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# Welfare Effects of Union Bargaining Centralisation in a Two-Sector Economy

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## Abstract

The paper analyses the welfare effects of union bargaining centralisation in a simple general equilibrium model. A two-sector model is developed where the wage rate in the first sector is either set decentralised by a small union at the firm level or centralised by a large union covering all workers. Worker's outside option is employment in the second sector with wages adjusting to clear the market. The paper shows that social welfare depends on (i) whether the union considers the connection between wages in both sectors, (ii) the structure of the union's objective function, and (iii) the elasticities of labour demand. The welfare maximising employment allocation can be obtained under a high degree of centralisation if the union maximises the total wage-bill. Otherwise, if the union is rent maximising, neither centralised nor decentralised wage setting yield the social optimum. A second best optimum can then be obtained under decentralised bargaining.

**Keywords:** Unions, Bargaining centralisation, Two-sector economy, Social welfare

**JEL Classification:** C78, J51, J61

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## 1 Introduction

There is a broad consensus among labour economists that unions cause labour market distortions since they tend to raise the wage above its market-clearing level. However, it is not obvious, neither empirically nor theoretically, how this distortion depends on the size of the union and the structure of the wage setting. Thus, it seems interesting to shed some more light on the question if bigger unions acting centralised and comprehending more workers are more harmful for economic welfare – or if they are better able to internalise externalities of their wage setting behaviour than small unions.

The seminal work by Calmfors & Driffill (1988) points out the ambiguous effects of bargaining centralisation on labour market outcome. Elster (1989), Wallerstein (1990) and Calmfors (1993) discuss several possible externalities caused by various degrees of centralisation. A more comprehensive theoretical analysis on the economic implications of centralised versus decentralised wage bargaining can be found in Moene et al. (1993). Besides, a number of theoretical contributions deal with the idea of a relationship between bargaining centralisation and labour market outcome. Most of them study the effects of an endogenous unemployment insurance in a union wage bargaining framework (Holmlund & Lundborg 1988, 1999, Kiander 1993, Sinko 2004). Hoel (1990) analyses firm's investment decision by abandoning the assumption of a fixed capital stock, while Hoel (1991) studies the importance of labour mobility in a union bargaining framework. Models dealing with labour taxation and tax burdens in centralised labour markets include Summers et al. (1993) and Kilponen & Sinko (2005). They argue that unions recognise the connection between taxes on labour supply and the public provision of goods if wage setting is more centralised. Empirical evidence can be found in Daveri & Tabellini (2000). Other papers not focussing on the level of wages but on the wage structure study the relationship between the degree of centralisation and wage inequality (Wallerstein 1990, Rasmussen 1992, Rowthorn 1992, Barth & Zweimüller 1995). Another strand of the literature analyses bargaining centralisation in an efficiency wage framework (Hoel 1989, Rodseth 1993).

This paper differs from the papers mentioned above in two respects. First, it extends the existing literature by considering the impact of different structures of wage setting centralisation in a dual labour market. In contrast to most of the literature,<sup>1</sup> the econ-

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<sup>1</sup>An exception is the brief discussion in Booth (1995) which is based on the analysis of trade unions in a two-sector economy in Oswald (1979).

omy is assumed to consist of a unionised and a competitive sector where the union's outside option is determined endogenously in the latter one. Two contrary wage setting scenarios are considered to study the impact of centralisation: decentralised wage formation at the firm level and centralised wage setting by a large union acting at the sector level. The rationale is straightforward: when each union acts independently at the firm level, it maximises its own utility ignoring the impacts on the outside option. But this point will not hold in the case of centralised wage formation if there is only one large union in the economy. Then the union has to take into account that a higher wage in the unionised sector increases labour supply in the competitive sector.

