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ABSTRACT

The Dilemma of Labor Unions:

Local Objectives vs. Global Bargaining*

Multinational enterprises are able to improve their disagreement profits by setting up foreign production facilities, with adverse consequences for negotiated wages and union utilities. In this paper, we take a new angle at this issue and analyze whether unions can improve their situation by cooperating internationally. By shifting the focus from firms to unions as the active players, we aim at explaining why unions find it hard to respond to the detrimental shift in bargaining position as a result of globalization and why there is so little evidence for union cooperation within multinational production networks. Our results show that cooperation is clearly beneficial for unions if their preferences regarding wages and employment are similar across countries. If these preferences differ, however, potential production relocations by multinationals create winners and losers among unions, and these distributional effects may impede cooperation.

JEL Classification: F23 and J51
Keywords: international cooperation, labour unions, multinational enterprise and union objectives

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1 Introduction

Labor market effects play a predominant role in the public debate on globalization. One key concern in industrialized countries is that the global improvements in transportation technology and the political liberalization of international trade will lower demand for labor at home, and that these developments lead to a fall in wages and a rise in unemployment (see Scheve and Slaughter, 2001). Numerous scientific papers have addressed these issues from various angels.[1] One particular branch of literature has focused on how globalization affects the bargaining process between labor unions and multinational enterprises (MNEs).[2] A key result from existing studies is that operating production facilities in several countries improves the bargaining position of MNEs vis-à-vis domestic unions, and that this improvement will help them to negotiate lower wages. For instance, Caves (1996, p. 125) argues that "if the MNE maintains capacity to produce the same goods in different national markets, output curtailed by a strike in one market can be replaced from another subsidiary's plant." In a similar vein, Zhao (1998, p. 285) writes that "FDI improves the firms' threat point payoffs by increasing the firms' mobility and bargaining strength. As a result, the unions have to yield to the multinational firms in terms of wages and employment in the bargaining games."[3]

In this paper, we turn our attention to possible union responses and ask a simple question: If unions lose because MNEs can shift production between locations in case of labor disputes, is it possible for these unions to eliminate this threat by cooperating internationally in the bargaining process? If unions can threaten to go on strike in *all* of a firm's plants in case of a labor dispute, the MNE has no longer the option to service markets

[1] The consequences of economic integration on factor returns have played a prominent role in the literature since the pathbreaking work of Stolper and Samuelson (1941). The issue of unemployment has surfaced the research agenda since Brecher's (1974) work on the role of minimum wages in an otherwise standard Heckscher-Ohlin model. Since these early days, the literature dealing with labor market effects of globalization has grown rapidly, focussing on more sophisticated models of labor market imperfection or product market competition. Prominent examples to this literature include Davidson, Martin, and Matusz (1988, 1999), Hosios (1990), Matusz, (1996) and, more recently, Lommerud, Meland, and Sørgard (2003), Kreickemeier and Nelson (2006), Helpman, Itskhoki, and Redding (2010), Davis and Harrigan (2011).

[2] See, for instance, Mezzetti and Dinopoulos (1991), Bughin and Vannini (1995), Zhao (1995, 1998), Skaksen and Sørensen (2001), and Eckel and Egger (2009).

[3] Eckel and Egger (2009), have shown that by threatening to serve local markets from foreign plants, MNEs are able to negotiate lower wages, and that this wage discount can be an important determinant of a firm's decision to invest abroad.

from foreign plants. In this case, the argument that a multinational firm has a better bargaining position than a national one should no longer be valid, and the bargaining outcome should be more beneficial for workers. The issue of international union cooperation is indeed an important topic of current discussions in union circles. In a publication of the Global Union Federations, an international umbrella organization for unions of various industries, White (2006, p.52) writes: "A key question facing unions is whether they need to follow the lead of global industry and organize across national borders. Should unions adopt organizing strategies that are truly international?" And the International Metalworkers' Federation (IMF, 2009, p. 16) states in its *2009-2013 Action Programme*: "In the long term, and as companies increasingly operate globally, collective bargaining at the international level, while respecting the rights of national unions, must be the goal of the IMF."

However, in spite of these declarations of intent, true evidence of international union cooperation in collective bargaining is almost impossible to find. There is some evidence of more general collaborations between national unions, mostly in the area of workplace security and workers' rights. For example, The Economist (2010) reports of talks between Britain's Unite union and America's Teamsters, both representing flight attendants, or of acts of solidarity between United Steel Workers (US) and workers of Mexico's Cananea copper mine. In addition, Global Unions has negotiated and signed a number of so called International Framework Agreements (IFAs) with MNEs in various industries.[4] These agreements apply to all of a target company's production locations, and even extend to some degree to its suppliers, but again, they are mainly a commitment to the 'core labor standards' of the International Labor Organization (ILO), and do not cover the actual bargaining process. Until 2006, there was only one effective and viable bargaining agreement between a Global Union Federation and an international employers' group, and that was for seafarers in 2003 (White, 2006).

The missing evidence on international union cooperation in collective bargaining poses an obvious puzzle: If cooperation is presumably beneficial for unions, why do we not observe more of it? In this paper, we argue that the reason for the missing evidence on union cooperation in bargaining is that it is not necessarily beneficial for *all* unions within a global MNE network to cooperate. Unions in different countries may have diverse

[4]Examples include such diverse enterprises as Chiquita (Agriculture, USA), IKEA (Furniture, Sweden), Volkswagen (Auto industry, Germany), Fonterra (Dairy industry, New Zealand), AngloGold (Mining, South Africa), EADS (Aerospace, Netherlands), and France Telekom (Telecommunications, France).

preferences regarding wages and employment, and this heterogeneity implies that they can be affected differently by the internationalization strategies of an MNE. If they cooperate, they will have to agree on a common objective function, and this can create losses for one of the participating unions. In this case, cooperation has two different effects: (i) Union cooperation reduces the disagreement profits of firms and improves the relative bargaining position of the union, and (ii) it changes the weight attached to wages and employment in the bargaining process, and this can create benefits and losses of its own.[5]

Our analysis is conducted in a stylized framework where one multinational maintains production facilities of a homogeneous product in two different countries. The MNE negotiates with local unions over wages and employment (efficient bargaining) and then sells the product as a monopolist facing (identical) linear demand schedules in both countries.[6] As a reference point, we first present a no trade scenario where local production and local sales must be identical and the firm cannot menace local unions with replacing domestic production by imports in case of disagreement. Then, we study how the option to trade changes the bargaining outcome. If both unions have identical preferences over wages and employment, we obtain the standard result that the firm improves its threat point and thus has a more comfortable bargaining position. As a consequence, wages fall and both unions lose relative to autarky.

But if one union has a lower relative preference for wages, and thus a higher relative preference for employment (referred to as the union with 'stronger employment orientation'), this union has a larger willingness to accept lower wages in return for higher employment, and thus will already end up with lower wages and higher employment in the no trade scenario. In the trade scenario, the multinational firm has an incentive to shift production towards the low-wage country and this stimulates labor demand in the country that hosts the more employment-oriented union and raises employment there, relative to the other country. While this relocation of production generates an additional

[5]Differences in union objectives are of course not the only reason for potential losses of cooperation. If unions differ in their members' outside income opportunities in case of disagreement with the firm – for instance due to different unemployment compensation schemes – it may as well be the case that cooperation is detrimental for one of the unions, if bargaining under cooperation is based on a uniform union threat point. While we have also analyzed this case, we do not discuss it here, as the respective insights are similar to the case of asymmetric union objectives and thus do not justify the additional complexity involved when accounting for a second form asymmetry.

[6]The efficient bargaining model is a widely used framework for studying firm-union negotiations, which has been introduced into the literature by McDonald and Solow (1981).

loss for the union with stronger wage orientation, which definitely loses relative to the no trade scenario, it provides a benefit to the union with stronger employment orientation. And this benefit may be strong enough to outweigh the direct losses from the firm's improvement in its outside income opportunities arising from the ability to import output from the foreign plant if an agreement with the local union is not reached in the trade scenario.

Relying on the insights above, we study the incentives of unions to cooperate at an international basis. Thereby, we model cooperation as the formation of an international union, which bargains with the multinational firm instead of the two national unions. The international union has its own objective and attaches a relative weight to wages and employment which in general differs from the one of national unions. Of course, the cooperation outcome depends to a large degree on the relative preference for wages and employment and so do the potential benefits from cooperation for the two unions. If national unions have identical preferences prior to cooperation, it is reasonable to assume that the international union adopts these preferences. In this case, unions are definitely better off if delegating their bargaining right to the international union, as this outweighs the multinational firm's advantage from reaching a better bargaining position due to trade. As a result, cooperation reproduces the bargaining outcome of the no trade scenario in the case of symmetric union preferences. However, if unions have diverse preferences, cooperation will never reproduce the no trade outcome. Furthermore, it is possible that the more employment oriented union loses relative to the pre-cooperation scenario, while the more wage-oriented union definitely benefits from bargaining at an international level. From our analysis we can therefore conclude that cooperation may fail if differences in union objectives are too large.

We round off the discussion in this paper by analyzing the scope for compensating the losers of cooperation. Since unions differ in their preferences and thus attach different weights to wages and employment it is not straightforward to identify an *optimal* redistribution mechanism that involves a transfer of both wages and employment, as the two unions might evaluate the relative value of these transfers differently. However, we can shed light on the role of job relocation as one specific redistribution instrument. Of course, this instrument is not arbitrarily chosen, but rather job relocation does not impact the bargaining outcome under union cooperation and is thus a lump-sum instrument in our setting. We show that even if this lump-sum instrument is employed, it is not always possible to render both unions better off with cooperation than without cooperation. This

provides a further argument for missing evidence on international agreements between local unions in the negotiation with multinational firms.

