

Rocha-Akis, Silvia; Schöb, Ronnie

**Working Paper**

## Welfare policy in the presence of unionised labour and internationally mobile firms

CESifo Working Paper, No. 3032

**Provided in Cooperation with:**

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Rocha-Akis, Silvia; Schöb, Ronnie (2010) : Welfare policy in the presence of unionised labour and internationally mobile firms, CESifo Working Paper, No. 3032, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/39034>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Welfare Policy in the Presence of Unionised Labour and Internationally Mobile Firms

Silvia Rocha-Akis  
Ronnie Schöb

CESIFO WORKING PAPER NO. 3032  
CATEGORY 1: PUBLIC FINANCE  
APRIL 2010

PRESENTED AT CESIFO AREA CONFERENCE ON PUBLIC SECTOR ECONOMICS, APRIL 2010

*An electronic version of the paper may be downloaded*

- *from the SSRN website:* [www.SSRN.com](http://www.SSRN.com)
- *from the RePEc website:* [www.RePEc.org](http://www.RePEc.org)
- *from the CESifo website:* [www.CESifo-group.org/wp](http://www.CESifo-group.org/wp)

# Welfare Policy in the Presence of Unionised Labour and Internationally Mobile Firms

## Abstract

In oligopolistic industries, increased cost saving opportunities via offshoring have a moderating effect on trade unions. In order to discourage mobile firms from leaving the country, unions accept lower sector wages. In effect, the negotiated wage becomes independent of workers' bargaining power and their domestic outside opportunities. Hence, wage moderation - induced by deeper economic integration - creates leeway for the government to engage in redistributive policies even if this improves the workers' outside options. Only if the latter become sufficiently attractive will redistribution induce some offshoring, and it is only at that level that further economic integration will lead to both wage moderation and offshoring activities. Therefore, our analysis suggests that rather than provoking a downsizing of the welfare state, offshoring defines an upper limit for the generosity of the welfare state below which redistribution becomes less instead of more distortive.

JEL-Code: F16, H30, H50, J30, J50, L10.

Keywords: offshoring, import competition, wage bargaining, oligopoly, redistribution.

*Silvia Rocha-Akis*  
*Department of Economics*  
*Vienna University of Economics and*  
*Business*  
*Nordbergstrasse 15*  
*Austria – 1090 Vienna*  
*silvia.rocha@wu-wien.ac.at*

*Ronnie Schöb*  
*School of Business & Economics*  
*Free University Berlin*  
*Boltzmannstrasse 20*  
*14195 Berlin*  
*Germany*  
*ronnie.schoeb@fu-berlin.de*

January 2010

We thank Ana B. Ania, Andreas Knabe, Espen Moen and two anonymous referees for very helpful comments on an earlier version of this paper. Part of this work was done while Rocha-Akis was working at the Oesterreichische Nationalbank and visiting the FU Berlin.

# 1 Introduction

In recent years, industrialised countries have seen considerable outward relocations of production. Not surprisingly, due to its direct impact on employment, offshoring has become an increasingly important topic in public debates, particularly in countries characterised by high unemployment and low job creation.

In line with the growing trend towards foreign direct investment (FDI), an impressive amount of literature on the determinants and the welfare implications of inward FDI has emerged. Far less attention has been devoted to the determinants and consequences of *outward* FDI, which – in the presence of regulated labour markets and state-provided welfare arrangements – are increasingly prone to generating conflict between labour unions, employers’ organisations and policy-makers.

In general, from the perspective of old industrialised countries, the importance of outward relocations of production may have grown due to several novel developments, such as (i) an increasing supply of low-wage, highly skilled labour, (ii) the reduction in the costs of global communication due to advances in financial, information and communication technologies, (iii) the improved tradability of services which can be delivered electronically and do not require face-to-face contact, and (iv) financial liberalisation and the rise in capital mobility.

It is a widely established fact that one of the key determinants of location choices for production is the cost of labour (see e.g. Barrell and Pain, 1996; Hatzius, 1998, 2000; Pennings and Sleuwaegen, 2000, 2006 for empirical evidence). Labour unions are frequently blamed for strengthening the trend towards moving production to lower-wage countries.<sup>1</sup> In many European countries, trade unions succeed in keeping wage rates above the market-clearing level, thus raising domestic wage costs and strengthening the tendency towards offshore production. This effect may be exaggerated by government interventions including high tax rates on labour income and high social insurance contributions combined with generous unemployment benefits, because these policy measures increase wage pressure in wage

---

<sup>1</sup>Although the number of union members in the OECD has declined over the last two decades, the share of employees whose remuneration and working conditions are directly or indirectly determined by collective bargaining is still considerable. In the EU, this share ranged from 30% in the UK to 68% in Germany, 90% in Belgium, Finland, France and Sweden, and 95% in Austria in the year 2000 (OECD, 2004).

negotiations between trade unions and firms (see e.g. Lockwood, 1990; Goerke, 1999; Daveri and Tabellini, 2000; Nickell, 2003; Koskela and Schöb, 2002) and, may consequently further increase the incentives for firms to move production offshore. Notwithstanding the impressive growth in labour taxation and social insurance contributions in most OECD countries,<sup>2</sup> the economic literature on fiscal policy and FDI has almost exclusively focused on capital taxation and lump sum policies.

Our investigation builds on two strands of literature, namely the literature on FDI and the literature on non-competitive labour markets and taxation. The question we address is how, in the presence of a unionised labour force and internationally mobile and immobile oligopolistic firms, the redistributive policies of the welfare state affect domestic employment in industries which are potentially susceptible to offshoring. This involves exploring how firms and labour unions interact and respond to changes in the social security system in the face of global competition.

The main features of our model are as follows: We consider an industry consisting of two profit-maximising firms that produce a homogeneous good using labour as the only factor of production. The workers in the industry constitute a small fraction of the overall labour force. Accordingly, welfare policy is exogenous from this industry's point of view. Wages are negotiated by a labour union and domestically located firms. The government imposes a tax on wages and uses the revenue to finance unemployment insurance payments and other public goods. Within the sector, not all companies are equally able to take advantage of a cheaper technology by means of offshoring. Specifically, we assume that both firms differ in terms of mobility, as only one of them, a multi-national enterprise (MNE), may choose to relocate its production facility to a foreign country from which it can serve the domestic market.

The main result is as follows. When offshoring becomes attractive for mobile firms, the trade union is tamed. It will moderate sector wages in such a way as to discourage the mobile firm from leaving the country. In fact, the negotiated wage rate becomes independent of the workers' domestic outside opportunities and as such creates leeway for the government to engage in redistributive policies. Thus, in the presence of firm mobility

---

<sup>2</sup>See Joumard (2001). In the EU-25, labour tax revenues contribute to around half of total tax receipts and finance most social welfare programmes (European Commission, 2006).

there remains scope for substantial redistribution without the threat of losing production. Only if workers' domestic outside opportunities are sufficiently attractive, redistribution induces some offshoring and it is only at that level that further economic integration will lead to both wage moderation and offshoring activities.

The paper is organised as follows: Section 2 links this work to related literature. Section 3 describes our model of a single-sector unionised duopoly. In section 4, we look at the alternative interactions between the union and the firms during wage negotiations. The union's stance with regard to offshoring serves to determine the equilibrium wage which ultimately depends on the workers' outside option. The impact of increased economic integration on domestic wage negotiations is then analysed in section 5. Section 6 endogenises the outside option of workers and shows how wage negotiations and offshoring are affected by the government's welfare policy. Section 7 concludes the paper.

## 2 Related literature

Most theoretical contributions on the welfare implications of (inward or outward) FDI in the presence of unionised labour markets focus on the conflict of interest between unions and firms without considering public policy.<sup>3</sup> Exceptions include Bughin and Vannini (1995), Leahy and Montagna (2000), and Skaksen (2005), who quantify the potential welfare gain from inward FDI as a measure for a lump sum subsidy. Brander and Spencer (1988) and Mezzetti and Dinopoulos (1991), on the other hand, examine the effects of trade policy. Another stream of literature analyses the incentives of governments to attract inward FDI by means of capital taxes. As noted by Desai et al. (2004), studies on the effects of tax policy on the location of FDI focus almost exclusively on *corporate* income taxes.<sup>4</sup> The role of distortionary labour taxation on the cost side of mobile firms (or production) and its welfare implications has been analysed by Aronsson and Sjögren (2004), Rocha-Akis (2007), Koskela and Schöb (2009), Koskela and Poutvaara (2009), and Keuschnigg and Ribi (2009). Anderson (2003) has shed light on the link between firm mobility and the implementation of welfare programmes but focuses on changes in the degree

---

<sup>3</sup>E.g. Zhao (1995, 1998), Naylor and Santoni (1998), Skaksen and Sørensen (2001), Lommerud et al. (2003), Munch (2003), Skaksen (2004), Eckel and Egger (2009).

<sup>4</sup>Examples which consider this link in the presence of unionised labour markets include Boadway et al. (2002), and Haufler and Mittermaier (2008).

of centralisation of the labour market and their implications for the costs of maintaining publicly financed welfare systems.

In a multi-country model, Aronsson and Sjögren (2004) focus on optimal labour taxation and policy coordination when firms are mobile and labour is unionised. In their framework, competitive firms may relocate to another jurisdiction and use the potential profit obtainable abroad as a threat during wage negotiations. The assumptions that all firms are identical and that redistributive policies are adjusted in such a way as to maximise welfare imply that relocation never takes place in equilibrium, as national governments coordinate optimally by reducing unemployment benefits and thus also wages.

Rocha-Akis (2007) analyses labour taxation and transfer policy in situations where imperfectly competitive firms may relocate abroad and the domestic labour market is unionised, showing how the specification of the government's objective determines the equilibrium outcome. One result is that a government that attaches sufficient weight to domestic consumer and producer surplus may find it optimal to set a high tax-and-transfer schedule even if it pushes part of production abroad, thus reducing domestic output and employment. This is because such a policy enforces lower wage demands from unions and therefore enhances the profits of domestically located producers as well as total output.

Koskela and Schöb (2009) investigate the implications of alternative labour tax reforms for domestic employment when identical and perfectly competitive firms face a unionised workforce that can be partly substituted by foreign labour in outsourcing arrangements. Their main findings are that a decrease in outsourcing costs may bring about a wage moderation effect that dominates the labour substitution effect, thereby enhancing domestic employment. Moreover, the negative employment consequences of higher labour taxes, higher unemployment benefits and lower tax exemption rates are shown to be magnified in the presence of outsourcing.

Using a two-country setup with perfectly competitive firms, Keuschnigg and Ribi (2009) analyse how outsourcing affects welfare policies in high-wage economies. The model allows for high and low-skilled workers, with only the latter running the risk of unemployment due to outsourcing. The labour market for low-skilled workers is described within a matching framework, while the wage rate of high-skilled workers is fixed. The government has the dual role of redistributing income and providing insurance against unemployment to risk-

averse employees. It turns out that an increase in the unemployment benefits increases the wages of low-skilled workers and leads to an unambiguous marginal increase in aggregate outsourcing activity. On the other hand, more redistribution by means of a higher tax used to finance a tax cut for low-skilled workers contributes to a decrease in low-skilled workers' gross wages, while increasing their net wages, thereby stimulating labour market participation. The paper concludes that redistribution and insurance are complementary policy instruments as increasing the degree of redistribution reduces the costs of providing better insurance.