Second, the paper analyses the impact of different union objective functions on social welfare under both centralised and decentralised wage setting. There is much literature on wage bargaining where unions are in general assumed to maximise an objective function depending on wage and employment levels. In the following, I will focus on two approaches: wage-bill maximisation and rent maximisation. While the first approach is based on the seminal work by Dunlop (1944), the latter one was developed by Rosen (1970) and de Menil (1971). Dunlop (1944), and later on Hieser (1970) and Johnston (1972), argued that the union wishes to maximise the total income, i. e. the wage-bill, of its members. However, Rosen (1970) and de Menil (1971) assume the real wage surplus to be the appropriate maximand. That is, the union maximises the difference between total wage income in the unionised sector and wage income under competitive conditions (Oswald 1979). In labour economics literature, both approaches are often treated to be very similar (Oswald 1985, Pencavel 1991, Booth 1995). But they yield the same labour market outcome if and only if the outside option, i. e. the wage in the competitive sector, is exogenous from the union's point of view. In the following, it will be shown that employment and wages resulting from both approaches differ if this assumption is abandoned. That is, the welfare effects of wage setting centralisation depend significantly on the structure of union's objective function.

The paper is organised as follows. Section 2 sets up the model. Section 3 analyses the labour market outcome assuming the union to be wage-bill maximising, while section 4 studies the impacts of a rent maximising union. In both sections, I distinguish between decentralised and centralised wage setting and point out the respective welfare effects. Section 5 concludes.

## 2 Model Framework

The economy consists of two sectors, a unionised and a competitive one. Workers are mobile between the sectors, i. e. those workers displaced from the unionised sector will flood into the competitive sector. The wage in the unionised sector  $w$  is set monopolistically either by a small union at the firm level or by a large union covering all workers. For given wage, firms then choose the level of employment. The wage in the competitive sector  $b$  equalises labour demand and supply. There are  $\lambda$  homogeneous firms and an equal number of unions in the unionised sector, whereas the number of firms in the competitive sector is normalised to unity. Firm location in both sectors is assumed to be exogenous. Let  $N$  denote the total available workforce in each firm in the unionised sector. The total workforce in the economy is denoted by  $Z$ . Each individual inelastically supplies one unit of labour. The utility out of the wage either in the unionised or the competitive sector is assumed to be linear in the respective wages. Furthermore, by assumption all workers are identical and union members.<sup>2</sup>

Production functions in both sectors are characterised by diminishing returns to labour, constant elasticities and satisfy the usual Inada conditions. The production function of a representative firm in the unionised sector is denoted by  $f(L)$ , with  $L$  being the employed workforce in the firm as a single input. Firms in both sectors sell their output in a competitive goods market, where the output prices are normalised to unity. Firm's profit can then be written as

$$\Pi = f(L) - wL.$$

Labour demand can be derived from the maximisation of firm's profit and is determined by the marginal productivity condition

$$L = f'^{-1}(w). \tag{1}$$

The production technology in the competitive sector may differ from the technology in the unionised sector. A representative firm's production function is denoted by  $g(M)$ , with  $M$  denoting employment in the competitive sector. Since  $M$  is exogenous from the firm's point of view, the wage  $b$  will be determined such that the marginal productivity

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<sup>2</sup>Dittrich & Schirwitz (2006) relax this restricting assumption in a dynamic bargaining framework by allowing for workers displaced from the unionised sector to leave the union.

condition holds:

$$b = g'(M). \quad (2)$$

As stated before, total population  $Z$  consists of workers employed in  $\lambda$  firms in the unionised sector and of workers in the competitive sector. Thus, the workforce in the competitive sector can be written as

$$M = Z - \lambda L, \quad (3)$$

implying the clearing of the labour market.

Before analysing the labour market effects of union wage setting, I will shed some light on the welfare optimum in the economy. A social planner would set an employment allocation such that the overall output in both sectors is maximised, i. e.

$$\begin{aligned} \max_L V &= \lambda f(L) + g(M) \\ \text{s. t. } Z &= \lambda L + M, \end{aligned} \quad (4)$$