While the discussion of international cooperation of unions has not been in the center of academic research so far, there are a few papers that have a similar focus as we do and are thus worthwhile to mention here. The first one is Straume (2002) who considers collusion of local unions in a two-country duopoly model with intra-industry trade. Considering two symmetric countries, unions always benefit from collusion in the Straume framework, and hence this model is not well equipped for explaining why we do not observe more international cooperation of unions in real world wage bargaining.[7] By associating union cooperation with the formation of a new international union, our model is related to Upmann (2008) who studies the incentives of unions to merge or separate. However, in contrast to us, Upmann does not consider union cooperation in the context of multinational firms nor does he analyze the scope for redistributing gains from cooperation. Union cooperation in the context of multinational firms has been addressed by Borghijs and Du Caju (1999). Focussing on the role of transaction costs for the coordination of wage-setting between symmetric plant-level unions within a single multinational, these authors conclude that European integration, by lowering transaction costs, should render union cooperation more attractive. However, as outlined above, supportive evidence for this mechanism is so far missing.[8]

The remainder of the paper is organized as follows. In Section 2 we introduce the reference model in which a multinational firm bargains with local unions, while lacking the ability to ship its output across borders. There, we also analyze how access to international trade changes the bargaining outcome and show how differences in union preferences govern trade gains and losses of local unions. In Section 3, we study the incentives for and the consequences of union cooperation. Thereby, we distinguish three scenarios. In the first one, we assume that the two national unions as well as the international union share the same preferences. In the second one, we consider diverging preferences of national unions and assume that wage-employment negotiations of the international union are based on

[7]Strozzi (2007) extends the analysis and investigates how substitutability of goods and the level of trade costs affect the incentives of unions to collude at an international level.

[8]Buccella (2011a) extends the framework of Borghijs and Du Caju (1999) to one with two firms and emphasizes that in this setting coordination in union wage setting may lead to welfare gains. Buccella (2011b) analyzes how the coordination of plant-level unions influences a multinational's decision to negotiate at the plant or firm level. Neither of these papers accounts for differences in union objectives or does shed light on why we lack evidence of international cooperation in union wage setting.

the objective of the more wage-oriented union. In the third scenario, we again consider divergent preferences but now assume that the international union adopts the preferences of the more employment-oriented union. The scope for redistributing gains from cooperation through employment relocation is subject of discussion in Section 4. The last section concludes with a brief summary of the most important results.

2 A multinational firm and national unions

We consider a partial equilibrium setting with two countries (A and B) and a monopoly firm, which operates a production facility in either economy. The firm uses the same production technology in both of its locations and hires workers as a variable production input. Each worker supplies one unit of labor, l, and can produce one unit of output. Workers are internationally immobile and members of local labor unions, which are organized at the plant level. Unions have a Stone-Geary objective function of the form $U_j = (w_j - \bar{w})^{\alpha_j} l_j$, $j = A, B$, with $\bar{w}$ denoting outside income opportunities of union members, which may be associated with wage income in other industries or unemployment benefits, and $\alpha_j > 0$ measuring the relative weight that the union attaches to the individual wage premium $w_j - \bar{w}$.[9]

To close the model, we assume that the monopoly firm faces linear demand in either market. Denoting by p_j and x_j the price and consumption level in j, inverse demand in this country is given by $p_j = 1 - x_j$, and the multinational's total profits are represented by $\Pi = p_A x_A + p_B x_B - w_B l_B - w_A l_A$. The firm unilaterally sets its output levels for the two countries, which, in view of product market clearing, equal the consumption levels x_A and x_B. On the other hand, wages and employment are jointly determined in a Nash bargain with local unions. Thereby, the firm-union bargaining pair in one location takes the bargaining outcome in the other location as given. Assuming that both parties have equal power in the bargaining process, the bargaining outcome in country j can be determined by maximizing the Nash product

$$\Omega_j = U_j \left[\Pi - \bar{\Pi}_j \right], \tag{1}$$

subject to the participation constraints $U_j \geq 0$ and $\Pi \geq \bar{\Pi}_j$. Thereby, $\bar{\Pi}_j$ is the firm's fallback profit, i.e. the profit that is realized by the firm in case of disagreement with the

[9] While the union objective U_j relies on an ad hoc specification, it is straightforward to formulate a simple model that offers a micro-foundation for this objective (see the appendix for details).

union from country j.

In an open economy, the bargaining outcome depends on a firm's ability to reach foreign consumers from a certain production facility. To analyze in detail how opportunities to trade affect wages and employment, we distinguish two scenarios. In the first one, we consider prohibitive trade costs (the *no trade* scenario), while in the second one we study the other limiting case of zero trade costs (the *free trade* scenario).[10] We start with a discussion of the no trade scenario in Subsection 2.1.

2.1 Wage and employment negotiations in the absence of trade

If trade costs are prohibitive, we have $x_j = l_j$ and $\Pi - \bar{\Pi}_j = \Pi_k + (1 - l_j - w_j)l_j$, where Π_k are profits of the local plant in country $k \neq j$. In this case, the negotiations in the two economies are independent. Furthermore, with the firm and the union negotiating on both employment and wages, the outcome of the bargaining process is Pareto efficient and lies on the contract curve (CC_j)

$$w_j = -\frac{1}{\alpha_j - 1}\bar{w} + \frac{\alpha_j}{\alpha_j - 1}(1 - 2l_j). \tag{2}$$

Thereby, Eq. (2) is established by the two first-order conditions to the Ω_j-maximization problem. The contract curve may in general be positively or negatively sloped in the (w, l)-space. Its slope is positive if $\alpha_j < 1$ and negative if $\alpha_j > 1$. In addition, one can reformulate the first-order condition for the Ω_j-maximizing employment level to characterize a second (w, l)-locus that determines how bargaining rents are split between the firm and the union. This locus is called the rent-sharing curve (RSC_j), which can be written as a weighted average of labor's marginal revenue product, $MRP_j = 1 - 2l_j$, and its average revenue product, $ARP_j = 1 - l_j$, with the bargaining power of firms and unions serving as weighting factors. Since we have assumed that firms and unions have equal bargaining power, the rent-sharing curve is given by

$$w_j = \frac{1}{2}(1 - 2l_j) + \frac{1}{2}(1 - l_j). \tag{3}$$

Eqs. (2) and (3) jointly determine the bargaining outcome, which equals

$$w_j^n = \bar{w} + \frac{\alpha_j}{3 + \alpha_j}(1 - \bar{w}), \qquad l_j^n = \frac{2}{3 + \alpha_j}(1 - \bar{w}), \tag{4}$$

[10] Focusing on free trade is useful for presenting our arguments in the simplest possible way. However, the main mechanisms remain unaffected if we extend the model to one with small positive levels of trade costs.

with superscript n referring to the *no trade* scenario. One further remark is in order here. In an *efficient bargaining* model with linear demand, it cannot be ruled out in general that the firm employs more workers than it actually uses in its production process. Noting that the firm has no incentive to further expand its sales level if the marginal revenue of doing so becomes negative, the firm's maximum sales level is given by $x_j = 1/2$, and the bargaining outcome gives rise to over-employment – and, provided that resources can be used productively elsewhere, wasted output from a social planner's point of view – if $l_j > 1/2$. To avoid such an outcome, we can restrict our attention to the case of a negatively sloped contract curve by assuming $\alpha_j > 1$, and this is what we do throughout our analysis.[11]

Substituting w_j^n and l_j^n into total profits Π, we obtain

$$\Pi^n = 2\left[\left(\frac{1-\bar{w}}{3+\alpha_j}\right)^2 + \left(\frac{1-\bar{w}}{3+\alpha_k}\right)^2\right], \tag{5}$$

which, in view of prohibitive trade costs, equals the firm's surplus from reaching an agreement in both economies: $\Pi - \bar{\Pi}_j$. Substituting w_j^n and l_j^n into the union objective finally gives

$$U_j^n = 2\alpha_j^{\alpha_j}\left(\frac{1-\bar{w}}{3+\alpha_j}\right)^{1+\alpha_j}. \tag{6}$$

Thereby, U_j differs from the pure income gain of union members if $\alpha_j > 1$.

This completes our discussion of wage and employment negotiations in the case of prohibitive trade costs. In the next subsection, we address the role of international trade for the bargaining outcome in the two economies.