### 3 Firm behaviour

Our model extends Bughin and Vannini's (1995) unionised oligopoly model of FDI by incorporating a redistributive welfare state. In this context, we primarily focus on a single industry consisting of a duopoly that produces a homogeneous good. The duopolists face a trade union which operates throughout the industry in the home country. In the background there is a second country, referred to as the foreign country, which is considered exogenous in our model. The two firms differ in terms of mobility: Firm  $d$  is assumed to be immobile, whereas firm  $f$  is a branch plant of an MNE which has the option of moving production abroad. The domestic government taxes labour income and provides benefits for unemployed workers. The domestic welfare policy, which is exogenous from the industry's viewpoint, has an impact on the labour union's bargaining strategy as it affects the workers' outside option, which in turn influences firms' investment and cross-border location decisions and thus the level of domestic production and employment.

Two different scenarios are possible: In the first scenario, both firms produce domestically. In the second scenario, the mobile firm has relocated abroad. Whereas in the former case both firms are subject to wage negotiations with a domestic labour union, in the latter scenario only the immobile firm has to pay the negotiated wage, while the mobile firm faces exogenously determined foreign labour input costs. Our aim is to analyse the extent to which redistributive policies affect the mobile firm's decision to move abroad.

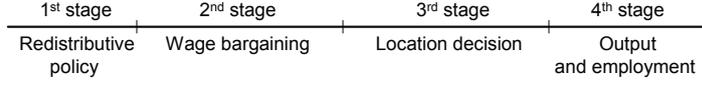


Figure 1: Timing of events.

Figure 1 illustrates the sequence of decisions over time. The sector takes the tax policy decisions made in stage 1 as given when wage negotiations take place. Given the negotiated wage rate, the MNE decides on its production location in stage 3. Finally, each firm chooses its optimal output and employment level. Since the location decision as well as the output and employment decisions are anticipated in the wage negotiations, we solve the problem recursively by means of backwards induction.

### 3.1 Output and employment

Both firms produce a homogeneous good and face a linear inverse demand function of the form  $p(Q) = \alpha - \beta Q$ , where  $\alpha, \beta > 0$ ,  $p$  is the output price, and  $Q = q_d + q_f$  denotes the sum of individual quantities produced by firms  $d$  and  $f$ . Labour is the only factor of production. Each firm  $i = d, f$  has access to the same linear technology, which is normalised in such a way that one unit of output is produced with one unit of labour. Thus,  $q_i$  represents both output and labour input. Labour is remunerated at a gross wage rate of  $\omega_i$ . Consequently, the profit functions are  $\pi_i = [p(Q) - \omega_i] q_i$ , where  $0 < \omega_i < \alpha$  ensures positive equilibrium production. In stage 4, each firm  $i$  takes the wage outcome  $(\omega_d, \omega_f)$  resulting from wage bargaining as given and strategically chooses its profit-maximising employment and output level  $q_i$ . The resulting equilibrium output of firm  $i$  is a function of both firms' labour costs and given by

$$q_i(\omega_i, \omega_j) = \frac{\alpha - 2\omega_i + \omega_j}{3\beta}, \quad i = d, f, i \neq j \quad (1)$$

reflecting the fact that the optimal choice of output by firm  $i$  in strategic quantity-setting depends on the output produced in the competing firm  $j$ . Substituting (1) into the profit

function, we can express profits as follows:<sup>5</sup>

$$\pi_i(\omega_i, \omega_j) = \beta [q_i(\omega_i, \omega_j)]^2, \quad i = d, f \quad (2)$$

### 3.2 The location decision

If the internationally mobile firm decides not to offshore, it faces the same domestic industry wage as its immobile competitor. Otherwise, it faces the given foreign wage  $\bar{\omega}_f$  and the fixed relocation cost  $K$ . The latter may capture factors such as putting infrastructure in place, laying off employees at home, hiring and training new workers, paying for legal and consulting fees, and the like. The firm chooses the location where the profit is highest. Therefore, firm  $f$  relocates if  $\pi_f^r(\bar{\omega}_f, \omega_d^r) - K \geq \pi_f^n(\omega^n, \omega^n)$ . Throughout the analysis, the superscripts  $r$  and  $n$  refer to variables in the regime *with* and *without* outward relocation, respectively. Since the profits from domestic (foreign) production decrease (increase) with the domestic wage, there exists an indifference wage  $\tilde{\omega}(\bar{\omega}_f, K)$  that renders the mobile firm indifferent to offshoring versus not offshoring, i.e.  $\pi_f^r(\bar{\omega}_f, \tilde{\omega}) - K = \pi_f^n(\tilde{\omega}, \tilde{\omega})$ . Using (1) and (2), this indifference wage is given by

$$\tilde{\omega}(\bar{\omega}_f, K) := \bar{\omega}_f + \frac{9\beta}{4(\alpha - \bar{\omega}_f)}K \quad (3)$$

Should the domestic wage exceed  $\tilde{\omega}(\bar{\omega}_f, K)$ , offshoring will take place; otherwise the mobile firm will prefer to produce domestically. The indifference wage increases in  $\bar{\omega}_f$  and  $K$ . Intuitively, the higher the costs associated with offshoring, the higher the domestic wage can be without triggering the outward relocation of production.<sup>6</sup>

## 4 Wage bargaining in partial equilibrium

The sector-specific labour force is normalised to unity and represented by a sector-specific trade union. We assume “right-to-manage” wage formation, that is, the firms and the union bargain over the wage rate, leaving each firm  $i$  with the right to subsequently

<sup>5</sup>This is a standard result for the Cournot oligopoly game with linear demand and constant marginal costs. In this case, each firm’s profit is proportional to the square of its output; see e.g. Jehle and Reny (2000, p. 162).

<sup>6</sup>Throughout, we assume that wages are sufficiently low to warrant positive output levels. The restriction  $K < \frac{2(\alpha - \bar{\omega}_f)^2}{9\beta}$  guarantees this in case  $\tilde{\omega}$  is the wage that prevails in the domestic country.

determine the output and employment levels. Moreover, we abstract from workers' choices regarding the allocation of time between work and leisure, and assume that the individual labour supply is inelastic. Workers employed at firm  $i$  earn a net-of-tax wage income  $\omega_i(1 - \tau)$  where  $\tau$  is the income tax rate. Workers who do not find employment in this industry become unemployed with a probability equal to the domestic aggregate unemployment rate  $u$ , in which case they are entitled to receive some gross unemployment benefit payments  $b$ , or they find employment in one of the other domestic sectors with a probability of  $1 - u$  where they earn the expected gross wage  $\bar{\omega}$ . Thus the individual's gross outside option is given by

$$\gamma = (1 - u)\bar{\omega} + ub \quad (4)$$

The unemployment benefit payments  $b$  may be proportional to the average wage or fixed, so as to guarantee a minimum subsistence level of welfare.

In the sections that follow we derive the negotiated wage rate in this sector for a given outside option by first analysing the case where both firms produce domestically (section 4.1) and then addressing the scenario where the MNE has moved its plant offshore (section 4.2). This information is used to analyse the union's stance towards offshoring and to identify the scope for wage moderation in section 4.3. Throughout sections 4 and 5, we determine the wage within a sector, given the behaviour in all other sectors. Finally, we endogenise the outside option and determine the general equilibrium in section 6.

#### 4.1 Wage bargaining without relocation

The objective of the union is to maximise the following union rent:

$$\theta_n = \sum_{i=1}^2 (\omega_i - \gamma) (1 - \tau) q_i(\omega_i, \omega_j), \quad i, j = d, f \quad (5)$$

where  $\omega_i > \gamma$  ensures that workers are willing to work in the industry. Notice that the union has two opposing goals: On the one hand, it aims to negotiate as high a wage rate in excess of the gross outside income as possible; on the other hand, it strives to achieve as high a level of employment as possible. The objective of each firm is to maximise its profit. It is standard practice in the literature on union-firm bargaining to allow for exogenous

relative bargaining power during wage contract negotiations. This is captured by the Nash bargaining product

$$\Omega_n(\omega_i, \omega_j) = \theta_n^\delta \left( \sum_{i=1}^2 \pi_i(\omega_i, \omega_j) \right)^{1-\delta}, \quad i, j = d, f \quad (6)$$

where  $\delta \in [0, 1]$  and  $1 - \delta$  denote the relative bargaining power of the union and the firms, respectively. This formulation reflects the fact that both firms are represented by a joint bargaining entity, for example an employers' association, implying that the firms' bargaining power is identical. Wage bargaining is thus realised so as to maximise the industry profits, whereas output is determined in such a way as to maximise the individual firm's profits. In effect, firms compete in the output market, but they bargain jointly for wages.<sup>7</sup> If the wage negotiations break down, each party ends up receiving the fallback payoff. In that case, workers would exit the industry and firms would cease production. As they are chosen by the government at a prior stage, the levels of the policy variables  $\tau$  and  $b$  are treated as exogenous by both the firms and the union.

Note that we are confronted with a symmetric case in the sense that both the good produced and the labour force are homogeneous. Consequently, the union treats all workers equally, so that the equilibrium wage arising from wage bargaining will be identical for all employed workers regardless of the particular firm at which they are employed. Furthermore, according to equation (1) the output level is also symmetric, amounting to

$$q(\omega) = \frac{\alpha - \omega}{3\beta} \quad (7)$$

---

<sup>7</sup>Zhao (1995) is among the few papers that model asymmetric union-firm bargaining. In his one-way FDI setting, one union bargains with two firms, of which only one is able to produce abroad in the case of disagreement. Both firms serve the domestic and the foreign markets. The union's fallback is the exogenous competitive wage which is identical in both countries. The model is more general in that each of the three bargaining parties is allowed to have a different level of relative negotiation power. However, in order for the problem to remain tractable, it is assumed that bargaining takes place simultaneously and independently in both countries, and that renegotiation is not possible. This means that, during wage negotiations in one country, firms' output and employment decisions in the other country are taken to be fixed. This is in sharp contrast to our approach, which is to model the extreme cases of joint bargaining (no relocation regime) and asymmetric bargaining (relocation regime, discussed in the next section). The asymmetric bargaining, which ultimately determines the fallback profit of the mobile firm, allows us to consider explicitly how the domestic firm's output depends on the competitor's output, which in turn depends on both countries' wage rates. Hence, the competitor's output decision is endogenous in wage negotiations.

where  $\omega = \omega_d = \omega_f$ . As a consequence, the outcome of the bargain will be the wage rate that maximises the following Nash product

$$\Omega_n(\omega) = [(\omega - \gamma)(1 - \tau)2q(\omega)]^\delta \left[ 2\beta (q(\omega))^2 \right]^{1-\delta}, \quad i, j = d, f \quad (8)$$

From the first-order condition, we can derive the unconstrained negotiated wage:<sup>8</sup>

$$\omega^n(\delta, \gamma) = \frac{\delta}{2}\alpha + \left(1 - \frac{\delta}{2}\right)\gamma \quad (9)$$

with  $0 \leq \gamma < \alpha$ . One can easily verify that the second-order condition for a maximum is fulfilled. From (1) we can determine the equilibrium output and employment level:

$$q(\omega^n(\delta, \gamma)) = q^n(\delta, \gamma) = \frac{2 - \delta}{6\beta}(\alpha - \gamma) \quad (10)$$

Expression (9) shows that the wage is a weighted average of the buyers' maximum willingness to pay and the workers' expected outside income,  $\gamma$ . The weights are determined by the union's relative power in negotiations,  $\delta$ : The stronger the union, the more weight is attributed to  $\alpha$ , thus contributing to a higher wage. From (4) it is clear that the wage increases with  $\bar{w}$  and  $b$ , as these variables raise the expected outside income of union members and therefore improve their bargaining position. A higher rate of domestic unemployment, on the other hand, lowers the workers' expected outside prospects, thereby weakening the negotiation position of the union and dampening the wage, i.e.  $\partial\gamma/\partial u = -(\bar{w} - b) < 0$ .