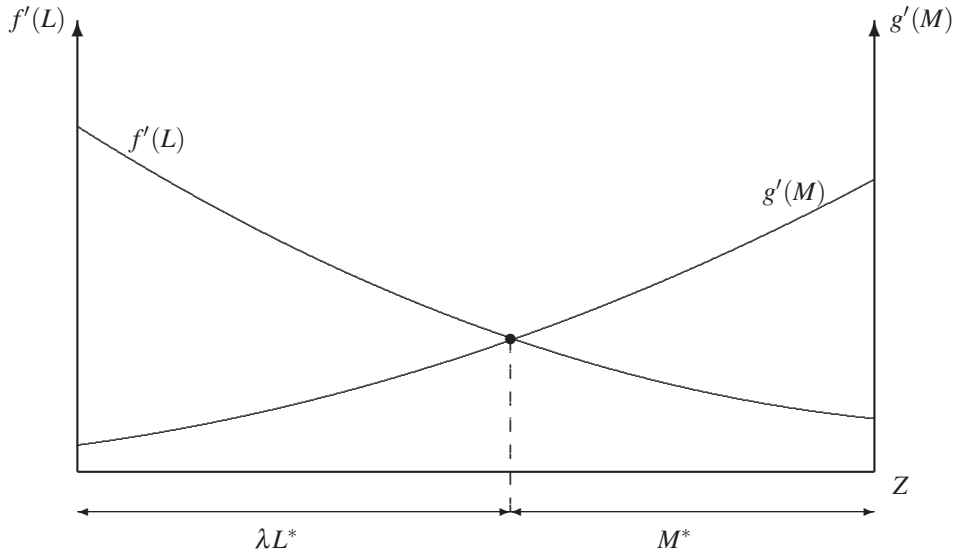
with  $V$  denoting social welfare.<sup>3</sup> Maximising (4) with respect to  $L$  yields the condition of the welfare optimum:

$$f'(L) = g'(M). \quad (5)$$

According to (5), social welfare is maximised if marginal productivities of workers in both sectors are equal. Figure 1 illustrates the optimal employment allocation  $\lambda L^*$  and  $M^*$ , where the (inverse) labour demand functions in both sectors are pictured by  $f'(L)$  and  $g'(M)$ .

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<sup>3</sup>Pencavel (1991) discusses alternative forms of social welfare. For instance, maximising a utilitarianistic objective function yields the same result.



**Figure 1:** Welfare maximising employment allocation in a two-sector economy.

### 3 Wage-Bill Maximising Union

#### Decentralised Wage Setting

First, the case where the wage rate is determined by a monopolistic union at the firm level is considered.<sup>4</sup> Both unions and firms take the competitive wage as given. The representative union maximises the total wage-bill of its members taking into account the firm's labour demand (1). Hence, the union has to solve the maximisation problem

$$\begin{aligned} \max_w U_1^d &= Lw + (N - L)b & (6) \\ \text{s. t. } L &= f'^{-1}(w). \end{aligned}$$

Maximising (6) with respect to  $w$  and making some rearrangements yield the familiar result

$$w_1^d = b_1^d \left( \frac{\eta_w^L}{1 + \eta_w^L} \right), \quad (7)$$

<sup>4</sup>Applying the more general right-to-manage approach would not change the qualitative results but only calculations get more complicated.

with  $\eta_w^L = \frac{\partial L}{\partial w} \frac{w}{L}$  denoting the elasticity of labour demand with respect to the wage in the unionised sector. Following the literature, it is assumed that  $\eta_w^L < -1$ .<sup>5</sup> There is thus  $\frac{\eta_w^L}{1+\eta_w^L} > 1$ , implying that the union sets a mark-up on the competitive wage. Firms react with a reduce in employment yielding  $L_1^d < L^*$ .

## Centralised Wage Setting

These results are only valid if unions are indeed large enough to have significant wage setting power but are too small to recognise the wage and employment consequences of their behaviour in the second sector. In the following, the case of centralised wage formation by a large union covering all workers is analysed. This union takes into account the wage effect in the competitive sector when setting the wage in the unionised sector. The higher the wage in the unionised sector, the lower employment is there. Since workers always work either in the unionised or in the competitive sector, this leads to higher employment and a lower wage in the competitive sector. If the union sets a mark-up on the competitive wage, a lower outside option reduces the union wage. If wage setting is decentralised at the firm level and if there is a large number of unions, each of them neglects the impact of its wage setting behaviour on the wage and employment in the second sector. However, this assumption cannot be maintained if wage setting takes place centralised at a sectoral level. The union now pays attention to the fact that the outside option depends on employment in the unionised sector. Using (2) and (3), the competitive wage can be written as a function of employment in the unionised sector:

$$b = g'(Z - \lambda L). \quad (8)$$

The union covers all  $Z$  workers and is assumed to maximise the total wage-bill. Hence, the maximisation problem can be expressed as

$$\begin{aligned} \max_w U_1^c &= \lambda Lw + (Z - \lambda L)b \\ \text{s. t. } L &= f'^{-1}(w) \\ b &= g'(Z - \lambda L) \end{aligned} \quad (9)$$

<sup>5</sup>This condition is satisfied by any conventional kind of production function with constant elasticities, e. g. the standard Cobb-Douglas function  $f(L) = L^\alpha$  with  $\alpha \in (0, 1)$ .



Solving (9) with respect to the wage and making some rearrangements yield the following equation defining the wages in both sectors:

$$w_1^c = b_1^c \left( \frac{\eta_w^L}{1 + \eta_w^L} \right) \left( \frac{1 + \eta_b^M}{\eta_b^M} \right), \quad (10)$$

with  $\eta_b^M = \frac{\partial M}{\partial b} \frac{b}{M} < -1$  being the elasticity of labour demand with respect to the wage in the competitive sector. Overall, the wage will be set by the union such that the benefit increase due to a marginal wage increase equals the marginal cost from both a reduction in employment and a reduction in the competitive wage for all workers employed in the competitive sector. As stated before, the crucial point is now that the union takes into account the impact of its behaviour on the competitive wage since it maximises the total wage-bill. Hence, according to this additional effect compared to decentralised wage setting, the mark-up on the competitive wage is lower if the union acts centralised. This can easily be shown by comparing (7) and (10) and reminding that  $\frac{1 + \eta_b^M}{\eta_b^M} \in (0, 1)$ .

Moreover, depending on the value of the elasticities in both sectors, the welfare maximising allocation can be obtained. If  $\eta_w^L > \eta_b^M$ , the union wage exceeds the competitive wage. This fact causes an excess burden, but smaller than under decentralised wage setting. Otherwise, if  $\eta_w^L = \eta_b^M$ , wages in both sectors are equal and the welfare maximising allocation is obtained. If  $\eta_w^L < \eta_b^M$ , the competitive wage would be higher than the unionised one. However, this would lead to some workers moving from the unionised to the competitive sector until both wages are equalised. Therefore, it can be stated that the welfare optimum is reached if  $\eta_w^L \leq \eta_b^M$ .

Comparing the labour market outcomes under the two various institutional settings, it is easy to see that the union sets a higher wage if acting at the firm level. Since firms choose employment according to their labour demand curves, employment in the unionised sector is higher in the centralised case. Contrary, the competitive wage is higher and employment in the competitive sector is lower under decentralised wage setting. The resulting dead-weight loss  $D_1^d$  is defined by

$$D_1^d = \int_{L_1^d}^{L^*} \lambda f'(L) - g'(M) \, dL. \quad (11)$$



## 4 Rent Maximising Union

### Decentralised Wage Setting

If the union maximises the gain from working in the union sector over the outside option, the objective function to be maximised is given by

$$\begin{aligned} \max_w U_2^d &= L(w - b) \\ \text{s.t. } L &= f'^{-1}(w). \end{aligned} \quad (12)$$

Solving (12) with respect to the wage yields

$$w_2^d = b_2^d \left( \frac{\eta_w^L}{1 + \eta_w^L} \right) \quad (13)$$

which is equivalent to (7). Hence, the wages set by a wage-bill and a rent maximising union are the same. This is due to the fact that the wage in the competitive sector is exogenous from the union's point of view. Thus, there is no difference between maximising the rents accruing to the workers in the unionised sector or maximising the total income of workers in both the unionised and the competitive sector.