2.2 Wage and employment negotiations under free trade

The multinational firm's ability to ship products across borders influences the outcome of wage and employment negotations in two important ways. First, a given employment increase in one location has, ceteris paribus, a smaller negative impact on the price level, because the multinational firm can export part of the additional output to the foreign

[11] Layard and Nickel (1990) argue that a positive relationship between employment and wages that is imposed by a positively sloped contract curve in our setting may simply be the consequence of a partial equilibrium perspective, while the respective wage-employment relationship becomes negative, once general equilibrium feedback effects are accounted for. This provides a further justification for restricting attention to parameter constellations for which the contract curve is negatively sloped, i.e. $\alpha_j > 1$.

economy. All other things equal, this lowers the wage elasticity of employment along the rent-sharing curve and, hence, widens the scope for rent extraction from the perspective of unions. Second, the ability to export also improves the firm's return in the case of disagreement with one bargaining partner. For instance, if the bargain fails in country A the firm can use part of its production in country B to serve consumers in country A. This raises the firm's fallback profit if an agreement with country A's union is not reached and thus lowers the bargaining surplus of the union in country A.[12]

With zero trade costs, the firm maximizes its profits by selling half of its total output in either economy. Hence, total profits of the firm if an agreement is reached in either country are given by $\Pi = [1 - (l_A + l_B)/2]\,(l_A + l_B) - w_A l_A - w_B l_B$, while its fallback position in the bargain with country j equals $\bar{\Pi}_j = (1 - l_k/2 - w_k)\,l_k$, $j \neq k$. Then, substituting $\Pi - \bar{\Pi}_j = (1 - l_j/2 - l_k - w_j)\,l_j$ into the Nash product in (1) and maximizing the resulting expression subject to the participation constraints $U_j \geq 0$ and $\Pi - \bar{\Pi}_j \geq 0$, we obtain, after straightforward calculations, the modified contract curve

$$w_j = -\frac{1}{\alpha_j - 1}\bar{w} + \frac{\alpha_j}{\alpha_j - 1}(1 - l_j - l_k) \tag{7}$$

as well as the modified rent-sharing curve

$$w_j = \frac{1}{2}\,(1 - l_j - l_k) + \frac{1}{2}\left(1 - \frac{l_j}{2} - l_k\right). \tag{8}$$

From these two equations, we can conclude that the bargaining outcomes in the two locations are interdependent if the multinational enterprise has access to international trade. To shed further light on this interdependence, we can combine Eqs. (7) and (8) to obtain w_j and l_j as functions of the foreign country's employment level, l_k:

$$w_j = \bar{w} + \frac{\alpha_j}{3 + \alpha_j}\,(1 - \bar{w} - l_k)\,, \qquad l_j = \frac{4}{3 + \alpha_j}\,(1 - \bar{w} - l_k)\,. \tag{9}$$

Since similar expressions can be derived for country k, we are now equipped to solve for country-specific employment and wage levels in the free trade equilibrium:

$$w_j^t = \bar{w} + \frac{\alpha_j\,(\alpha_k - 1)\,(1 - \bar{w})}{\alpha_j \alpha_k + 3\,(\alpha_j + \alpha_k) - 7}, \qquad l_j^t = 4\frac{(\alpha_k - 1)\,(1 - \bar{w})}{\alpha_j \alpha_k + 3\,(\alpha_j + \alpha_k) - 7}, \tag{10}$$

[12]For this argument to hold, it is essential that firms and union negotiate on wages (and employment), while the respective effect is by construction not present in a monopoly union model, in which the union sets the wage while the firm sets employment. Naylor (1998, 1999), Lommerud, Meland, and Sørgard (2003), and Bastos and Kreickemeier (2009) are prominent examples that consider monopoly unions in an open economy.

with superscript t referring to *trade*.[13] Comparing w_j^t and l_j^t to their counterparts in Subsection 2.1, we can conclude that wages are definitely lower in the free trade scenario than in the no trade scenario. Employment effects of abolishing trade barriers are less clear and crucially depend on the prevailing differences in union objectives. If $\alpha_A = \alpha_B$, freeing up trade stimulates employment in both economies. With $\alpha_A < \alpha_B$, these positive employment effects are reinforced in country A, which hosts the employment-oriented union. The additional employment expansion in country A comes at the cost of employment losses in country B, which hosts the wage-oriented union. This relocation effect may actually be sufficiently strong to induce an overall employment reduction in country B if trade barriers are abolished.[14]

These employment differences also generate an asymmetry in the wage-employment negotiations of the bargaining pairs in j and k. From the analysis above, we can deduce that higher employment in one plant improves the firm's fallback position in the Nash bargain with the foreign union and thus lowers the surplus that can be realized by an agreement in the other country. To be more specific, if $\alpha_A < \alpha_B$ the overall surplus is lower in the bargain of country B than in the bargain of country A and this leads to the somewhat counterintuitive result that the employment-oriented union in country A negotiates both a higher employment level and a higher wage rate than the wage-oriented union in country B. Hence, the union that attaches a higher weight on the wage premium of its members ends up with lower wages in the free trade scenario. Finally, noting from above that the multinational enterprise sells half of its total output in either market, it is clear that the plant-level wage-employment negotiations generate exports from country A to country B. This provides a so far unexplored reasoning for the empirical observation that trade and foreign investment are not mutually excluding but can be complementary forms of foreign market penetration.[15]

[13] According to (10), an outcome with positive employment and wage levels in either country requires $\alpha_j, \alpha_k > 1$. This is the case we are focussing on throughout our analysis (see above). In a scenario with $\alpha_j < 1 < \alpha_k$ wage-employment negotiations would lead to a corner solution with the plant in country j serving the entire world market.

[14] Also world-wide employment does not necessarily increase if the multinational gets access to exporting. To see this, note that, in view of (4) and (10), world-wide employment in the no trade and free trade scenario are given by $l_W^n = 2(6+\alpha_j+\alpha_k)/\left[\alpha_j\alpha_k + 3(\alpha_j+\alpha_k) + 9\right]$ and $l_W^t = 4(\alpha_j+\alpha_k-2)/[\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7]$, respectively. This implies that $l_W^t >,=,< l_W^n$ if $\alpha_j\alpha_k(\alpha_j+\alpha_k-4) - 5(\alpha_j+\alpha_k) + 3(\alpha_j^2+\alpha_k^2) >,=,< 0$ and thus $l_W^t < l_W^n$ if α_j, α_k close to one.

[15] Empirical evidence on the complementarity between trade investment is extensive. Prominent studies emphasizing this complementarity include Lipsey and Weiss (1981), Grubert and Mutti (1991), Barrell and

With these insights at hand, we can now substitute the bargaining outcome in (10) into the firm's overall profits to obtain

$$\Pi^t = 4(1-\bar{w})^2 \frac{4\alpha_j\alpha_k + \alpha_j^2 + \alpha_k^2 - 6\left(\alpha_j + \alpha_k - 1\right)}{\left[\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7\right]^2}. \tag{11}$$

As formally shown in the appendix, these profits are larger than those realized in the case of prohibitive trade costs, so that the multinational firm unambiguously benefits from getting access to international trade. Thereby, it is the prospect of exporting and not the actual engagement in trade that matters for this outcome. In particular, if the two unions have identical objectives, i.e. if $\alpha_A = \alpha_B$, there is no incentive for the multinational enterprise to ship goods across borders (and the multinational would definitely abstain from doing so if exporting involved just infinitesimal transport costs). Still, the multinational firm benefits in this case, because, by credibly threatening to export in the case of disagreement, it improves its bargaining position vis-à-vis the two local unions.

Finally, substituting (10) into the union objective, gives

$$U_j^t = \left(\frac{\alpha_j\left(\alpha_k - 1\right)}{\alpha_j\alpha_k + 3\left(\alpha_j + \alpha_k\right) - 7}\right)^{\alpha_j} \frac{4\left(\alpha_k - 1\right)\left(1-\bar{w}\right)^{1+\alpha_j}}{\alpha_j\alpha_k + 3\left(\alpha_j + \alpha_k\right) - 7}. \tag{12}$$

Comparing U_j^t and U_j^n we find that the impact of trade on union objective is not clearcut in general and crucially depends on the relative size of weighting factors α_j and α_k. To be more specific, we know from the analysis above that the union with the stronger wage orientation, i.e. with the larger α-parameter, ends up with lower wages and possibly lower employment than in the no trade scenario and, hence, is definitely worse off in the free trade scenario. Things are different for the union with the stronger employment orientation. This union also experiences a wage reduction with detrimental welfare effects. But at the same time, it may benefit from an employment expansion, and the positive employment effect can actually be strong enough to render the union better off under free trade than in the absence of trade. As formally shown in the appendix (and graphically depicted in Figures 1 and 2 below), we can characterize an indifference locus which separates the parameter domain with union losses from trade from the parameter domain with union gains from trade. To put it formally, from the perspective of the union in j there exists a critical $\hat{\alpha}_k(\alpha_j) > \alpha_j$, $\hat{\alpha}_k'(\alpha_j) > 0$, such that $U_j^t >, =, < U_j^n$ if $\alpha_k >, =, < \hat{\alpha}_k$.

Pain (1999) and, more recently, Brouwer, Paap, and Viaene (2008). Blonigen (2001) and Swenson (2004) argue that these findings may be subject to an aggregation bias, and that existing data is less supportive for a complementarity between the two forms of foreign market penetration at the product level.

This completes our discussion on uncoordinated wage-employment negotiations within a multinational firm that has access to international trade. The following proposition summarizes the main insights from the analysis above.

Proposition 1. *The ability to export improves the bargaining position of the multinational firm and lowers the negotiated wage in both countries. Employment definitely increases in the plant which faces the employment-oriented union, while it may fall in the other plant. Due to its better fallback position in the wage-employment negotiation, the multinational firm benefits from an abolition of trade barriers. While the wage-oriented union definitely loses, the employment-oriented union may benefit from the firm's ability to export, if the differences in union objectives are sufficiently pronounced.*

3 A multinational firm and international unions

We now assume that local unions in the two countries can coordinate their bargaining strategies, by forming a single international union that negotiates with the multinational firm. Forming an international union implies that workers have to agree on a common objective function, $U = (w - \bar{w})^{\beta} l_j$, with weighting factor β assuming the role of α_j in the case of uncoordinated wage bargaining. While we do not discuss in detail how the wage orientation of the integrated union is formed, it seems reasonable to restrict the domain of β to interval $[\alpha_A, \alpha_B]$, where $\alpha_A \leq \alpha_B$ is assumed without loss of generality.[16]

With coordinated bargaining, the firm does no longer enjoy a better bargaining position due to imports from its second plant in the case of disagreement, because both plants are covered in the same negotiation. With a uniform union objective, wages and employment in the two countries are identical and, similar to the no trade scenario, they are given by

$$w_j^c = \bar{w} + \frac{\beta}{3+\beta}(1-\bar{w}), \qquad l_j^c = \frac{2}{3+\beta}(1-\bar{w}), \tag{13}$$

where superscript c refers to *cooperation*. Furthermore, total profits and individual union's utility are given by

$$\Pi^c = 4\left(\frac{1-\bar{w}}{3+\beta}\right)^2, \qquad U_j^c = 2\beta^{\alpha_j}\left(\frac{1-\bar{w}}{3+\beta}\right)^{1+\alpha_j}, \tag{14}$$

respectively. Whether Π^c, U_j^c are larger or smaller than their counterparts in the no trade scenario and the free trade scenario without cooperation depends on the value of objective

[16] In the appendix, we present a simple model that allows for an endogenous determination of β.

parameter β relative to α_A, α_B. To shed light on the role of this objective parameter, we distinguish three scenarios, namely (i) $\beta = \alpha_A = \alpha_B$, (ii) $\alpha_B > \alpha_A = \beta$, and (iii) $\beta = \alpha_B > \alpha_A$, which are discussed in detail in Subsections 3.1-3.3.