## 4.2 Wage bargaining with relocation

If the MNE relocates its plant to the foreign country, both firms will choose their output levels according to equation (1), where the wage rate paid by the offshoring firm,  $\bar{w}_f \in (0, \alpha)$ , is exogenous. Both the domestic union and the domestic firm anticipate the asymmetric game in the product market and bargain over the domestic wage rate. The Nash bargaining product is given by

$$\Omega_r(\omega_d, \bar{w}_f) = \theta_r^\delta [\pi_d^r(\omega_d, \bar{w}_f)]^{1-\delta} \quad (11)$$

---

<sup>8</sup>See appendix A.1 for a derivation.

where

$$\theta_r = (\omega_d - \gamma)(1 - \tau)q_d(\omega_d, \bar{\omega}_f) \quad (12)$$

represents the union rent. Solving for the maximisation problem, we obtain the following equilibrium gross domestic wage in the relocation regime:<sup>9</sup>

$$\begin{aligned} \omega_d^r(\delta, \gamma, \bar{\omega}_f) &= \frac{\delta}{4}(\alpha + \bar{\omega}_f) + \left(1 - \frac{\delta}{2}\right)\gamma \\ &= \omega^n(\delta, \gamma) - \frac{\delta}{4}(\alpha - \bar{\omega}_f) \end{aligned} \quad (13)$$

where the second-order condition for a maximum is fulfilled. Given  $\delta$ ,  $\gamma$ , and  $\bar{\omega}_f$ , a comparison of expressions (9) and (13) shows that the domestic wage is lower when the mobile firm has moved abroad. By substituting (13) into (1), we obtain the equilibrium domestic production and employment level:

$$\begin{aligned} q_d^r(\delta, \gamma, \bar{\omega}_f) &= \frac{2 - \delta}{3\beta} \left( \frac{\alpha + \bar{\omega}_f}{2} - \gamma \right) \\ &= 2q^n(\delta, \gamma) - \frac{2 - \delta}{6\beta}(\alpha - \bar{\omega}_f) \end{aligned} \quad (14)$$

In order to rule out a situation where one of the firms becomes a monopolist, equation (1) requires that  $2\bar{\omega}_f - \alpha \leq \omega_d^r(\delta, \gamma, \bar{\omega}_f) \leq (\alpha + \bar{\omega}_f)/2$ , a condition which essentially guarantees that the domestic wage does not diverge too far with respect to its foreign counterpart. Whereas the former constraint is always fulfilled if  $\bar{\omega}_f < \alpha/2$ , the latter constraint is implied by the requirement of a positive union rent, which in turn implies that  $\gamma \leq \gamma_{max}(\bar{\omega}_f) := (\alpha + \bar{\omega}_f)/2$ .

Note that in both scenarios – with and without relocation of the MNE – the union rent increases with the domestic wage.<sup>10</sup> Since the firms produce the same good, it is not surprising that for any given level of  $\gamma$ , offshoring results in a lower level of total domestic industry employment. This is easily shown by a comparison of expressions (10) and (14). Thus, the union is aware that beyond the negative incremental employment effect

<sup>9</sup>See appendix A.2 for details.

<sup>10</sup>This is revealed by partially differentiating the union rent given by (5) with respect to  $\omega^n$ , that is,  $\frac{\partial \theta_n}{\partial \omega^n} = \frac{2(1-\tau)}{3\beta} [\alpha - 2\omega^n + \gamma]$ . Setting  $\omega^n = \omega^n(\delta, \gamma)$  as specified in (9), we can express the term in square brackets as  $(1 - \delta)(\alpha - \gamma) > 0$ . Therefore,  $\frac{\partial \theta_n}{\partial \omega^n} > 0$ . Similarly, partially differentiating (12) with respect to the domestic negotiated wage results in  $\frac{\partial \theta_r}{\partial \omega_d} = \frac{(1-\tau)}{3\beta} [\alpha - 4\omega_d + 2\gamma\bar{\omega}_f]$ . Using expression (13), the term in brackets becomes  $(\alpha + \bar{\omega}_f)(1 - \delta) + 2[2 + \gamma(1 + \delta)] > 0$ .

associated with an incremental increase in labour costs, the wage-employment tradeoff may be critically aggravated in the presence of international firm mobility, as a higher wage may translate into the closure of an entire production facility, thus generating non-linear effects on domestic employment and wages. It is precisely this rationale that motivates our considerations in the next section.

### 4.3 The union's attitude towards offshoring and the role of the workers' outside option

So far, we have identified the unconstrained negotiated wage for the two scenarios. Obviously, if the negotiated wage as determined by (9) is below the indifference wage, i.e.  $\omega^n(\delta, \gamma) < \tilde{\omega}(\bar{\omega}_f, K)$ , both firms will produce domestically. This case persists as long as the outside option is sufficiently low for domestic workers in the sector. More specifically, we have

$$\omega^n(\delta, \gamma) \leq \tilde{\omega}(\bar{\omega}_f, K) \Leftrightarrow \gamma \leq \underline{\gamma}(\delta, \bar{\omega}_f, K) := \frac{2}{2-\delta} \left[ \bar{\omega}_f - \frac{\delta}{2}\alpha + \frac{9\beta}{4(\alpha - \bar{\omega}_f)}K \right]. \quad (15)$$

If the unconstrained negotiated wage were marginally above the indifference wage, the mobile firm would move abroad, in which case the negotiated wage would correspond to  $\omega_d^r(\delta, \gamma, \bar{\omega}_f) < \tilde{\omega}(\bar{\omega}_f, K) < \omega^n(\delta, \gamma)$ . This cannot be optimal from the viewpoint of the trade union, since fewer workers would be employed and would also receive a negotiated wage which is lower than the indifference wage. This effect arises from the marginal cost advantage the offshoring firm would have and use strategically. Since the negotiated wage increases with the workers' outside option  $\gamma$ , there is a level  $\bar{\gamma}$  below which  $\omega_d^r(\delta, \gamma, \bar{\omega}_f) < \tilde{\omega}(\bar{\omega}_f, K)$ .<sup>11</sup> Hence, in the interval  $\gamma \in [\underline{\gamma}, \bar{\gamma}]$  it is in the trade union's best interest not to expel the mobile producer from the domestic country, and it can do so by not raising the wage even if the outside option improves. The equilibrium union rent in the regime without offshoring is thus defined as

$$\theta_n = \begin{cases} \theta_n^u(\gamma) = [\omega^n(\delta, \gamma) - \gamma](1 - \tau)2q(\omega^n(\delta, \gamma)), & \text{if } 0 \leq \gamma < \underline{\gamma} \\ \theta_n^c(\gamma) = [\tilde{\omega}(\bar{\omega}_f, K) - \gamma](1 - \tau)2q(\tilde{\omega}(\bar{\omega}_f, K)), & \text{if } \underline{\gamma} \leq \gamma < \bar{\gamma} \end{cases} \quad (16)$$

---

<sup>11</sup>Specifically,  $\bar{\gamma} := \frac{\tilde{\omega} - \frac{\delta}{4}(\alpha + \bar{\omega}_f)}{1 - \frac{\delta}{2}} < \tilde{\omega}$ .

where  $\theta_n^u$  is the rent accruing to workers when the union can react to changes in  $\gamma$  without triggering an outward relocation of production, while  $\theta_n^c$  denotes the rent derived by the union when it adopts wage moderation (the superscripts  $u$  and  $c$  stand for unconstrained and constrained bargaining, respectively).

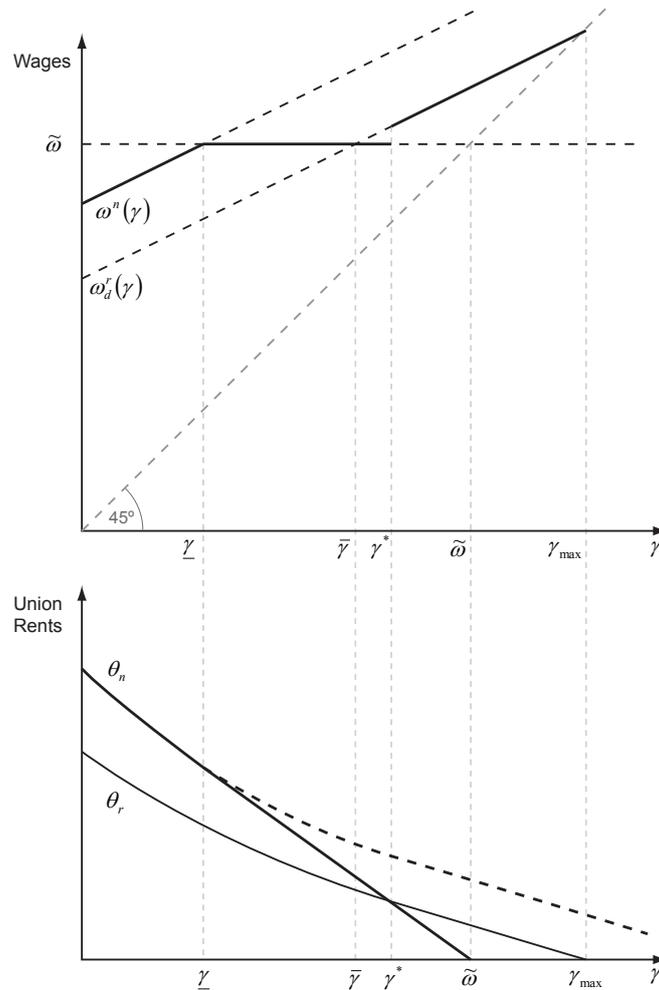


Figure 2: Equilibrium wage and union rents.

The upper part in figure 2 summarises our results so far.<sup>12</sup> The horizontal line represents the indifference wage that is independent of the domestic workers' outside option. The  $\omega^n(\gamma)$ -curve indicates the unconstrained negotiated wage provided that both firms produce domestically, while the  $\omega_d^r(\gamma)$ -curve expresses the negotiated wage when the mobile firm competes from abroad. For low values of the outside option, that is,  $0 \leq \gamma < \underline{\gamma}$ , the domestic wage resulting from wage bargaining is below the critical level at which the

<sup>12</sup>For the sake of notational simplicity, we omit the arguments below wherever there is no risk of confusion.

possibility of relocating becomes attractive for the mobile firm. There is no threat of offshoring, and increasing outside opportunities are associated with higher wages in the sector.

For  $\underline{\gamma} \leq \gamma \leq \bar{\gamma}$ , the union has no leeway in negotiating a wage above the critical level  $\tilde{\omega}$  because it would have to accept lower wages for fewer workers. The presence of firm mobility tames the union insofar as it is no longer able to take advantage of better outside options for its workers.