### Centralised Wage Setting

A centralised union wishes to maximise the wage surplus in all  $\lambda$  firms taking into account the competitive sector outcome. Therefore, it is moreover subject to changes in the competitive sector outcome due to its wage setting behaviour. It faces the optimisation problem

$$\begin{aligned} \max_w U_2^c &= \lambda L(w - b) \\ \text{s.t. } L &= f'^{-1}(w) \\ b &= g'(Z - \lambda L). \end{aligned} \quad (14)$$

Maximisation with respect to the wage yields

$$w_2^c = b_2^c \left( \frac{\eta_w^L}{1 + \eta_w^L} \right) \left( \frac{1 + \eta_b^L}{\eta_b^L} \right), \quad (15)$$

with  $\eta_b^L = \frac{\partial L}{\partial b} \frac{b}{L}$  denoting the elasticity of labour demand in the unionised sector with respect to changes in the competitive wage. Because a higher competitive wage causes lower employment in the competitive sector and thus more employment in the unionised sector, it follows that  $\eta_b^L > 0$  and  $\frac{1+\eta_b^L}{\eta_b^L} > 1$ . Comparing (13) and (15), it is easy to see that the union's mark-up on the outside option is higher than in the decentralised case. This is due to the fact that the union only cares for the workers in the unionised sector. By setting a higher wage, the gain from working in the union sector over the outside option can be increased because the competitive wage decreases.

The welfare effects are straightforward. A first-best optimum is neither reached under decentralised nor under centralised wage setting. However, it can be checked that social welfare is higher in the decentralised case. The respective dead-weight losses can be calculated in the same manner as in (11). In figure 3, they are pictured by the triangles ABC and ADE.

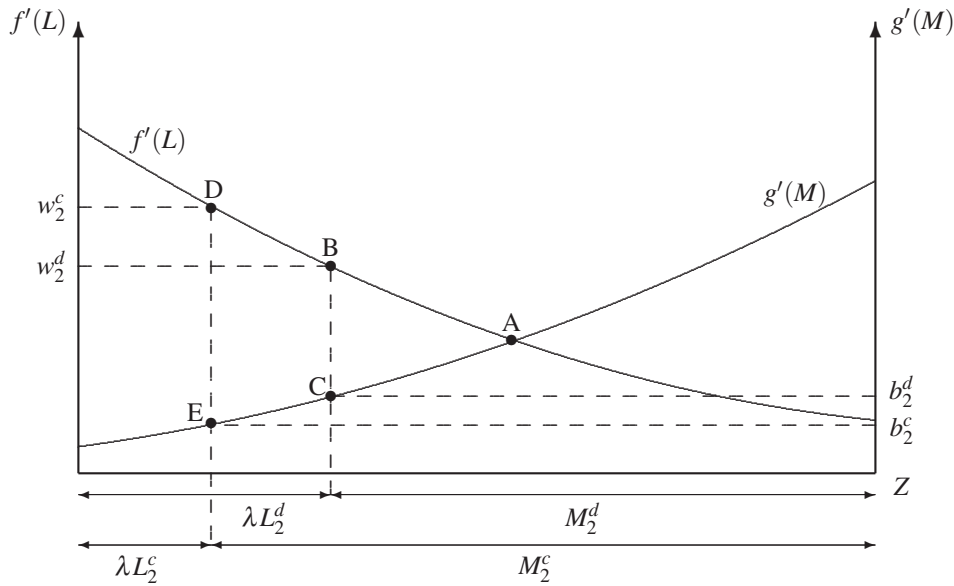


Figure 3: Wages and employment under a rent maximising union.

## 5 Conclusion

This paper analyses the labour market outcome of two extreme regimes of wage setting centralisation in a dual labour market. It can be shown that welfare effects of wage setting centralisation are ambiguous and depend significantly on the structure of the union's objective function. If the union maximises the total wage-bill of workers both in the unionised and in the competitive sector, employment in the unionised sector and social welfare are higher in the centralised scenario. This is caused by a centralised union taking into account the consequences of its wage setting behaviour on the competitive sector outcome. In other words, this union considers that a higher union wage would decrease the wage in the competitive sector. A decentralised acting union will not take into account these effects and will thus set a higher wage. Moreover, the optimal employment allocation may be obtained in the centralised setting if the elasticity of labour demand in the unionised sector does not exceed the labour demand elasticity in the competitive sector.