3.1 Identical Union Objectives: $\beta = \alpha_A = \alpha_B$

If $\beta = \alpha_A = \alpha_B$, formation of an international union destroys the firm's ability to export in the case of disagreement, because if bargaining is not successful workers are on strike in both locations. Hence, cooperation reduces the multinational's fallback profit in the wage-employment negotiation, while it does not impact the production pattern due to *ex ante* symmetry in union objective. Put differently, if $\beta = \alpha_A = \alpha_B$ cooperation replicates the outcome of the no trade scenario: $\Pi^c = \Pi^n$, $U_j^c = U_j^n$. Hence, accounting for the insights from Section 2, it is immediate that $\Pi^c < \Pi^t$ and $U_j^c > U_j^t$.

The following proposition summarizes the main insights from this subsection.

Proposition 2. *If union objectives are identical, union cooperation reproduces the outcome in the no trade scenario, implying that the multinational firm loses, while the two unions benefit relative to free trade without cooperation.*

Proof. Analysis in the text. □

3.2 Divergent Preferences I: $\alpha_B > \alpha_A = \beta$

Let us now assume that the preferences of the two unions diverge, and that the negotiations of the newly formed international union are based on the preferences of the employment-oriented union in country A: $\alpha_B > \alpha_A = \beta$. Similar to the case of symmetric union objectives analyzed above, cooperation worsens the multinational's fallback profit in the case of disagreement. However, at the same time, the multinational benefits from a stronger employment-orientation in country B, so that there are now two counteracting effects of cooperation on profits of the multinational producer. Comparing profits in the free trade regime with cooperation with profits in the no trade scenario, we can isolate the profit gain arising from a change in union objective. According to (5) and (14), we obtain

$$\Pi^c - \Pi^n = 2\left[\left(\frac{1-\bar{w}}{3+\alpha_A}\right)^2 - \left(\frac{1-\bar{w}}{3+\alpha_B}\right)^2\right] > 0, \tag{15}$$

so that the multinational firm is definitely better off with trade and union cooperation than in the no trade scenario. But is this profit gain sufficiently large to compensate the

multinational firm for a worsening in its fallback profit relative to the free trade scenario without cooperation? To answer this question, we have to compare Π^c and Π^t. As formally shown in the appendix, this gives $\Pi^c - \Pi^t < 0$. Hence, under free trade the multinational firm is definitely worse off with union cooperation than with two independent unions.

We now turn to the effects of cooperation on the union objective in country j, which are depicted in Figures 1 and 2. Thereby, Figure 1 displays the case of $\beta = \alpha_j$ and is thus relevant for country $j = A$, while Figure 2 displays the case of $\beta = \alpha_k$ and is thus relevant for country $j = B$. We first consider the union in country A and thus focus on Figure 1. With $\beta = \alpha_j$, we have $U_j^c = U_j^n$, according to (6) and (14). Hence, the two indifference loci $\Upsilon_j^{t/n} \equiv U_j^t/U_j^n = 1$ and $\Upsilon_j^{t/c} \equiv U_j^t/U_j^c = 1$ must be congruent in this case.[17] For (α_j, α_k)-combinations above indifference locus $\Upsilon_j^{t/c} = 1$ the union in country $j = A$ benefits from trade, while it loses from cooperation with the other union. To be more specific, we know from the analysis in Section 2 that with sufficiently large differences in objective parameters α_j, α_k, the employment-oriented union is better off in the free trade than the no trade scenario, as benefits from employment expansion dominate losses from a wage reduction in this case. By coordinating the bargaining strategy and negotiating according to union j's objective, the wage-employment bargain will reproduce the outcome of the no trade scenario in country j and hence the union loses from cooperation in the parameter domain above the $\Upsilon_j^{t/c} = 1$-locus. Things are different below the $\Upsilon_j^{t/c} = 1$ locus. While trade (without cooperation) may still stimulate employment of country j in this region – at least for (α_j, α_k)-combinations above the 45° line – the respective employment expansion is not strong enough to compensate for losses from a decline in the wage rate, so that the union in country j is worse off with trade and thus benefits from cooperation and formation of an international union. In view of $\alpha_B > \alpha_A$, the region above the 45° line is relevant, so that country A benefits from cooperation as along as the prevailing α-differences are not too large.

Let us now consider the situation in country B, which is depicted by Figure 2. From the perspective of union $j = B$ cooperation leads to adoption of the other union's objective, which implies that the bargaining strategy becomes more employment-oriented. Furthermore, from inspection of (6), we can infer that $dU_j^n/d\alpha_k >, =, < 0$ if $3\alpha_j >, =, < \alpha_k$. We can interpret this result in the following way: From the perspective of union leadership there are losses from delegating the bargaining right to an agent with lower wage orien-

[17] The formal properties of all indifference loci that are discussed in this and the next subsection are characterized in the appendix.

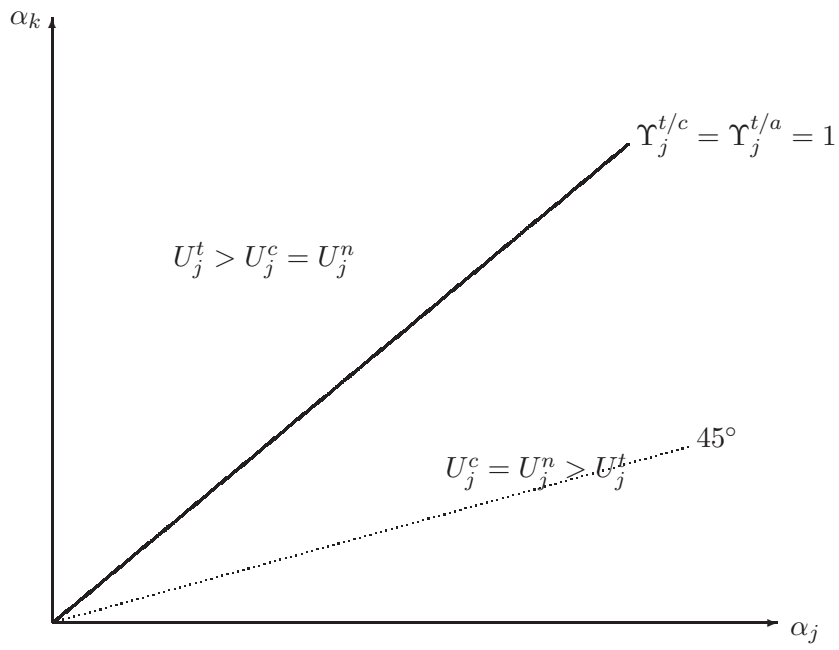

Figure 1: Benefits and losses from union cooperation if $\beta = \alpha_j$

tation, implying that in the region below indifference locus $\Upsilon_{j,1}^{c/n} \equiv U_j^c/U_j^n = 1$ – which coincides with the 45°-line in Figure 2 – the union in county j is worse off with trade and cooperation than in the no trade scenario. Due to the non-monotonicity of the relationship between U_j^n and α_k, there exists a second indifference locus $\Upsilon_{j,2}^{c/n} \equiv U_j^c/U_j^n = 1$ above the 45° line, such that the union in j is worse off with trade and cooperation than in the no trade scenario for (α_j, α_k)-combinations above $\Upsilon_j^{c/n} = 1$. Furthermore, we see that indifference locus $\Upsilon_j^{t/n} = 1$ – which separates the parameter domain associated with losses from trade from the parameter domain associated with gains from trade – and indifference locus $\Upsilon_j^{t/c} = 1$ – which separates the parameter domain associated with losses from cooperation from the parameter domain with benefits from cooperation – lie within the cone spanned by the two lines $\Upsilon_{j,1}^{c/n} = 1$, $\Upsilon_{j,2}^{c/n} = 1$. Finally, it is notable that objective gains associated with delegation to a moderately higher α-level are responsible for the finding that the $\Upsilon_j^{t/c} = 1$ locus lies above the $\Upsilon_j^{t/n} = 1$ locus in Figure 2.