In order to see what happens when  $\gamma > \bar{\gamma}$ , we first look at  $\gamma = \bar{\gamma}$ . In this case, both firms still produce domestically. If the outside option is marginally above  $\bar{\gamma}$ , however, the negotiated wage rises above  $\tilde{\omega}$  and the mobile firm moves offshore. Nevertheless, it is still not optimal for the trade union to push for a wage rate above  $\tilde{\omega}$  because the benefit of a marginally higher wage would come at the cost of losing the jobs provided by the mobile firm. This is because according to (1),  $2q(\tilde{\omega}, \tilde{\omega}) > q(\omega_d^r(\bar{\gamma}), \bar{\omega}_f)$ . Close to  $\bar{\gamma}$ , the wage-enhancing effect associated with a marginal wage increase is of second order, while the employment-reducing effect is of first order.

At  $\gamma = \tilde{\omega}$ , the union rent is strictly higher in the regime with offshoring because in that case all laid-off workers receive  $\tilde{\omega}$  and a few receive  $\omega_d^r > \tilde{\omega}$ , whereas in the symmetric case without offshoring *all* trade union members receive  $\tilde{\omega}$ . As a result, there is a critical level  $\gamma^* \in (\bar{\gamma}, \tilde{\omega})$  at which the union becomes indifferent to following a low-wage/high-employment strategy or a high-wage/low-employment strategy.

The lower part of figure 2 shows the corresponding union rents as a function of the outside option  $\gamma$ . First, according to (16), it is clear that the union rent  $\theta_n$  under constrained bargaining decreases linearly with  $\gamma$ , whereas the union rent arising from unconstrained bargaining in the regime without offshoring decreases and is convex in  $\gamma$  (see appendix A.3). Furthermore, note that by definition,  $\theta_n^u(\gamma) = \theta_n^c(\gamma)$  at  $\gamma = \underline{\gamma}$  because  $\omega^n(\delta, \underline{\gamma}) = \tilde{\omega}(\bar{\omega}_f, K)$  (see (15)). For values of  $\gamma$  above  $\underline{\gamma}$ , the rent  $\theta_n^c$  is captured by the straight line, whereas  $\theta_n^u$  is shown by the dotted curve. The latter is only meaningful in the absence of firm mobility. Since the union only extracts a rent as long as the negotiated wage exceeds the outside option, note that  $\theta_n^c(\gamma) = 0$  if  $\gamma = \tilde{\omega}$  and  $\theta_n^u(\gamma) = 0$  if  $\gamma = \alpha > \tilde{\omega}$ .

The union rent in the offshoring regime,  $\theta_r(\gamma)$ , is obtained by substituting (13) into (12).

It is also a monotonically decreasing and convex function of  $\gamma$  (see appendix A.4). In section 4.2, we showed that for any given level of  $\gamma$ , both the negotiated wage and domestic industry employment are unambiguously higher when both firms produce domestically and the union is unconstrained from charging a wage above  $\tilde{\omega}$ . Hence, for  $0 \leq \gamma \leq \underline{\gamma}$ , we know that  $\theta_n(\gamma) > \theta_r(\gamma)$ . Clearly, the union rents  $\theta_n^c$  and  $\theta_r$  must intersect for some  $\gamma \in (\underline{\gamma}, \tilde{\omega})$  since  $\theta_n^c = 0$  if  $\gamma = \tilde{\omega}(\bar{\omega}_f, K)$  while  $\theta_r(\gamma) = 0$  if  $\gamma = \gamma_{max}(\bar{\omega}_f, K) > \tilde{\omega}(\bar{\omega}_f, K)$ . Summing up, we can define the equilibrium domestic wage rate depending on the outside option as

$$\omega^* = \begin{cases} \omega^n(\delta, \gamma) & \text{if } 0 \leq \gamma < \underline{\gamma}, \\ \tilde{\omega}(\bar{\omega}_f, K) & \text{if } \underline{\gamma} \leq \gamma < \gamma^*, \\ \omega_d^r(\delta, \gamma, \bar{\omega}_f) & \text{if } \gamma^* \leq \gamma < \gamma_{max}. \end{cases}$$

This is illustrated by the bold line in the upper part of figure 2. Our findings so far can be summarised by the following proposition:

**Proposition 1:** *The labour union's attitude towards offshoring depends on the income workers can expect to obtain outside the industry. Specifically, if*

- (i)  $0 \leq \gamma < \underline{\gamma}$ , *the negotiated wage,  $\omega^n(\delta, \gamma)$ , is below the critical level that induces offshoring;*
- (ii)  $\underline{\gamma} \leq \gamma < \gamma^*$ , *the union adopts a wage moderation strategy by setting the indifference wage  $\tilde{\omega}(\bar{\omega}_f, K)$  so as to discourage the MNE from offshoring;*
- (iii)  $\gamma^* \leq \gamma < \gamma_{max}$ , *the union is not willing to moderate the wage; it adopts a high-wage/low-employment strategy, demanding  $\omega_d^r(\delta, \gamma, \bar{\omega}_f) > \tilde{\omega}(\bar{\omega}_f, K)$  and inducing offshoring.*

## 5 Comparative statics: The impact of globalisation

Globalisation is generally associated with lower costs of mobility and a more intense competitive environment worldwide. In this sense, our model allows us to explore the impact of

deeper international integration on the relationship between the workers' expected outside income and the equilibrium wage. Given that lower values of  $K$  increase the attractiveness

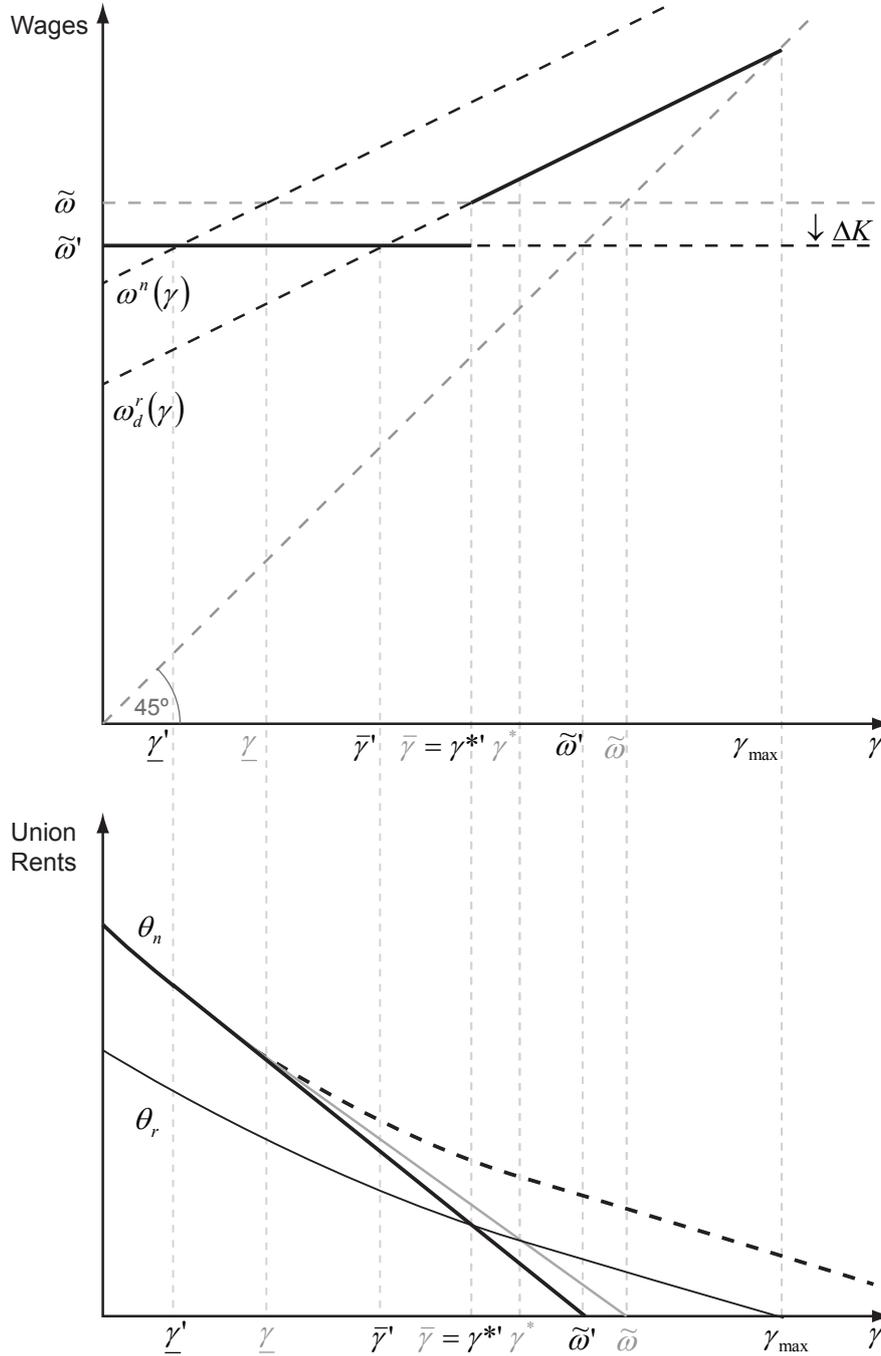


Figure 3: The effect of lower firm relocation costs.

of the foreign country, the  $\tilde{\omega}$ -line shifts downwards when  $K$  falls, as illustrated in figure 3. Consequently,  $\underline{\gamma}$  and  $\bar{\gamma}$  shift to the left in parallel to  $\underline{\gamma}'$  and  $\bar{\gamma}'$ , respectively. Hence, the lowest level of the outside option that forces the trade union to moderate its wage demands

decreases when  $K$  falls. Likewise, the critical level at which the union switches from a wage moderation strategy to a high-wage/low-employment strategy, unambiguously falls from  $\gamma^*$  to  $\gamma^{*'}$ . In order to see this, note that the kink in the  $\theta_n$ -curve in the lower part of figure 3 moves to the left along the curve, as the straight line representing the union rent under constrained bargaining rotates clockwise, connecting the points  $\theta_n(\underline{\gamma}')$  and  $\theta_n(\tilde{\omega}')$ . Hence, the no-relocation rent now lies below its previous position. Since the rent in the relocation case does not change, the intersection of the two curves  $\theta_n^c$  and  $\theta_r$  is now at  $\gamma^{*'} < \gamma^*$ . Formally, one can show that the union rent in the constrained bargaining regime is an increasing function of the indifference wage (see appendix A.3). Consequently, for a given  $\gamma$ ,  $\theta_n^c$  decreases as  $K$  (and therefore  $\tilde{\omega}$ ) decrease. Moreover,  $\theta_n^c$  is generally steeper than  $\theta_n^u$  when  $\gamma = \underline{\gamma}$  (see appendix A.3).

Intuitively,  $\gamma^*$  falls because lower mobility costs translate into a lower indifference wage and therefore  $\theta_n^c(\gamma)$  decreases, whereas  $\theta_r(\gamma)$  remains unaffected as it captures the (anticipated) union rent when the mobile firm has already relocated. Since the rent surplus depends on the difference between the negotiated wage and the reservation wage  $\gamma$ , a drop in  $K$  leads to a fall in the threshold  $\gamma^*$  at which the union is indifferent to offshoring versus domestic production.

