examined the effect of the corporate tax on wages, it is worth examining the effect of taxation on employment in the unionized (corporate) sector. Differentiating the full employment conditions we obtain:

$$\lambda_{L1}L_1^* + \lambda_{L2}L_2^* = L^* = 0 \tag{24}$$

$$\lambda_{K1}K_1^* + \lambda_{K2}K_2^* = K^* = 0 \tag{25}$$

Solving simultaneously equations (8), (24), and (25), we can get the value of L_1, and L_2 in terms of w_1-r, and w_2-r. After the appropriate substitutions and some manipulations we have:

$$L_1^* = (-\lambda_{L2}/D)\{\lambda_{K1}\Theta_{K2}\sigma_1(\sigma_D-\sigma_2) + \lambda_{K2}\sigma_2[\Theta_{K1}(\sigma_D-\sigma_1)-\phi\sigma_D]\}T^* \tag{26}$$

It is clear that the presence of trade union affects negatively the employment in the unionized sector. More generally, the employment in the corporate sector depends on the values of the elasticities of factor substitution in the two sectors, and the elasticity of substitution between commodities in consumption. Consider, for example, the case where $\sigma_D = \sigma_1 = \sigma_2 = \sigma$. Equation (26) reduces then to

$$L_1^* = (1/D)\lambda_{L2}\lambda_{K2}\phi\sigma T^* \tag{27}$$

which means that employment in the unionized sector falls. Similarly, if the elasticity of substitution in the non-unionized sector is zero, the employment in the corporate sector falls. In that case, however, the presence of trade union has no effect on employment as the following relationship reveals.

$$L_1^* = -(1/D)\lambda_{L2}\lambda_{K1}\sigma_D\Theta_{K2}\sigma_1 T^* \tag{28}$$

That is, if σ_2 is zero the trade union cannot affect the incidence of the profits tax. If, on the other hand, $\sigma_1 = 0$ then employment in the unionized sector will again fall, but in that case the presence of trade union favours employment in the non-unionized sector.

5. CONCLUDING REMARKS

In the preceding analysis we have attended to extend Harberger's analysis of the incidence of the corporate income tax, by assuming that in the corporate sector there is a trade union. To make the analysis simple, we have limited ourselves to the examination of some general cases. More particularly, we have assumed that the corporate (unionized) sector is relatively labour intensive and that the elasticity of substitution between labour and capital in the corporate sector is less than unity. It is obvious that our analysis could be extended by considering several other cases, e.g. by assuming that the corporate sector is relatively capital intensive and/or that the substitutability between labour and capital in the corporate sector is greater than one.

A basic result of our analysis is that if there is a trade union in the corporate sector, it may affect significantly the incidence of the corporation income tax. It depends, of course, on relative factor intensities, factor and commodity substitutability as in Harberger's model. The trade union effect, however, is also influenced by these parameters, and the Harberger's results may change in the opposite direction because of the presence of the trade union. It is worth noting that the presence of trade union does not always work in favour of the unionized labour in terms of wages, relative to capital, and employment. In fact it is quite possible, under certain conditions, that the non-unionized wages rise relative to the unionized ones as a result of the imposition of the corporate income tax.

Finally, it is worth noting that our results are substantially different from those derived by Atkinson and Stiglitz (1980), where there was a constant exogenous wage differential between the unionized and non-unionized wages. In fact their results differ only marginally from those derived by Harberger. Our results are also different from those of Lockwood (1990), although his results are not directly comparable to ours, due mainly to the very different nature of his model.

APPENDIX

As explained in the main text of the paper, we have defined

$$\Theta_{K1} = (r_1 K_{1)}/(p_1 X_1).$$

Totally differentiating yields

$$d\Theta_{K1} = [(K_1 dr_1 + r_1 dK_1)p_1 X_1 - r_1 K_1 (X_1 dp_1 + p_1 dX_1)]/(p_1 X_1)^2.$$

After some manipulations we can easily get that

$$\Theta_{K1}^{\cdot} = r_1^{\cdot} + a_{K1}^{\cdot} - p_1^{\cdot}$$

Combining this with equations (4) and (10) of the main text yields equation (3).

With regard to the basic equations of our model, we follow Jones (1965), and the zero profit conditions are:

$$a_{L1} w + a_{K1} r_1 = p_1 \qquad \text{(A1)}$$

$$a_{L2} w + a_{K2} r = p_2 \qquad \text{(A2)}$$

where $r_1 = r(1 + t) = rT$, with t being the corporate income tax rate.

Differentiating totally, and assuming cost minimization, we obtain equations (4) and (5).

Similarly, the full employment conditions are:

$$a_{L1} X_1 + a_{L2} X_2 = L \qquad \text{(A3)}$$

$$a_{K1} X_1 + a_{K2} X_2 = K \qquad \text{(A4)}$$

Differentiating totally yields equations (6) and (7).

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