Clearly, with $\alpha_B > \alpha_A$, the relevant parameter domain for the union in country $j = B$ lies below the 45° line in Figure 2 and, hence, we end up with the following ranking of

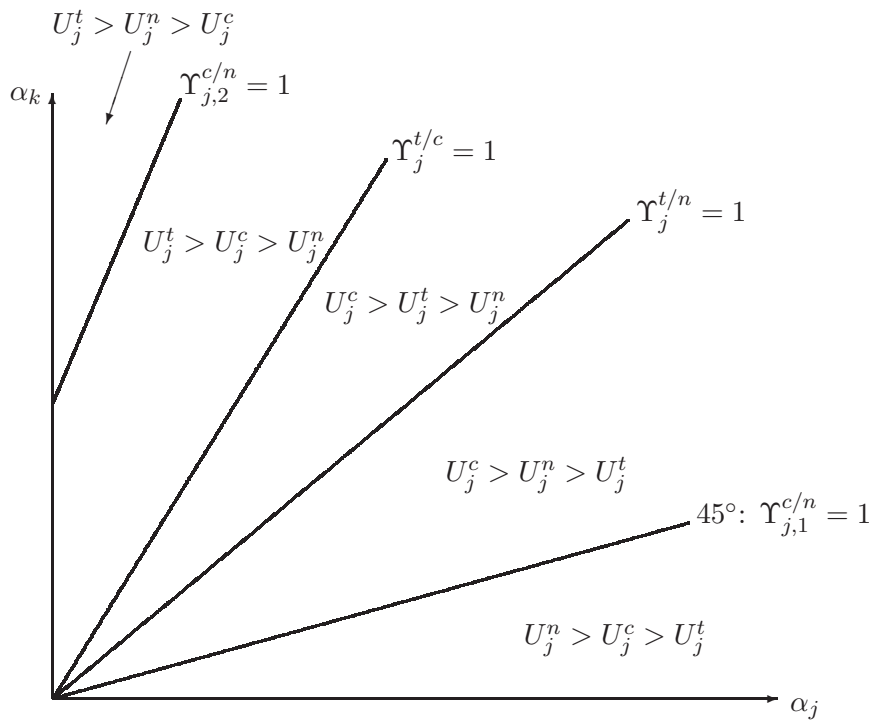

Figure 2: Benefits and losses from union cooperation if $\beta = \alpha_k$

union objectives: $U_B^n > U_B^c > U_B^t$. Put differently, cooperation of unions helps reducing losses from trade. However, since the union in country B has to accept a stronger employment orientation, there are losses from delegation, so that the no trade result cannot be replicated by union cooperation in the free trade scenario.

The following proposition summarizes the main insights from above.

Proposition 3. *If union preferences diverge and the wage negotiations in the cooperation case are based on the objective of the employment-oriented union, the multinational firm loses relative to the free trade scenario without union cooperation but it is still better off than in the no trade scenario. The employment-oriented union reaches the same utility level as in the no trade scenario, and it benefits relative to free trade without cooperation as long as union objectives are not too different. The wage-oriented union also benefits from cooperation relative to the free trade scenario without cooperation but, due to losses from delegation, it is worse off than in the no trade scenario.*

Proof. See the discussion in the text and the formal characterization of the respective indifference loci in the appendix. □

3.3 Divergent Preferences II: $\beta = \alpha_B > \alpha_A$

We now consider the other limiting case with the newly formed international union adopting the objective of the wage-oriented union in country B. From the perspective of the multinational firm, there are now double losses from cooperation. On the one hand, the firm experiences a decline in its fallback profit that can be realized if bargaining fails and, on the other hand, the negotiations for the plant in country A are now governed by a stronger wage orientation of the union than it was the case in the free trade scenario without cooperation. The second source of profit losses can be illustrated by comparing profits in the no trade scenario with the profits in the free trade scenario with cooperation. According to (5) and (14), we get

$$\Pi^c - \Pi^n = 2\left[\left(\frac{1-\bar{w}}{3+\alpha_B}\right)^2 - \left(\frac{1-\bar{w}}{3+\alpha_A}\right)^2\right] < 0. \tag{16}$$

Combining (16) with the insights from Proposition 1, the following profit ranking is immediate: $\Pi^t > \Pi^n > \Pi^c$, implying that cooperation is the worst case from the perspective of the multinational.

Let us now consider the impact of cooperation on the union objective in country j. With $\beta = \alpha_B$, Figure 1 now depicts the respective effects for the union in country $j = B$, with the relevant domain lying below the 45°-line if $\alpha_B > \alpha_A$. With the international union adopting the objective of the union in B, cooperation simply replicates this union's no trade outcome. Furthermore, we know from Proposition 1 that the union with a stronger wage orientation is definitely worse off in the free trade scenario than in the no trade scenario. Hence, for the union in country B, the following utility ranking is immediate: $U_B^c = U_B^n > U_B^t$. Regarding the implications for the union in country $j = A$, we can look at Figure 2, where the region above the 45° line constitutes the relevant parameter domain due to $\alpha_B > \alpha_A$. The two potential sources of benefits from coordination – the improvement in the bargaining position of unions and delegation gains from adopting a moderately stronger wage orientation – give rise to four possible outcomes, as indicated by the respective parameter domains in Figure 2. As outlined in Subsection 3.2 delegation to a higher α-level is only beneficial if the prevailing differences in union objectives are not too large. The potential delegation gains drive a wedge between U_A^c and U_A^n and they are responsible for the finding that the $\Upsilon_j^{t/c} = 1$ locus lies above the $\Upsilon_j^{t/n} = 1$ locus. Hence, there exists a parameter domain for which cooperation not only improves union utility relative to the trade regime but also relative to the no trade regime. However, similar to

our findings in Subsection 3.2 cooperation is not beneficial for the employment-oriented union in country A, if the respective α-differences are excessive.

We complete the analysis in this subsection by summarizing the main insights in the following proposition.

Proposition 4. *If union preferences diverge and the wage-employment negotiations of the international union are based on the objective of the wage-oriented union, the multinational firm loses relative to both the free trade scenario without union cooperation and the no trade scenario. The wage-oriented union reaches the same utility level as in the no trade scenario, and it benefits relative to free trade without cooperation. The employment-oriented union benefits from cooperation relative to the free trade scenario without cooperation as long as union objectives are not too different. In this case, the union is also better off than in the no trade regime. On the contrary, if differences in union objectives are excessive, cooperation not only renders the employment-oriented union worse off than in the free trade regime without cooperation but also lowers union utility relative to the no trade scenario.*

Proof. See the discussion in the text and the formal characterization of the respective indifference loci in the appendix. □

4 How to compensate losers from coordinated bargaining

In the previous section we were concerned with the benefits from international cooperation of labor unions in their negotiation with a multinational enterprise. Thereby, we have seen that cooperation, while destroying the multinational's ability to replace domestic production by foreign imports in the case of disagreement, does not necessarily render both unions better off. With the employment-oriented union possibly benefiting from free trade (without cooperation) relative to the no trade regime, it may well be the case that this union loses from cooperation. Clearly, such losses may be an important obstacle to the formation of an international union and they may therefore provide a reasoning for why we do not observe a surge in the international cooperation of union activity despite the dramatic increase in multinational activity over the last few decades.

If one party loses while the other party benefits from cooperation there might be scope for compensating the losers. A first question is how such a compensation may look like in the context of labor unions. One theoretically appealing possibility to redistribute

the gains from cooperation is to shift jobs between the two locations. As long as the total number of workers remains constant, this redistribution scheme does not affect the bargaining outcome and thus has the flavor of a lump-sum instrument. In this case, the key question of interest is: Are the cooperation gains of the union in country B sufficiently high to compensate for (potential) cooperation losses of the union in country A? The answer depends on whose preferences are adopted by the international union. To see this, note that cooperation induces a wage increase in both countries, but at the same time lowers employment in the country that hosts the employment-oriented union. If the international union adopts the objective of the employment-oriented union ($\beta = \alpha_A$), the employment reduction in country A is less severe and, hence, gains of the union in country B are sufficiently high to compensate for losses of the union in country A. Put differently, if $\beta = \alpha_A$, then jobs can be relocated in a way to ensure that both unions are better off with cooperation than without cooperation. Things are different if the international union adopts the objective of the wage-oriented union. In this case, the employment reduction in country A that is triggered by cooperation is large and it is thus not always possible to find an allocation of jobs such that both unions benefit from cooperation.

The following proposition summarizes to what extent relocation of jobs may be successful in rendering cooperation beneficial for both unions.

Proposition 5. *If the international union adopts the objective of the labor-oriented union, jobs can always be allocated in a way that renders both unions better off with cooperation than without cooperation. On the contrary, if the international union adopts the objective of the wage-oriented union and the differences in union objectives are significant, cooperation gains of the wage-oriented union need not be high enough to compensate for cooperation losses of the labor-oriented union.*

Proof. See appendix. □

Proposition 5 makes clear that access to a lump-sum redistribution instrument may not be sufficient to render cooperation a success story. Of course, in reality things are even more complicated. For instance, while relocating jobs for redistributing cooperation gains is theoretically appealing, convincing members to agree on offshoring jobs in order to establish an international union does not seem to be a promising task for union leadership. A further problem that arises with the redistribution instrument considered here is that the respective relocation mechanism only works if the integrated union can negotiate

plant-specific employment levels. While in our framework the multinational is indifferent between any possible division of its total employment on the two plants when facing an international union, this is no longer the case if we relax the assumption of zero costs for shifting jobs internationally. In fact, positive transportation costs may be a reason for rendering a firm reluctant to accept job relocation. This is not to say that such agreements are impossible. However, one should be warned to infer from our analysis above that instruments for redistributing gains from cooperation can be easily implemented in the context of (international) labor unions.[18]

5 Concluding remarks

We have set up a simple theoretical model with a single multinational firm operating a production facility in two economies. Wages and employment are set in a bargain with local unions. From the perspective of the firm the two production locations are fully symmetric except of the preferences of local unions for wages and employment. In this setting, we show that the option of trade provides two benefits for the multinational. On the one hand, it allows the firm to shift production towards the country that hosts the more employment-orient union, which is the union that has the lower wage claim all other things equal. On the other hand, it increases the profits the firm can realize in the case of disagreement and thus improves the multinational's bargaining position vis-à-vis local unions. The latter arises due to the firm's ability to replace local production by imports if an agreement in the bargain with one of the two unions is not reached.