Thus, the model supports the well-established result that the option of shifting production abroad restrains unions and lowers wages (e.g. Mezzetti and Dinopoulos, 1991; Zhao, 1995; Koskela and Schöb, 2009). However, our model relativises this result in that it predicts that there is an interval  $[\gamma^{*'}; \gamma^*]$  where increased globalisation induces the union to switch from a low-wage/high-employment strategy to a high-wage/low employment strategy and thus trigger offshoring.

**Proposition 2:** *Deeper economic integration in the form of lower mobility costs has the following effects:*

- (i) *The indifference wage falls, i.e.  $\frac{\partial \tilde{\omega}}{\partial K} > 0$ ;*
- (ii) *The union is forced to moderate its wage demands at lower levels of  $\gamma$ , i.e.  $\frac{\partial \gamma}{\partial K} > 0$ ;*
- (iii) *The threshold value for the workers' outside option at which the union is indifferent as to where the mobile firm locates falls, i.e.  $\frac{\partial \gamma^*}{\partial K} > 0$ . Hence, there exists an interval  $[\gamma^{*'}; \gamma^*]$  where the trade union changes from a low-wage/high-employment strategy to a*

*high-wage/low-employment strategy.*

Proposition 2 (iii) states that there is an interval where it is optimal for the trade union to change its strategy when relocation costs  $K$  decrease. In the close neighbourhood to the left of  $\gamma^*$ , a fall in  $K$  unambiguously goes hand in hand with higher equilibrium domestic wages at the cost of an increase in the relocation-induced displacement of workers. More precisely, whether or not offshoring leads to an increase in the domestic wage rate depends on both the level of  $\gamma$  and the magnitude of the cost reduction,  $\Delta K$ . Consider the case in figure 3, where  $K$  falls by an amount  $(\Delta K)^*$  such that the intersection of the shifted  $\theta_n^c$  and  $\theta_r$ -curves occurs at the initial  $\bar{\gamma}$ , where  $\tilde{\omega} = \omega_d^r$ . Then, for  $\gamma \in [\underline{\gamma}', \bar{\gamma}]$  the union continues to moderate wages and accept the lower indifference wage  $\tilde{\omega}'$ . At  $\gamma = \bar{\gamma}$ , however, a marginal increase in  $\gamma$  induces the union to switch away from a wage-moderation strategy. In this case, the wage negotiated with the immobile firm unambiguously exceeds the initial indifference wage,  $\tilde{\omega}$ . However, if the size of the cost reduction exceeds  $(\Delta K)^*$ , the indifference wage falls further so that  $\gamma^{*'} < \bar{\gamma}$ . Then, in the area just to the left of the initial  $\bar{\gamma}$ , it is optimal for the trade union to change to the high-wage strategy even if the negotiated wage falls short of the initial indifference wage,  $\tilde{\omega}$ . This can be summarised as follows:

**Proposition 3:** *If increased globalisation due to falling  $K$  induces the trade union to give up a part of the workforce, the resulting negotiated wage depends on both the initial outside option and the extent to which  $K$  is reduced. Specifically, let  $(\Delta K)^*$  be the magnitude of the cost reduction so that when  $\gamma = \bar{\gamma}$  workers are indifferent to the mobile firm's location, i.e.  $\theta_r(\bar{\gamma}) = \theta_n^c(\bar{\gamma})$ . Then,*

(i) *if  $\Delta K \leq (\Delta K)^*$ ,  $\gamma^{*'} \in (\bar{\gamma}, \gamma^*)$  and for  $\gamma \geq \gamma^{*'}$  we obtain  $\omega_d^{r'} > \tilde{\omega}$ ;*

(ii) *if  $\Delta K > (\Delta K)^*$ ,  $\gamma^{*'} \in (\bar{\gamma}', \bar{\gamma})$*

*and for  $\gamma \in (\gamma^{*'}, \bar{\gamma})$  we obtain  $\omega_d^{r'} < \tilde{\omega}$*

*whereas for  $\gamma > \bar{\gamma}$  we obtain  $\omega_d^{r'} > \tilde{\omega}$ .*

We can also consider the effects of fiercer global competition in the form of lower variable foreign labour costs,  $\bar{\omega}_f$ . In that case, the potential profits obtainable abroad increase so that the  $\tilde{\omega}$ -line shifts downwards. Additionally, provided that the mobile firm produces

abroad, the effect of a lower foreign wage is to reduce the immobile firm's profit, which dampens the domestic wage rate (see equation (13)). For every level of  $\gamma$ , therefore, the  $\omega_d^r$ -line also shifts downwards. The overall effect is that both  $\underline{\gamma}$  and  $\bar{\gamma}$  shift to the left,<sup>13</sup> but the  $[\underline{\gamma}, \bar{\gamma}]$ -interval widens. Furthermore, since both the  $\theta_n^c(\gamma)$ -curve and the  $\theta_r(\gamma)$ -curve in the lower part of figure 3 shift downwards in this case, the overall effect on  $\gamma^*$  is ambiguous because of the countervailing effect created by fiercer oligopolistic competition. In other words, a high-wage strategy involving offshoring and tough import competition, may be less desirable than a wage moderation strategy. The interval in which the trade union changes strategies becomes smaller, and the resulting wage will be lower.

## 6 General equilibrium and the welfare state

The government uses a labour tax to finance a public good  $G$  (which is assumed to enter all individuals' utilities in an additively separable manner) and unemployment benefit payments,  $b$ . We have  $N$  sectors, so the budget constraint is given by

$$\tau \sum_N \omega_N Q_N = G + \left( N - \sum_N Q_N \right) (1 - \tau) b \quad (17)$$

where

$$Q_N = \begin{cases} 2q_N^n & \text{if the mobile firm does not relocate} \\ q_{Nd}^r & \text{otherwise} \end{cases}$$

denotes domestic employment in sector  $N$  and  $\omega_N$  denotes the negotiated wage in that sector. If we define  $L = \sum_N Q_N$  as the aggregate employment level, noting that the total labour supply is  $N$ , the unemployment rate is given by  $u = N^{-1}(N - L)$ .

The general equilibrium analysis takes the interaction between the different sectors into account. These interactions crucially depend on the assumption we make about the rest of the economy. One possibility is to assume that the rest of the economy is characterised by a competitive labour market. In this case, the outside income would correspond to  $\gamma = \bar{\omega} = \omega^c$  where  $\omega^c$  refers to the gross wage rate in a competitive labour market. Al-

---

<sup>13</sup>Note that we have  $\frac{\partial \bar{\gamma}}{\partial \bar{\omega}_f} > 0$ .

ternatively, we can assume that the other sectors are also unionised, in which case there is unemployment in equilibrium. The extent to which unemployment affects the outside option depends on whether laid-off workers in the industry in question are able to find employment elsewhere. An empirical investigation by Burda and Mertens (2001) indicates that around 80% of all workers in Germany who had been involuntarily dismissed from their jobs in 1986 had socially insured employment 4 years after the displacement. Egger et al. (2007) examine the consequences of production relocations for workers using individual-level panel data from Austria. Their main finding is that outsourcing reduces the flow of workers to the sectors in which the economy has a comparative disadvantage, which is not offset by a proportionate inflow of workers to the sectors with a comparative advantage. This suggests that outsourcing leads to an increase in net unemployment. Such a relationship is also supported by Kletzer (2000) for the US. This points to the importance of the country's unemployment rate in determining the extent to which offshoring is prone to generating long-term unemployment among workers who lose their jobs due to such shifts in production. We therefore adopt the standard assumption that the outside option is given by (4), i.e.  $\gamma = (1-u)\bar{\omega} + ub$ . Furthermore, we consider a country in which all sectors are exposed to offshoring. In order to determine the general equilibrium, we assume that all sectors are symmetric. This implies that all sector wages are the same in equilibrium, so that  $\omega_N = \bar{\omega} \equiv \omega \quad \forall N$ . We proceed by characterising the general equilibrium for the three potential wage regimes identified in proposition 1, starting with the autarky case.

1.  $\gamma < \underline{\gamma}$

When offshoring is too expensive to be a credible threat in wage bargaining, the negotiations in all sectors yield the wage rate (9) and subsequently sector employment (10). Additionally, we have to consider the outside option,  $\gamma$ , which in equilibrium is determined by the equilibrium wage rates and employment. We thus have three equations that must

hold in equilibrium:

$$\begin{aligned}
F^1 & : \quad \omega - \left(1 - \frac{\delta}{2}\right) \gamma - \frac{\delta}{2} \alpha = 0 \\
F^2 & : \quad \gamma - (1 - u)\omega - ub = \gamma - \left(1 - \frac{N - L}{N}\right) \omega - \frac{N - L}{N} b = 0 \\
F^3 & : \quad L + N \frac{\omega}{3\beta} - N \frac{\alpha}{3\beta} = 0
\end{aligned}$$

Furthermore, the balanced budget constraint (17) must be met. As we are interested in how a more generous welfare system affects the labour market, we analyse how an increase in  $b$ , indicating a more redistributive system, affects the wage rate and employment. Using total differentials  $F_\omega^i + F_\gamma^i + F_L^i = -F_b^i$ ,  $i = 1, 2, 3$  and applying Cramer's rule (see appendix A.5 for details), we obtain the following results:

$$\begin{aligned}
\frac{d\omega}{db} & = D^{-1}u \left(1 - \frac{\delta}{2}\right) > 0 \\
\frac{d\gamma}{db} & = D^{-1}u > 0 \\
\frac{dL}{db} & = -D^{-1} \left(1 - \frac{\delta}{2}\right) \left(uN \frac{1}{3\beta}\right) < 0
\end{aligned}$$

where

$$D = 1 + \left(1 - \frac{\delta}{2}\right) \left(\frac{\omega - b}{3\beta} - (1 - u)\right) = 1 - \underbrace{\left(1 - \frac{\delta}{2}\right) (1 - u)}_{< 1} + \left(1 - \frac{\delta}{2}\right) \left(\frac{\omega - b}{3\beta}\right) > 0. \tag{18}$$

An increase in unemployment benefit payments will increase gross wages, thus reducing aggregate employment. Hence, as long as offshoring is not an alternative for the mobile firm, the model confirms standard results from the literature which show that there is a tradeoff between a more redistributive system and employment (e.g. Nickell et al., 2005).

## 2. $\underline{\gamma} \leq \gamma < \gamma^*$

In this interval, the trade union will accept the indifference wage which ensures that the mobile firm does not relocate abroad. The outside option is then given by  $\gamma = (1 - u)\tilde{\omega} + ub$  but it is irrelevant in wage negotiations. Employment is given by (1). As long as an increase in the outside option does not increase wages, it will have no effect on employment. Thus,

for  $\underline{\gamma} \leq \gamma < \gamma^*$  we have

$$\frac{d\omega}{db} = \frac{dL}{db} = 0$$

and

$$\frac{d\gamma}{db} = u.$$

This result is in line with our finding in section 4.3. When offshoring becomes attractive for the mobile firm, the best response on the trade union's part is to moderate wages in such a way that the mobile firm is kept in the home country. This fixes the wages and makes them independent of the generosity of the welfare system. Furthermore, the financing of more redistribution does not affect the gross wages as the entire incidence falls on net wages. Even though the prospect of becoming unemployed becomes less distressful, overall domestic employment is not affected. In effect, notwithstanding the presence of trade unions, redistribution becomes costless for the government because the wage is determined by forces totally unrelated to the workers' bargaining power. In fact, the major concern of workers is for their labour costs to remain sufficiently attractive compared to mobile firms' outside opportunities, which are basically affected by  $K$  and  $\bar{\omega}_f$ . If the government prefers more redistribution, it would be optimal from the government's perspective to choose a replacement ratio that just ensures  $\gamma^*$ . This result is in sharp contrast to the statement that globalisation leads to a race to the bottom among welfare states. An increase in  $b$  raises the outside option but it has no repercussions for unemployment.