However, if the union is rent maximising, employment in the unionised sector and social welfare are higher under decentralised bargaining. A centralised union indeed takes into account the consequences of its wage setting behaviour on the competitive sector outcome. But since it does not care for the workers in the competitive sector, a higher wage is set to maximise the aggregate gain from employment in the union sector over the outside option. In both settings, the union sets a mark-up on the competitive wage. Thus, the social optimum is not obtained, neither under decentralised nor under centralised bargaining. The second-best allocation would then be attained with decentralised bargaining at the firm-level. To finally determine the welfare effects of wage setting centralisation, a precise definition of the empirically relevant union's objective function is important.

## Appendix: Mathematical Derivations

### Wage-Bill Maximising Union

Under decentralised wage setting, maximising (6) with respect to  $w$  yields

$$\begin{aligned}\frac{\partial U_1^d}{\partial w} &= \frac{\partial L}{\partial w}(w-b) + L = 0 \\ \Leftrightarrow &\frac{\partial L}{\partial w} \frac{w}{L}(w-b) + w = 0 \\ \Leftrightarrow &w(1 + \eta_w^L) - b\eta_w^L = 0.\end{aligned}$$

Reformulating gives (7).

In the centralised framework, maximising (9) gives

$$\begin{aligned}\frac{\partial U_1^c}{\partial w} &= \lambda \left( \frac{\partial L}{\partial w} w + L \right) - \lambda \frac{\partial L}{\partial w} b - \lambda (Z - \lambda L) \frac{\partial b}{\partial M} \frac{\partial L}{\partial w} = 0 \\ \Leftrightarrow &\frac{\partial L}{\partial w}(w-b) + L - \lambda(N-L) \frac{\partial b}{\partial M} \frac{\partial L}{\partial w} = 0 \\ \Leftrightarrow &\frac{\partial L}{\partial w} \frac{w}{L}(w-b) + w - \lambda(N-L) \frac{\partial b}{\partial M} \frac{\partial L}{\partial w} \frac{w}{L} = 0 \\ \Leftrightarrow &w(1 + \eta_w^L) - b\eta_w^L - \frac{\partial b}{\partial M} M \eta_w^L = 0 \\ \Leftrightarrow &w(1 + \eta_w^L) - b\eta_w^L \left( 1 + \frac{\partial b}{\partial M} \frac{M}{b} \right) = 0.\end{aligned}$$

Reformulating and considering  $\frac{\partial b}{\partial M} \frac{M}{b} = \frac{1}{\eta_b^M}$  yields (10).

### Rent Maximising Union

The first-order condition under decentralised wage setting is the same as in the wage-bill maximising case. With centralised wage setting, (14) is differentiated with respect to  $w$ :

$$\begin{aligned}\frac{\partial U_2^c}{\partial w} &= \frac{\partial L}{\partial w}(w-b) + L \left( 1 - \frac{\partial b}{\partial L} \frac{\partial L}{\partial w} \right) = 0 \\ \Leftrightarrow &\frac{\partial L}{\partial w} \frac{w}{L}(w-b) + w \left( 1 - \frac{\partial b}{\partial L} \frac{\partial L}{\partial w} \right) = 0\end{aligned}$$

$$\begin{aligned} \Leftrightarrow \quad & w(1 + \eta_w^L) - b\eta_w^L - w \frac{\partial b}{\partial L} \frac{\partial L}{\partial w} = 0 \\ \Leftrightarrow \quad & w(1 + \eta_w^L) - b\eta_w^L - \eta_w^L \frac{\partial b}{\partial L} L = 0 \\ \Leftrightarrow \quad & w(1 + \eta_w^L) - b\eta_w^L \left(1 + \frac{\partial b}{\partial L} \frac{L}{b}\right) = 0. \end{aligned}$$

Reformulating and considering  $\frac{\partial b}{\partial L} \frac{L}{b} = \frac{1}{\eta_b^L}$  yields (15).

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