In this setup, we have analyzed the unions' incentives to cooperate at an international level. This cooperation is modeled as formation of an international union, which negotiates on wages and employment in both production facilities of the multinational enterprise. As a consequence, the firm loses its ability to replace local production by imports in the case of disagreement, which improves the bargaining position of unions. In the borderline case of identical union objectives, cooperation reproduces the bargaining outcome of the no trade scenario and thus renders both unions better off. However, if union objectives differ, there is a source of welfare losses, as the international union cannot follow both

[18]From inspection of Figure 2 it is also obvious that relocating jobs does not necessarily be successful in generating utility gains relative to the no trade equilibrium. With the international union choosing a uniform objective for its negotiations with the multinational firm, there may be *aggregate* losses from delegation if the differences in the two unions' objectives are excessive.

unions' interests in its bargain with the multinational enterprise, and hence unions may lose due to deviations from their own objectives. Furthermore, there is a second source of welfare loss for the employment-oriented union. This union benefits from the stronger wage-orientation of the other union and diverts part of initially foreign production to the domestic plant in the absence of cooperation. Hence, the union can lose from formation of an international union, as it gives up its preference-based locational advantage and thus part of domestic production when cooperating with the wage-oriented union.

Since it is in general not clear that both unions benefit from cooperation, our analysis provides an intuition for why we lack empirical evidence on international cooperation of unions in their bargaining with multinational firms. On the other hand, cooperation is always beneficial for at least one union and thus there may be scope for a redistribution scheme that helps rendering both unions better off with cooperation than without cooperation. To address this issue, we have studied relocation of employment between the two production plants as a lump-sum instrument for redistributing cooperation gains in our model. The results from this analysis are not promising, as even lump-sum redistribution of cooperation gains may not be successful in rendering both unions better off after formation of an international union.

Being the aim of this paper to shed first light on the possible factors that may hinder union cooperation in the bargaining with multinational firms, we have identified differences in the unions' wage/employment orientation as one important candidate in this respect. However, this is not the only factor that may explain the lack of international cooperation between unions. For instance, it is an empirical fact that, even within Europe, countries differ significantly in their unemployment compensation schemes. In our model, differences in unemployment compensation would result in different outside income opportunities of workers and thus would provide an alternative reason for a gap in union objectives between the two economies with similar implications for the incentives of international cooperation between plant-level unions. Aside from extending our framework to one that allows for differences in the unemployment compensation scheme, it would also be interesting to study the problems arising from cooperation between unions that are organized at different levels of centralization – the firm, the industry, or the country level – or to shed light on other policy instruments that may be useful for rendering international cooperation of unions more attractive. However, these and other possible extensions are beyond the scope of this paper and thus left open for future research.

A Appendix

A.1 A comparison of Π^t and Π^n

Differentiating (11) with respect to α_j, yields

$$\frac{d\Pi^t}{d\alpha_j} = -\frac{8(1-\bar{w})^2(\alpha_k-1)\left[2\alpha_j\alpha_k+2\alpha_j-8\alpha_k+\alpha_k^2+3\right]}{\left[\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7\right]^3}. \tag{17}$$

We can now define $\zeta(\alpha_j) \equiv 2\alpha_j\alpha_k + 2\alpha_j - 8\alpha_k + \alpha_k^2 + 3$, with $\zeta'(\alpha_j) > 0$. Noting further that $\zeta(\alpha_k) > 3(\alpha_k-1)^2 > 0$, it is immediate that $d\Pi^t/d\alpha_j < 0$ holds for any $\alpha_j \geq \alpha_k$. However, this implies that

$$\Pi^t > \lim_{\alpha_j\to\infty}\Pi^t = \frac{4(1-\bar{w})^2}{(3+\alpha_k)^2} \tag{18}$$

if $\alpha_j \geq \alpha_k$. Furthermore, we can deduce from (5) that

$$\Pi^n = 2\left[\left(\frac{1-\bar{w}}{3+\alpha_j}\right)^2 + \left(\frac{1-\bar{w}}{3+\alpha_k}\right)^2\right] \leq \frac{4(1-\bar{w})^2}{(3+\alpha_k)^2} \tag{19}$$

if $\alpha_j \geq \alpha_k$. Combining (18) and (19), it follows that $\Pi^t > \Pi^n$ if $\alpha_j \geq \alpha_k$. Due to the symmetry of the problem, we can rely on the same line of reasoning for showing that $\Pi^t > \Pi^n$ if $\alpha_k \geq \alpha_j$, so that $\Pi^t > \Pi^n$ must hold for any possible (α_j, α_k)-combination, with $\alpha_j, \alpha_k > 1$. *QED*

A.2 A comparison of Π^t and Π^c

From (18), we can deduce that

$$\Pi^t > 4\max\left[\left(\frac{1-\bar{w}}{3+\alpha_j}\right)^2, \left(\frac{1-\bar{w}}{3+\alpha_k}\right)^2\right]. \tag{20}$$

Accounting for (14) and noting that $\min\{\alpha_j, \alpha_k\} \leq \beta \leq \max\{\alpha_j, \alpha_k\}$, we can safely conclude that

$$\Pi^c = 4\left(\frac{1-\bar{w}}{3+\beta}\right)^2 < \Pi^t. \tag{21}$$

This completes the proof. *QED*

A.3 Characterization of indifference locus $\Upsilon_j^{t/n} = 1$

Using Eqs. (6) and (12), we obtain

$$\Upsilon_j^{t/n} \equiv \frac{U_j^t}{U_j^n} = 2\left(\frac{(3+\alpha_j)(\alpha_k-1)}{\alpha_j\alpha_k + 3(\alpha_j+\alpha_k) - 7}\right)^{1+\alpha_j}, \tag{22}$$

with the union in country j being indifferent between the no trade and the free trade scenario if $\Upsilon_j^{t/n} = 1$. Partially differentiating $\Upsilon_j^{t/n}$ with respect to α_j and α_k gives

$$\frac{\partial \Upsilon_j^{t/n}}{\partial \alpha_j} = -\Upsilon_j^{t/n}\left[\frac{16(1+\alpha_j)}{(3+\alpha_j)[\alpha_j\alpha_k + 3(\alpha_j+\alpha_k) - 7]} - \ln\left(\frac{(3+\alpha_j)(\alpha_k-1)}{\alpha_j\alpha_k + 3(\alpha_j+\alpha_k) - 7}\right)\right] < 0,$$
$$\frac{\partial \Upsilon_j^{t/n}}{\partial \alpha_k} = \Upsilon_j^{t/n}\frac{4(\alpha_j-1)(1+\alpha_j)}{(\alpha_k-1)[\alpha_j\alpha_k + 3(\alpha_j+\alpha_k) - 7]} > 0.$$

Hence, applying the implicit function theorem to $\Upsilon_j^{t/n} = 1$ gives

$$\left.\frac{d\alpha_k}{d\alpha_j}\right|_{\Upsilon_j^{t/n}=1} = -\frac{\partial \Upsilon_j^{t/n}/\partial \alpha_j}{\partial \Upsilon_j^{t/n}/\partial \alpha_k} > 0. \tag{23}$$

Furthermore, noting that

$$\left.\Upsilon_j^{t/n}\right|_{\alpha_j=\alpha_k} = 2\left(\frac{3+\alpha_j}{7+\alpha_j}\right)^{1+\alpha_j} < 1, \qquad \lim_{\alpha_k\to\infty} \Upsilon_j^{t/n} = 2. \tag{24}$$

we can conclude that, for any $\alpha_j > 1$, there exists a unique $\hat{\alpha}_k(\alpha_j) > \alpha_j$, such that $\Upsilon_j^{t/n} >, =, < 1$ if $\alpha_k >, =, < \hat{\alpha}_k(\alpha_j)$.

As a final element of the formal characterization of indifference locus $\Upsilon_j^{t/n} = 1$, we show that $\Upsilon_j^{t/n} = 1$ is inconsistent with $\alpha_k \geq 9\alpha_j$. This property is needed in order to determine the position of $\Upsilon_j^{t/n} = 1$ relative to the other indifference loci in Figures 1 and 2. Noting from above that $\partial \Upsilon_j^{t/n}/\partial \alpha_k > 0$, it is immediate that $\Upsilon_j^{t/n} > 1$ for any $\alpha_k > 9\alpha_j$ if

$$\hat{\Upsilon}_j^{t/n} \equiv \left.\Upsilon_j^{t/n}\right|_{\alpha_k=9\alpha_j} = 2\left(\frac{9\alpha_j^2 + 26\alpha_j - 3}{9\alpha_j^2 + 30\alpha_j - 7}\right)^{1+\alpha_j} \geq 1. \tag{25}$$

It is easily confirmed that $\hat{\Upsilon}_j^{t/n} = 2$ if $\alpha_j = 1$, while $\lim_{\alpha_j\to\infty} \hat{\Upsilon}_j^{t/n} = 2e^{-4/9} > 1$. Hence, the inequality in Eq. (25) is fulfilled for any $\alpha_j > 1$ if $\hat{\Upsilon}_j^{t/n}$ is monotonic in α_j. To check monotonicity, we differentiate $\hat{\Upsilon}_j^{t/n}$ with respect to α_j. This gives

$$\frac{d\hat{\Upsilon}_j^{t/n}}{d\alpha_j} = \hat{\Upsilon}_j^{t/n}\left[\ln\left(\frac{9\alpha_j^2 + 26\alpha_j - 3}{9\alpha_j^2 + 30\alpha_j - 7}\right) + \frac{4(1+\alpha_j)(9\alpha_j^2 - 18\alpha_j - 23)}{(9\alpha_j^2 + 30\alpha_j - 7)(9\alpha_j^2 + 26\alpha_j - 3)}\right]. \tag{26}$$