### 3. $\gamma = \gamma^*$

If we raise  $b$  at the critical level  $\gamma = \gamma^*$ , the outside option improves, *ceteris paribus*,  $\partial\gamma^*/\partial b = u$ . It becomes attractive for the trade unions to raise the wage above the indifference level even if this compels mobile firms to relocate abroad. If a first firm relocates, however, the outside option  $\gamma$  falls until it reaches  $\gamma^*$  again, in which case there is no incentive for further unions to switch to the high-wage/low-employment strategy.

In order to show that the relocation of one firm from some sector  $x$  dampens the outside option, we rewrite  $\gamma$  as

$$\gamma = \frac{\sum_{z \neq x} Q_z(\omega_z - b) + q_x(\omega_x - b)}{N} + b.$$

Before offshoring, we had  $[q_x(\omega_x - b)] = 2q^n(\tilde{\omega})(\tilde{\omega} - b)$  in sector  $x$ . After offshoring, we have  $q_x(\omega_x - b) = q_d^r(\omega_d^r - b)$ . Thus,

$$\Delta\gamma = \frac{1}{N} [q_d^r(\omega_d^r - b) - 2q^n(\tilde{\omega})(\tilde{\omega} - b)] = \frac{1}{N} [q_d^r\omega_d^r - 2q^n(\tilde{\omega})\tilde{\omega} + b(2q^n(\tilde{\omega}) - q_d^r)]. \quad (19)$$

At  $\gamma^*$  we know that for each sector  $\theta_n = \theta_r$ , which according to (16) and (12) implies that  $(\tilde{\omega} - \gamma^*) 2q^n(\tilde{\omega}) = (\omega_d^r - \gamma^*) q_d^r$  and thus  $q_d^r\omega_d^r - 2q^n(\tilde{\omega})\tilde{\omega} = -\gamma^* (2q^n(\tilde{\omega}) - q_d^r)$ . Substituting into (19) yields

$$\Delta\gamma = \frac{1}{N} [-\gamma^* (2q^n(\tilde{\omega}) - q_d^r) + b(2q^n(\tilde{\omega}) - q_d^r)] = -\frac{2q^n(\tilde{\omega}) - q_d^r}{N} (b - \gamma^*) < 0$$

since  $\omega > b$  implies that  $\gamma^* > b$  for any  $u < 1$ . Hence, the shift of one sector to a high-wage/low-employment strategy that induces offshoring will lower the equilibrium outside option. Therefore, as long as not all mobile firms have relocated, higher unemployment benefit payments will trigger partial offshoring. For this case, our analysis shows that a more generous welfare state creates adverse effects in the form of a lower domestic level of employment. Beyond the marginal increase in unemployment caused by higher unemployment benefits, also observed in the absence of offshoring, redistribution now leads to outward firm relocations. The larger the sectors, the stronger the implications for unemployment. Note that in this case there are two wages in equilibrium. While workers in those sectors where the trade union still moderates wages only receive the indifference wage  $\tilde{\omega}$ , the high-wage/low-employment sectors pay a higher wage  $\omega_d^r(\gamma^*)$ .

#### 4. $\gamma^* < \gamma$

If the outside option is sufficiently high, all mobile firms eventually relocate and the comparative statics resemble those in case 1, albeit at lower employment levels. In other words, we observe increasing wages and falling employment when unemployment benefit payments are raised.

Figure 4 summarises the general equilibrium effects. Below  $\underline{\gamma}$ , we observe the case of autarky. Redistribution is costly as it increases wage demands and thus lowers employ-

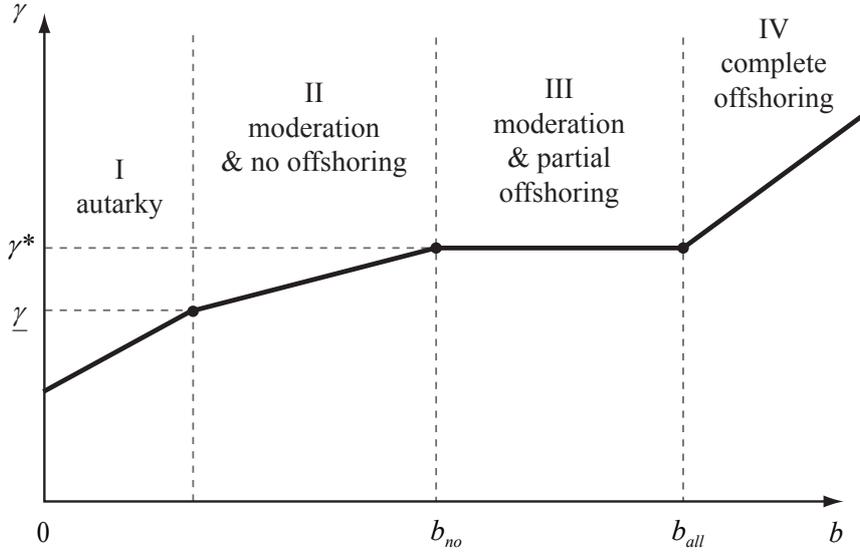


Figure 4: Redistribution.

ment. Above  $\underline{\gamma}$ , offshoring becomes attractive for mobile firms if trade unions demand sufficiently high wages. This leads to wage moderation, which in turn enables the government to redistribute income from employed to unemployed workers at no cost. Although the outside option increases linearly along with  $b$ , figure 2 already showed that this has no repercussions with regard to allocation. This is possible until a critical value for the unemployment benefit payment  $b_{no}$  is reached. Beyond  $b_{no}$ , a higher  $b$  prompts some firms to move offshore, which in turn brings the outside option back down to  $\gamma^*$ . Thus, a more generous unemployment benefit system has no effect on the outside option until the last sector has lost its mobile firm. This is the case at  $b_{all}$ , beyond which no sector is threatened by any further offshoring. These findings can be summarised as follows:

**Proposition 4:** *For any given degree of globalisation, a more generous unemployment benefit system in the form of higher unemployment benefit payments,  $b$ ,*

- (i) *leads to higher domestic wages and lower employment without triggering offshoring if  $\gamma < \underline{\gamma}$ ;*
- (ii) *does not affect domestic wages and employment and does not trigger offshoring if  $\underline{\gamma} \leq \gamma < \gamma^*$ ;*
- (iii) *causes offshoring and reduces employment if  $\gamma = \gamma^*$ . Domestic firms in sectors with*

wage moderation continue to pay the indifference wage  $\tilde{\omega}$ , while firms in the high-wage/low-employment sectors pay the higher wage  $\omega_d^r(\gamma^*)$ ;

(iv) induces all remaining mobile firms across all sectors to relocate abroad and increases domestic unemployment further, if  $\gamma > \gamma^*$ , where the wage rate for employed domestic workers amounts to  $\omega_d^r(\gamma) > \omega_d^r(\gamma^*)$ .

## 7 Conclusion

This paper has explored the implications of welfare policies for domestic employment and wages in industries which are unionised and potentially affected by offshoring. In this context, we have focused on the extent to which policies regarding unemployment insurance affect the interaction between labour unions and oligopolistic firms, some of which are internationally mobile. More specifically, we were interested in the extent to which a generous unemployment insurance system can be held responsible for the relocation-induced loss of jobs, when the various actors' incentives are taken into account.

A typical result in standard trade union models that ignore offshoring is that a more generous welfare system leads to higher gross wages and a lower level of aggregate employment. This is confirmed in our model for the benchmark case where offshoring is too expensive to pose a threat in wage negotiations. However, if offshoring is a viable option and the workers' fallback option is sufficiently attractive, a higher level of redistribution would lead to few domestic workers benefitting from higher wages, while many would lose their jobs. Thus, trade unions are forced to moderate their wage demands by setting a wage that leaves internationally mobile firms just indifferent to domestic production versus offshoring. Such a wage is actually independent of the generosity of the welfare system. As long as welfare arrangements are not too generous, the financing of additional redistribution does not affect these gross wages so that the entire incidence falls on net wages. Hence, redistribution from employed to unemployed individuals is non-distortive from the government's perspective. A government with a strong preference for redistribution would therefore optimally choose as high a level of unemployment insurance benefits as possible that is still consistent with the union's preference for wage moderation. This prediction only changes if the welfare system expands beyond a certain limit. Then some

trade unions will opt for a high-wage/low-employment strategy, which leads to offshoring and domestic job losses.

Our finding has interesting policy implications. Even if deeper economic integration dampens the wage rate prevailing under a moderation regime, there is scope for substantial redistribution without the threat of losing production. This runs counter to the widespread view that globalisation leads to a race to the bottom in social policy. In fact, the opposite effect emerges: The threat that some mobile firms might relocate abroad compels trade unions to moderate wages and thus creates more leeway for the government to engage in redistribution policies. Only if the welfare state's engagement in redistribution reaches a critical level that induces some offshoring, will increased economic integration work to depress the wage prevailing under a moderation regime and thus render a high-wage/low-employment strategy more attractive. In this regard, our results support the finding in Keuschnigg and Ribi (2009) that, in the presence of mobile production, redistribution might involve a smaller efficiency cost than is commonly perceived. Rather than provoking a race to the bottom, our analysis suggests that offshoring defines an upper limit for the generosity of the welfare state below which redistribution actually becomes less costly.