Expressing the natural logarithm in Eq. (26) by the Mercator series, furthermore implies:

$$\frac{d\hat{\Upsilon}_j^{t/n}}{d\alpha_j} = \hat{\Upsilon}_j^{t/n}\left[\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}\left(\frac{4(1-\alpha_j)}{9\alpha_j^2+30\alpha_j-7}\right)^n + \frac{4(1+\alpha_j)(9\alpha_j^2-18\alpha_j-23)}{(9\alpha_j^2+30\alpha_j-7)(9\alpha_j^2+26\alpha_j-3)}\right]$$

or, equivalently,

$$\frac{d\hat{\Upsilon}_j^{t/n}}{d\alpha_j} = \hat{\Upsilon}_j^{t/n}\left[\sum_{n=2}^{\infty}\frac{(-1)^{n+1}}{n}\left(\frac{4(1-\alpha_j)}{9\alpha_j^2+30\alpha_j-7}\right)^n - \frac{8(13\alpha_j^2+6\alpha_j+13)}{(9\alpha_j^2+30\alpha_j-7)(9\alpha_j^2+26\alpha_j-3)}\right] < 0.$$

This proves monotonicity of $\hat{\Upsilon}_j^{t/n}$ in α_j and together with the other insights from above we can therefore safely conclude that $\Upsilon_j^{t/n} = 1$ requires $\alpha_k < 9\alpha_j$. At the same time, we have noted above that $\Upsilon_j^{t/n} = 1$ requires $\alpha_k > \alpha_j$, so that the respective indifference locus must lie above the 45°-line in Figures 1 and 2. This completes the formal characterization of the $\Upsilon_j^{t/n} = 1$-locus.

A.4 Characterization of indifference locus $\Upsilon_j^{c/n} = 1$

Using Eqs. (6) and (14), we obtain

$$\Upsilon_j^{c/n} \equiv \frac{U_j^c}{U_j^n} = \left(\frac{\beta}{\alpha_j}\right)^{\alpha_j}\left(\frac{3+\alpha_j}{3+\beta}\right)^{1+\alpha_j}, \tag{27}$$

so that $\Upsilon_j^{c/n} = 1$ holds for any possible (α_j, α_k)-combination if $\beta = \alpha_j$. In contrast, if $\beta = \alpha_k$, we can calculate

$$\frac{\partial\hat{\Upsilon}_j^{c/n}}{\partial\alpha_k} = \hat{\Upsilon}_j^{c/n}\frac{3\alpha_j-\alpha_k}{\alpha_k(3+\alpha_k)}, \qquad \hat{\Upsilon}_j^{c/n}\Big|_{\alpha_k=\alpha_j} = 1, \qquad \lim_{\alpha_k\to\infty}\hat{\Upsilon}_j^{c/n} = 0, \tag{28}$$

where $\hat{\Upsilon}_j^{c/n} \equiv \Upsilon_j^{c/n}\Big|_{\beta=\alpha_k}$. From Eq. (28), it is easily inferred that $\hat{\Upsilon}_j^{c/n} = 1$ has two solutions: one at $\alpha_k = \alpha_j$ and one at $\alpha_k > 3\alpha_j$. To distinguish the two cases, we introduce a new notation. To be more specific, we write $\Upsilon_{j,1}^{c/n}$ for referring to $\Upsilon_j^{c/n}$ if $\beta = \alpha_k = \alpha_j$ and $\Upsilon_{j,2}^{c/n}$ for referring to $\Upsilon_j^{c/n}$ if $\beta = \alpha_k > \alpha_j$.

It is immediate that $\Upsilon_{j,1}^{c/n} = 1$ is congruent with the 45°-line in the (α_j, α_k)-space and thus implies a positive relationship between the two preference parameters. We can thus focus on the properties of the $\Upsilon_{j,2}^{c/n} = 1$-locus in the subsequent analysis. Noting from above that $\Upsilon_{j,2}^{c/n} = 1$ requires $\alpha_k > 3\alpha_j$, it is clear from Eq. (28) that $\partial\Upsilon_{j,2}^{c/n}/\partial\alpha_k < 0$ must hold in the relevant parameter domain. Furthermore, differentiating $\Upsilon_{j,2}^{c/n}$ with respect to

α_j gives

$$\frac{\partial \Upsilon_{j,2}^{c/n}}{\partial \alpha_j} = \Upsilon_{j,2}^{c/n} \left[\ln \left(\frac{\alpha_k (3+\alpha_j)}{\alpha_j (3+\alpha_k)} \right) - \frac{2}{3+\alpha_j} \right]. \tag{29}$$

Noting that the bracket term in Eq. (29) is increasing in α_k and equal to[19] $\nu(\alpha_j) \equiv \ln[(3+\alpha_j)/(1+\alpha_j)] - 2/(3+\alpha_j) > 0$ if evaluated at $\alpha_k = 3\alpha_j$, we can safely conclude that $\partial \Upsilon_{j,2}^{c/n} / \partial \alpha_j > 0$ holds in the relevant parameter domain. Taking stock, we have now shown that $\Upsilon_{j,2}^{c/n} = 1$ constitutes a positive relationship between α_j and α_k.

In a final step, we show that $\Upsilon_{j,2}^{c/n} = 1$ requires $\alpha_k \geq 9\alpha_j$, in order to determine its position relative to the other indifference loci in Figure 2. Recollecting form Eq. (28) that $\partial \Upsilon_{j,2}^{c/n} / \partial \alpha_k < 0$ if $\alpha_k > 3\alpha_j$, it is clear that

$$\hat{\Upsilon}_{j,2}^{c/n} \equiv \Upsilon_{j,2}^{c/n} \Big|_{\alpha_k = 9\alpha_j} = 9^{\alpha_j} \left(\frac{3+\alpha_j}{3+9\alpha_j} \right)^{1+\alpha_j} \geq 0 \tag{30}$$

is necessary and sufficient for this outcome. Noting that $\hat{\Upsilon}_{j,2}^{c/n} = 1$ if $\alpha_j = 1$, while $\lim_{\alpha_j \to \infty} \hat{\Upsilon}_{j,2}^{c/n} = e^{8/3}/9 > 1$, we can conclude that inequality (30) is fulfilled for any $\alpha_j > 0$ if $\hat{\Upsilon}_{j,2}^{c/n}$ is monotonic in α_j. To show monotonicity, we differentiate $\hat{\Upsilon}_{j,2}^{c/n}$ with respect to α_j. This gives[20]

$$\frac{\hat{\Upsilon}_{j,2}^{c/n}}{d\alpha_j} = \Upsilon_{j,2}^{c/n} \left[\ln(9) + \ln \left(\frac{3+\alpha_j}{3+9\alpha_j} \right) - \frac{8(1+\alpha_j)}{(3+\alpha_j)(1+3\alpha_j)} \right] > 0. \tag{31}$$

This proves that condition (30) holds with strict inequality for any $\alpha_j > 1$. Putting together the findings from above, we can thus safely conclude that $\Upsilon_j^{c/n} = 1$ requires either $\alpha_k = \alpha_j$ or $\alpha_k \geq 9\alpha_j$. This completes the formal characterization of the two $\Upsilon_j^{c/n} = 1$-loci in Figure 2.

A.5 Characterization of indifference locus $\Upsilon_j^{t/c} = 1$

Using Eqs. (12) and (14), we get

$$\Upsilon_j^{t/c} \equiv \frac{U_j^t}{U_j^c} = 2 \left(\frac{\alpha_j}{\beta} \right)^{\alpha_j} \left(\frac{(3+\beta)(\alpha_k - 1)}{\alpha_j \alpha_k + 3(\alpha_j + \alpha_k) - 7} \right)^{1+\alpha_j}. \tag{32}$$

If $\beta = \alpha_j$, then $U_j^n = U_j^c$ and thus $\Upsilon_j^{t/c} = \Upsilon_j^{t/n}$. Since the properties of $\Upsilon_j^{t/n}$ have been extensively discussed above, we do not need to repeat this discussion here, but instead

[19] The positive sign of $\nu(\alpha_j)$ can be stablished, when noting that $\nu'(\alpha_j) < 0$ and $\lim_{\alpha_j \to \infty} \nu(\alpha_j) = 0$.

[20] The positive sign of the derivative can be established, when noting that the bracket term on the right-hand side of Eq. (31) is decreasing in α_j and approaches zero if α_j goes to infinity.

can focus on $\beta = \alpha_k$ in the subsequent analysis. To avoid clutter, we use the following notation: $\hat{\Upsilon}_j^{t/c} \equiv \Upsilon_j^{t/c}\Big|_{\beta=\alpha_k}$ and first show existence of a unique $\hat{\Upsilon}_j^{t/c} = 1$-locus.