## A Appendix

### A.1 Derivation of the equilibrium wage rate in the regime without relocation

Define  $A \equiv 2(\omega - \gamma)(1 - \tau)q(\omega)$  and  $B \equiv 2\beta q^2(\omega)$  so that the Nash bargaining product given by (8) corresponds to  $\Omega(\omega) = A^\delta B^{1-\delta}$ . The first-order condition for an interior maximum of (8) over  $\omega$  is then given by

$$\begin{aligned} \delta A^{\delta-1} 2(1-\tau) \left( q(\omega) + (\omega - \gamma) \frac{\partial q(\omega)}{\partial \omega} \right) B^{1-\delta} + A^\delta (1-\delta) B^{-\delta} 4\beta q(\omega) \frac{\partial q(\omega)}{\partial \omega} &= \\ \frac{\delta}{\omega - \gamma} \left( q(\omega) + (\omega - \gamma) \frac{\partial q(\omega)}{\partial \omega} \right) + 2(1-\delta) \frac{\partial q(\omega)}{\partial \omega} &= \\ \delta(\alpha - 2\omega + \gamma) - 2(1-\delta)(\omega - \gamma) &= \\ \delta\alpha + (2-\delta)\gamma - 2\omega &= 0 \end{aligned}$$

## A.2 Derivation of the equilibrium wage rate in the relocation regime

Define  $C \equiv 2(\omega_d - \gamma)(1 - \tau)q_d(\omega_d, \omega_f)$  and  $D \equiv 2\beta [q_d(\omega_d, \omega_f)]^2$  so that the Nash bargaining product (11) corresponds to  $\Omega_r(\omega_d) = C^\delta D^{1-\delta}$ . The first-order condition with respect to the domestic wage rate is then given by

$$\begin{aligned} & \delta C^{\delta-1} (1 - \tau) \left( q_d(\omega_d, \omega_f) + (\omega_d - \gamma) \frac{\partial q_d(\omega_d, \omega_f)}{\partial \omega_d} \right) D^{1-\delta} + \\ & \quad C^\delta (1 - \delta) D^{-\delta} 2\beta q_d(\omega_d, \omega_f) \frac{\partial q_d(\omega_d, \omega_f)}{\partial \omega_d} = \\ & \frac{\delta}{\omega_d - \gamma} \left( q_d(\omega_d, \omega_f) + (\omega_d - \gamma) \frac{\partial q_d(\omega_d, \omega_f)}{\partial \omega_d} \right) + 2(1 - \delta) \frac{\partial q_d(\omega_d, \omega_f)}{\partial \omega_d} = \\ & \quad \delta(\alpha + \omega_f + 2\gamma - 4\omega_d) - 4(1 - \delta)(\omega_d - \gamma) = \\ & \quad \delta(\alpha + \omega_f) + 2(2 - \delta)\gamma - 4\omega_d = 0 \end{aligned}$$

## A.3 How the union rent depends on the workers' outside option and the indifference wage when mobile firms do not relocate abroad

It is easy to show that the union rent under unconstrained bargaining in the regime without offshoring decreases and is convex in  $\gamma$ :

$$\frac{\partial \theta_n^u}{\partial \gamma} = \left[ \left( \frac{\partial \omega^n}{\partial \gamma} - 1 \right) q^n(\gamma) + [\omega^n(\gamma) - \gamma] \frac{\partial q^n}{\partial \gamma} \right] 2(1 - \tau) = - \left[ \delta q^n(\gamma) + [\omega^n(\gamma) - \gamma] \frac{2 - \delta}{3\beta} \right] (1 - \tau) < 0$$

$$\frac{\partial^2 \theta_n^u}{\partial \gamma^2} = - \left[ \delta \frac{\partial q^n}{\partial \gamma} + \left( \frac{\partial \omega^n}{\partial \gamma} - 1 \right) \frac{2 - \delta}{3\beta} \right] (1 - \tau) > 0$$

since  $\frac{\partial q^n}{\partial \gamma} < 0$  and  $\frac{\partial \omega^n}{\partial \gamma} = 1 - \frac{\delta}{2} < 1$ .

When the union is constrained in bargaining, its rent is increasing with the indifference wage:

$$\frac{\partial \theta_n^c}{\partial \tilde{\omega}} = 2 \left[ q^n(\tilde{\omega}) + \frac{\partial q^n}{\partial \tilde{\omega}} (\tilde{\omega} - \gamma) \right] (1 - \tau) > 0 \Leftrightarrow q^n(\tilde{\omega}) + \frac{\partial q^n}{\partial \tilde{\omega}} (\tilde{\omega} - \gamma) > 0 \Leftrightarrow \alpha - 2\tilde{\omega} + \gamma > 0$$

Since the left hand side of the latter inequality is increasing with  $\gamma$  and since the lowest value of  $\gamma$  consistent with wage moderation is  $\underline{\gamma}$ , we substitute  $\gamma = \underline{\gamma}$ . Using (3) we have

$$(1 - \delta) \left[ \alpha - \bar{\omega}_f - \frac{9\beta}{4(\alpha - \bar{\omega}_f)} K \right] > 0 \quad \forall K < \bar{K}(\bar{\omega}_f).$$

Moreover, at  $\gamma = \underline{\gamma}$ , the union rent is steeper under constrained bargaining. Specifically,

$$\left| \frac{\partial \theta_n^c}{\partial \gamma} \right| > \left| \frac{\partial \theta_n^u}{\partial \gamma} \right|$$

holds if  $2q^n(\tilde{\omega}) > \delta q^n(\gamma) + (\omega^n(\gamma) - \gamma) \frac{2-\delta}{3\beta}$  which when setting  $\gamma = \underline{\gamma}$  holds if  $\alpha - 2\tilde{\omega} + \underline{\gamma} > 0$ . Substituting  $\tilde{\omega}$  and  $\underline{\gamma}$  with (3) and (15), respectively, yields  $2(1 - \delta)(\alpha - \tilde{\omega}) > 0 \quad \forall K < \bar{K}(\bar{\omega}_f)$ .

#### A.4 How the union rent in the relocation regime depends on the workers' outside options

When the mobile firm competes from abroad, the domestic union rent is decreasing and convex in  $\gamma$ :

$$\frac{\partial \theta_r}{\partial \gamma} = \left[ \left( \frac{\partial \omega_d^r}{\partial \gamma} - 1 \right) q_r^r(\gamma) + [\omega_d^r(\gamma) - \gamma] \frac{\partial q_d^r}{\partial \gamma} \right] (1 - \tau) = - \left[ \frac{\delta}{2} q_d^r(\gamma) + [\omega_d^r(\gamma) - \gamma] \frac{2 - \delta}{3\beta} \right] (1 - \tau) < 0$$

$$\frac{\partial^2 \theta_r}{\partial \gamma^2} = - \left[ \frac{\delta}{2} \frac{\partial q_d^r}{\partial \gamma} + \left( \frac{\partial \omega_d^r}{\partial \gamma} - 1 \right) \frac{2 - \delta}{3\beta} \right] (1 - \tau) > 0$$

since  $\frac{\partial q_d^r}{\partial \gamma} < 0$  and  $\frac{\partial \omega_d^r}{\partial \gamma} = \frac{\partial \omega^n}{\partial \gamma} = 1 - \frac{\delta}{2} < 1$ .

#### A.5 Derivation of the determinant

Taking the derivatives with respect to  $\omega$ ,  $\gamma$ ,  $L$  and  $b$  yields the following system of equations:

$$\begin{vmatrix} F_\omega^1 & F_\gamma^1 & F_L^1 \\ F_\omega^2 & F_\gamma^2 & F_L^2 \\ F_\omega^3 & F_\gamma^3 & F_L^3 \end{vmatrix} = \begin{vmatrix} -F_b^1 \\ -F_b^2 \\ -F_b^3 \end{vmatrix}$$

The determinant is

$$|D| = \begin{vmatrix} F_{\omega}^1 & F_{\gamma}^1 & F_L^1 \\ F_{\omega}^2 & F_{\gamma}^2 & F_L^2 \\ F_{\omega}^3 & F_{\gamma}^3 & F_L^3 \end{vmatrix} = \begin{vmatrix} 1 & -\left(1 - \frac{\delta}{2}\right) & 0 \\ -(1-u) & 1 & -\frac{1}{N}(\omega - b) \\ N\frac{1}{3\beta} & 0 & 1 \end{vmatrix}$$

or

$$D = 1 - \underbrace{\left(1 - \frac{\delta}{2}\right)(1-u)}_{<1} + \left(1 - \frac{\delta}{2}\right) \left(\frac{\omega - b}{3\beta}\right) > 0.$$

## References

- Andersen T. M. (2003), Welfare Policies, Labour Taxation and International Integration, *International Tax and Public Finance* 10, 43-62.
- Aronsson, T. and Sjögren T. (2004), Efficient taxation, wage bargaining and policy coordination, *Journal of Public Economics* 88, 2711–2725.
- Barrell, R. and Pain, N. (1996), An econometric analysis of US foreign direct investment, *The Review of Economics and Statistics* 78,200–207.
- Boadway, R., Cuff, K. and Marceau, N. (2002), Inter-jurisdictional competition for firms, *International Economic Review* 43,761–782.
- Brander, J. A. and Spencer, B. J. (1988), Unionized oligopoly and international trade policy, *Journal of International Economics* 24, 217–234.
- Bughin, J. and Vannini, S. (1995), Strategic direct investment under unionized oligopoly, *International Journal of Industrial Organization* 13, 127–145.
- Burda, M. C. and Mertens, A. (2001), Estimating wage losses of displaced workers in Germany, *Labour Economics* 8,15–41.
- Daveri, F. and Tabellini, G. (2000), Unemployment, growth and taxation in industrialised countries, *Economic Policy* 15, 47–104.

- Desai, M. A., Foley, C. F. and Hines, J. R. (2004), Foreign direct investment in a world of multiple taxes, *Journal of Public Economics* 88, 2727–2744.
- Eckel, C. and Egger, H. (2009), Wage bargaining and multinational firms, *Journal of International Economics* 77, 206–214.
- Egger, P., Pfaffermayr, M. and Weber, A. (2007), Sectoral adjustment of employment to shifts in outsourcing and trade: Evidence from a dynamic fixed effects multinomial logit model, *Journal of Applied Econometrics* 22, 559–580.
- European Commission (2006), *Structures of the taxation systems in the European Union: 1995-2004*, Directorate-General for Taxation and Customs Union, & Eurostat.
- Goerke, L. (2000), The Wedge, *The Manchester School* 68, 608–623.
- Hatzius, J. (1998), Domestic jobs and foreign wages, *Scandinavian Journal of Economics* 100, 733–746.
- Hatzius, J. (2000), Foreign direct investment and factor demand elasticities, *European Economic Review* 44, 117–143.
- Haufler, A. and Mittermaier, F. (2008), Unionisation triggers tax incentives to attract foreign direct investment, CESifo Working Paper 2312.
- Jehle, G. A. and Reny, P. J. (2000), *Advanced Microeconomic Theory*, Addison Wesley, 2nd edition.
- Joumard, I. (2001), Tax Systems in European Union Countries, OECD Working Paper 301.
- Keuschnigg, C. and Ribi, E. (2009), Outsourcing, unemployment and welfare policy, *Journal of International Economics* 78, 168–176.
- Kletzer, L.G. (2000), Trade and job loss in U.S. manufacturing, 1979-1994, in *The Impact of International Trade on Wages*, National Bureau of Economic Research, Inc.

- Koskela, E. and Poutvaara, P. (2009), Is there scope for gains from revenue-neutral labor tax reforms with flexible outsourcing?, IZA Discussion Paper 3984.
- Koskela, E. and Schöb, R. (2002), Optimal factor income taxation in the presence of unemployment, *Journal of Public Economic Theory* 4, 387–404.
- Koskela, E. and Schöb, R. (2009), Outsourcing of unionized firms and the impact of labor market policy reforms, *Review of International Economics*, forthcoming.
- Leahy, D. and Montagna, C. (2000), Unionisation and FDI: Challenging conventional wisdom?, *The Economic Journal* 110, 80–92.
- Lockwood, B. (1990), Tax Incidence, Market Power, and Bargaining Structure, *Oxford Economic Papers* 42, 187–209.
- Lommerud, K. E., Meland, F. and Søgard, L. (2003), Unionised oligopoly, trade liberalisation and location choice, *The Economic Journal* 113, 782–800.
- Mezzetti, C. and Dinopoulos, E. (1991), Domestic unionization and import competition, *Journal of International Economics* 31, 79–100.
- Munch, J. R. (2003), The location of firms in unionized countries, *Scandinavian Journal of Economics* 105, 49–71.
- Naylor, R. and Santoni, M. (1998), International trade and economic integration when labour markets are generally unionized, *European Economic Review* 42, 1251–1267.
- Nickell, S. (2003), Employment and Taxes, CESifo Working Paper 1109.
- Nickell, S., Nunziata, L. and Ochel, W. (2005), Unemployment in the OECD since the 1960s. What do we know?, *The Economic Journal* 115, 1–27.
- OECD (2004), *Employment Outlook: Chapter 3*, OECD, Paris.
- Pennings, E. and Sleuwaegen, L. (2000), International relocation: firm and industry determinants, *Economics Letters* 67, 179–186.

- Pennings, E. and Sleuwaegen, L. (2006), International relocation of production: Where do firms go?, *Scottish Journal of Political Economy* 53, 430–446.
- Rocha-Akis, S. (2007), Essays on strategic fiscal policy in the presence of internationally mobile firms, Dissertation thesis, Vienna University of Economics and Business.
- Skaksen, J. R. (2004), International outsourcing when labour markets are unionized, *Canadian Journal of Economics* 37, 78–94.
- Skaksen, M. R. (2005), Should governments subsidise inward foreign direct investment?, *Scandinavian Journal of Economics* 107, 123–140.
- Skaksen M. Y. and Sørensen J. R. (2001), Should trade unions appreciate foreign direct investment?, *Journal of International Economics* 55, 379–390.
- Zhao, L. (1995), Cross-hauling direct foreign investment and unionized oligopoly, *European Economic Review* 39, 1237–1253.
- Zhao, L. (1998), The impact of foreign direct investment on wages and employment, *Oxford Economic Papers* 50, 284–301.

# CESifo Working Paper Series

for full list see [www.cesifo-group.org/wp](http://www.cesifo-group.org/wp)

(address: Poschingerstr. 5, 81679 Munich, Germany, [office@cesifo.de](mailto:office@cesifo.de))

---

- 2969 Wolfram F. Richter, Efficient Education Policy – A Second-Order Elasticity Rule, February 2010
- 2970 Tomer Blumkin, Yoram Margalioth and Efraim Sadka, Taxing Children: The Redistributive Role of Child Benefits – Revisited, February 2010
- 2971 Chang Woon Nam and Georg Wamser, Application of Regionally Varying Additionality Degrees in the Practice of EU Cohesion Policy, February 2010
- 2972 Ali Bayar, Frédéric Dramais, Cristina Mohora, Masudi Opese and Bram Smeets, Modeling Russia for Climate Change Issues, February 2010
- 2973 Magnus Söderberg, Informal Benchmarks as a Source of Regulatory Threat in Unregulated Utility Sectors, March 2010
- 2974 Piotr Wdowiński and Marta Malecka, Asymmetry in Volatility: A Comparison of Developed and Transition Stock Markets, March 2010
- 2975 Frans van Winden, Michal Krawczyk and Astrid Hopfensitz, Investment, Resolution of Risk, and the Role of Affect, March 2010
- 2976 Hyun-Ju Koh and Nadine Riedel, Do Governments Tax Agglomeration Rents?, March 2010
- 2977 Johann K. Brunner and Susanne Pech, Optimum Taxation of Bequests in a Model with Initial Wealth, March 2010
- 2978 Guglielmo Maria Caporale and Nicola Spagnolo, Stock Market Integration between three CEECs, Russia and the UK, March 2010
- 2979 Florian Englmaier, Ales Filipi and Ravi Singh, Incentives, Reputation and the Allocation of Authority, March 2010
- 2980 Konstantinos Angelopoulos, George Economides and Apostolis Philippopoulos, What is the Best Environmental Policy? Taxes, Permits and Rules under Economic and Environmental Uncertainty, March 2010
- 2981 Frederick van der Ploeg, Rapacious Resource Depletion, Excessive Investment and Insecure Property Rights, March 2010
- 2982 Wolfram F. Richter and Christoph Braun, Efficient Subsidization of Human Capital Accumulation with Overlapping Generations and Endogenous Growth, March 2010
- 2983 Francesco Cinnirella, Marc Piopiunik and Joachim Winter, Why Does Height Matter for Educational Attainment? Evidence from German Pre-Teen Children, March 2010

- 2984 Bernard Van Praag, Well-being Inequality and Reference Groups – An Agenda for New Research, March 2010
- 2985 Francesca Barion, Raffaele Miniaci, Paolo M. Panteghini and Maria Laura Parisi, Profit Shifting by Debt Financing in Europe, March 2010
- 2986 Alexander Haupt and Magdalena Stadejek, The Choice of Environmental Policy Instruments: Energy Efficiency and Redistribution, March 2010
- 2987 John Komlos and Marek Brabec, The Trend of BMI Values among US Adults, March 2010
- 2988 Emanuele Massetti and Lea Nicita, The Optimal Climate Policy Portfolio when Knowledge Spills across Sectors, March 2010
- 2989 Helmut Rainer and Thomas Siedler, Family Location and Caregiving Patterns from an International Perspective, March 2010
- 2990 Toru Kikuchi and Ngo Van Long, A Simple Model of Service Offshoring with Time Zone Differences, March 2010
- 2991 Assaf Razin, Efraim Sadka and Benjarong Suwankiri, Migration and the Welfare State: Dynamic Political-Economy Theory, March 2010
- 2992 Bård Harstad, Buy Coal! Deposit Markets Prevent Carbon Leakage, March 2010
- 2993 Axel Dreher, Stephan Klasen, James Raymond Vreeland and Eric Werker, The Costs of Favoritism: Is Politically-driven Aid less Effective?, March 2010
- 2994 Sven Neelsen and Thomas Stratmann, Effects of Prenatal and Early Life Malnutrition: Evidence from the Greek Famine, March 2010
- 2995 Claude Hillinger and Bernd Süßmuth, The Quantity Theory of Money: An Assessment of its Real Linchpin Prediction, March 2010
- 2996 Matthew M. Chingos and Martin R. West, Do More Effective Teachers Earn More Outside of the Classroom?, March 2010
- 2997 Laurence Jacquet and Dirk Van de gaer, A Comparison of Optimal Tax Policies when Compensation or Responsibility Matter, March 2010
- 2998 Valentina Bosetti, Carlo Carraro, Romain Duval and Massimo Tavoni, What Should we Expect from Innovation? A Model-Based Assessment of the Environmental and Mitigation Cost Implications of Climate-Related R&D, March 2010
- 2999 Scott Alan Carson, Nineteenth Century Stature and Family Size: Binding Constraint or Productive Labor Force?, March 2010
- 3000 Jukka Pirttilä and Ilpo Suoniemi, Public Provision, Commodity Demand and Hours of Work: An Empirical Analysis, March 2010

- 3001 Bertrand Candelon and Franz C. Palm, Banking and Debt Crises in Europe: The Dangerous Liaisons?, March 2010
- 3002 Joan Costa-i-Font and Marin Gemmill-Toyama, Does Cost Sharing really Reduce Inappropriate Prescriptions?, March 2010
- 3003 Scott Barrett, Climate Treaties and Backstop Technologies, March 2010
- 3004 Hans Jarle Kind, Tore Nilssen and Lars Sørgard, Price Coordination in Two-Sided Markets: Competition in the TV Industry, March 2010
- 3005 Jay Pil Choi and Heiko Gerlach, Global Cartels, Leniency Programs and International Antitrust Cooperation, March 2010
- 3006 Aneta Hryckiewicz and Oskar Kowalewski, Why do Foreign Banks Withdraw from other Countries? A Panel Data Analysis, March 2010
- 3007 Eric A. Hanushek and Ludger Woessmann, Sample Selectivity and the Validity of International Student Achievement Tests in Economic Research, March 2010
- 3008 Dennis Novy, International Trade and Monopolistic Competition without CES: Estimating Translog Gravity, April 2010
- 3009 Yin-Wong Cheung, Guonan Ma and Robert N. McCauley, Renminbising China's Foreign Assets, April 2010
- 3010 Michel Beine and Sara Salomone, Migration and Networks: Does Education Matter more than Gender?, April 2010
- 3011 Friedrich Schneider, Tilman Brück and Daniel Meierrieks, The Economics of Terrorism and Counter-Terrorism: A Survey (Part I), April 2010
- 3012 Friedrich Schneider, Tilman Brück and Daniel Meierrieks, The Economics of Terrorism and Counter-Terrorism: A Survey (Part II), April 2010
- 3013 Frederick van der Ploeg and Steven Poelhekke, The Pungent Smell of "Red Herrings": Subsoil Assets, Rents, Volatility and the Resource Curse, April 2010
- 3014 Vjollca Sadiraj, Jan Tuinstra and Frans van Winden, Identification of Voters with Interest Groups Improves the Electoral Chances of the Challenger, April 2010
- 3015 Guglielmo Maria Caporale, Davide Ciferri and Alessandro Girardi, Time-Varying Spot and Futures Oil Price Dynamics, April 2010
- 3016 Scott Alan Carson, Racial Differences in Body-Mass Indices for Men Imprisoned in 19<sup>th</sup> Century US Prisons: A Multinomial Approach, April 2010
- 3017 Alessandro Fedele, Paolo M. Panteghini and Sergio Vergalli, Optimal Investment and Financial Strategies under Tax Rate Uncertainty, April 2010

- 3018 Laurence Jacquet, Take it or Leave it: Take-up, Optimal Transfer Programs, and Monitoring, April 2010
- 3019 Wilhelm Kohler and Jens Wrona, Offshoring Tasks, yet Creating Jobs?, April 2010
- 3020 Paul De Grauwe, Top-Down versus Bottom-Up Macroeconomics, April 2010
- 3021 Karl Ove Aarbu, Demand Patterns for Treatment Insurance in Norway, April 2010
- 3022 Toke S. Aidt and Jayasri Dutta, Fiscal Federalism and Electoral Accountability, April 2010
- 3023 Bahram Pesaran and M. Hashem Pesaran, Conditional Volatility and Correlations of Weekly Returns and the VaR Analysis of 2008 Stock Market Crash, April 2010
- 3024 Stefan Buehler and Dennis L. Gärtner, Making Sense of Non-Binding Retail-Price Recommendations, April 2010
- 3025 Leonid V. Azarnert, Immigration, Fertility, and Human Capital: A Model of Economic Decline of the West, April 2010
- 3026 Christian Bayer and Klaus Wälde, Matching and Saving in Continuous Time: Theory and 3026-A Matching and Saving in Continuous Time: Proofs, April 2010
- 3027 Coen N. Teulings and Nick Zubanov, Is Economic Recovery a Myth? Robust Estimation of Impulse Responses, April 2010
- 3028 Clara Graziano and Annalisa Luporini, Optimal Delegation when the Large Shareholder has Multiple Tasks, April 2010
- 3029 Erik Snowberg and Justin Wolfers, Explaining the Favorite-Longshot Bias: Is it Risk-Love or Misperceptions?, April 2010
- 3030 Doina Radulescu, The Effects of a Bonus Tax on Manager Compensation and Welfare, April 2010
- 3031 Helmut Lütkepohl, Forecasting Nonlinear Aggregates and Aggregates with Time-varying Weights, April 2010
- 3032 Silvia Rocha-Akis and Ronnie Schöb, Welfare Policy in the Presence of Unionised Labour and Internationally Mobile Firms, April 2010