Partially differentiating $\hat{\Upsilon}_j^{t/c}$ with respect to α_j gives

$$\frac{\partial \hat{\Upsilon}_j^{t/c}}{\partial \alpha_j} = \hat{\Upsilon}_j^{t/c} \left[\ln\left(\frac{\alpha_j(\alpha_k - 1)(3 + \alpha_k)}{\alpha_k \left[\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7\right]} \right) + \frac{2(\alpha_k - 5)}{\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7} \right].$$

Applying the Mercator series for expressing the natural logarithm, we obtain

$$\frac{\partial \hat{\Upsilon}_j^{t/c}}{\partial \alpha_j} = \hat{\Upsilon}_j^{t/c} \left[\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \left(-\frac{\alpha_j\alpha_k + 3\alpha_j + 3\alpha_k^2 - 7\alpha_k}{\alpha_k \left[\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7\right]} \right)^n + \frac{2(\alpha_k - 5)}{\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7} \right]$$

or, equivalently,

$$\frac{\partial \hat{\Upsilon}_j^{t/c}}{\partial \alpha_j} = \hat{\Upsilon}_j^{t/c} \left[\sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{n} \left(-\frac{\alpha_j\alpha_k + 3\alpha_j + 3\alpha_k^2 - 7\alpha_k}{\alpha_k \left[\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7\right]} \right)^n - \frac{\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) + \alpha_k^2}{\alpha_k \left[\alpha_j\alpha_k + 3(\alpha_j + \alpha_k) - 7\right]} \right],$$

which is unambiguously negative. Noting further that

$$\hat{\Upsilon}_j^{t/c}\Big|_{\alpha_j=1} = \frac{(\alpha_k + 3)^2}{8\alpha_k} > 1, \qquad \hat{\Upsilon}_j^{t/c}\Big|_{\alpha_j=\alpha_k} = 2\left(\frac{3 + \alpha_j}{7 + \alpha_j}\right)^{1+\alpha_j} < 1 \tag{33}$$

according to (24) and (32), we can safely conclude that, for any $\alpha_k > 1$, there exists a unique $\alpha_j \in (1, \alpha_k)$, such that $\hat{\Upsilon}_j^{t/c} = 1$.

With this insight at hand, we now determine the location of indifference locus $\hat{\Upsilon}_j^{t/c} = 1$ relative to the other indifference loci in Figure 2. For this purpose, we can first note that the parameter domain below the $\Upsilon_{j,1}^{c/n} = 1$ locus implies $\alpha_k > \alpha_j$ and thus $\hat{\Upsilon}_j^{t/c} < 1$. Furthermore, we can recollect from above that an outcome on $\Upsilon_j^{t/n} = 1$ requires $\alpha_k < 9\alpha_j$, while an outcome on $\Upsilon_{j,2}^{c/n} = 1$ requires $\alpha_k \geq 9\alpha_j$. Since, $\Upsilon_j^{t/c} \times \Upsilon_j^{c/n} = \Upsilon_j^{t/n}$ holds by construction, we can therefore conclude that any parameter pair (α_j, α_k) above the $\Upsilon_{j,2}^{c/n} = 1$-locus in Figure 2 implies $\Upsilon_j^{c/n} < 1$ and $\Upsilon_j^{t/n} > 1$ and would thus be inconsistent with $\Upsilon_j^{t/c} = 1$. Similarly, we can conclude that any parameter pair (α_j, α_k) in the cone spanned by $\Upsilon_j^{t/n} = 1$ and $\Upsilon_{j,1}^{c/n} = 1$ in Figure 2 implies $\Upsilon_j^{t/n} < 1$ and $\Upsilon_j^{c/n} > 1$ and would thus be inconsistent with $\Upsilon_j^{t/c} = 1$. Putting together, we can therefore safely conclude that $\hat{\Upsilon}_j^{t/c} = 1$ must lie within the cone spanned by the two indifference loci $\Upsilon_j^{t/n} = 1$ and $\Upsilon_{j,2}^{c/n} = 1$ in Figure 2. This completes the formal characterization of the $\Upsilon_j^{t/c} = 1$-loci in Figures 1 and 2.[21]

[21] In a previous version of this manuscript, we have also shown that locus $\Upsilon_j^{t/c} = 1$ must be positively sloped in the (α_j, α_k)-space. However, since this proof turns out to be tedious without providing additional insights for establishing the results in the main text, we decided against presenting these calculations here.

A.6 Proof of Proposition 5

Setting U_k^t from (12) equal to $U_k^r \equiv (\beta/(3+\beta))^{\alpha_k}(1-\bar{w})^{\alpha_k} l_k^r$ – with r denoting post-relocation variables – and solving for l_k^r gives the minimum possible employment in country k, which is consistent with $U_k^t \geq U_k^r$:

$$l_k^r = \left(\frac{\alpha_k(\alpha_j-1)(3+\beta)}{\beta\left(\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7\right)}\right)^{\alpha_k} \frac{4(1-\bar{w})(\alpha_j-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}. \tag{34}$$

Hence, cooperation plus job relocation is beneficial for the union in country j if $U_j^r \geq U_j^t$, where

$$U_j^r \equiv \left(\frac{\beta}{3+\beta}\right)^{\alpha_j}(1-\bar{w})^{\alpha_j}\left[\frac{4(1-\bar{w})}{3+\beta} - l_k^r\right], \tag{35}$$

according to Eqs. (13) and (14). Combining (12), (34), and (35), it is immediate that $U_j^r \geq U_j^t$ is equivalent to

$$\begin{aligned} Q \equiv \frac{(3+\beta)^{1+\alpha_j}}{\beta^{\alpha_j}}\left(\frac{\alpha_j(\alpha_k-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{\alpha_j}\frac{\alpha_k-1}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7} \\ + \frac{(3+\beta)^{1+\alpha_k}}{\beta^{\alpha_k}}\left(\frac{\alpha_k(\alpha_j-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{\alpha_k}\frac{\alpha_j-1}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7} - 1 \leq 0. \end{aligned} \tag{36}$$

Due to symmetry, the ranking of α_j and α_k is irrelevant for our results and, hence, we can set $\alpha_k \geq \alpha_j$ without loss of generality. We can then distinguish two cases regarding the size of β: $\beta = \alpha_j$ and $\beta = \alpha_k$. Let us first consider $\beta = \alpha_j$. In this case, we have $Q = Q_j$, with

$$Q_j \equiv \left(\frac{(3+\alpha_j)(\alpha_k-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_j} + \left(\frac{\alpha_k}{\alpha_j}\right)^{\alpha_k}\left(\frac{(3+\alpha_j)(\alpha_j-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_k} - 1. \tag{37}$$

Accounting for $\alpha_k \geq \alpha_j$ and substituting (22), we obtain

$$\left(\frac{(3+\alpha_j)(\alpha_k-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_j} = \frac{\Upsilon_j^{t/n}}{2} \geq \left(\frac{(3+\alpha_j)(\alpha_k-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_k}, \tag{38}$$

so that

$$\Psi(\alpha_j,\alpha_k) \equiv \frac{\Upsilon_j^{t/n}}{2}\Big[1+\left(\frac{\alpha_k}{\alpha_j}\right)^{\alpha_k}\left(\frac{\alpha_j-1}{\alpha_k-1}\right)^{1+\alpha_k}\Big] < 1, \tag{39}$$

is sufficient for $Q_j < 0$. Noting that $\left[\alpha_k(\alpha_j-1)/\big(\alpha_j(\alpha_k-1)\big)\right]^{\alpha_k}$ is smaller than one for any $\alpha_k > \alpha_j$ and equal to one if $\alpha_k = \alpha_j$, we can also be sure that

$$\Psi(\alpha_j,\alpha_k) \leq \tilde{\Psi}(\alpha_j,\alpha_k) \equiv \frac{\Upsilon_j^{t/n}}{2}\Big[1+\frac{\alpha_j-1}{\alpha_k-1}\Big]. \tag{40}$$

Partially differentiating $\tilde{\Psi}(\cdot)$ with respect to α_k and accounting for (23), we can calculate

$$\frac{\partial\tilde{\Psi}(\alpha_j,\alpha_k)}{\alpha_k} \equiv \frac{\Upsilon_j^{t/n}}{2}\frac{\alpha_j-1}{(\alpha_k-1)^2}\left[\left(1+\frac{3(\alpha_k-1)(\alpha_j-1)+4(\alpha_k-\alpha_j)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)\left(1+\frac{\alpha_j-1}{\alpha_k-1}\right)-1\right],$$

which is unambiguously positive. In view of $\lim_{\alpha_k\to\infty}\tilde{\Psi}(\alpha_j,\alpha_k)=1$, we can therefore conclude that $\tilde{\Psi}(\cdot)<1$ and thus $\Psi(\cdot)<1$ must hold for any $\alpha_k\geq\alpha_j$. This proves that $Q_j<0$.

Let us now consider the second case: $\beta=\alpha_k$. In this case, we have $Q=Q_k$, with

$$Q_k \equiv \left(\frac{\alpha_j}{\alpha_k}\right)^{\alpha_j}\left(\frac{(3+\alpha_k)(\alpha_k-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_j}+\left(\frac{(3+\alpha_k)(\alpha_j-1)}{\alpha_j\alpha_k+3(\alpha_j+\alpha_k)-7}\right)^{1+\alpha_k}-1. \quad (41)$$

Noting that

$$\lim_{\alpha_k\to\alpha_j} Q_k = 2\left(\frac{3+\alpha_j}{7+\alpha_j}\right)^{1+\alpha_j}-1<0, \qquad \lim_{\alpha_k\to\infty} Q_k=\infty,$$

we can safely conclude that $Q_k>0$ if α_k sufficiently high (relative to α_j). This completes the proof. *QED*

A simple micro-foundation of union objectives

Union objective in this paper can be interpreted as a transformed Stone-Geary objective function: $U_j=V_j^{1/(1-\theta_j)}$, with $V_j=(w_j-\bar{w})^{\theta_j}l_j^{1-\theta_j}$, $\theta_j\in(0,1)$, and $\alpha_j=\theta_j/(1-\theta_j)$. The Stone-Geary objective function has a nice interpretation. To put it in the words of Jackman (1985, pp. 361-362): "The union first calculates the wage cost of providing its minimum acceptable level of wages [$\bar{w}$] and minimum acceptable level of employment [0]. If the total income available to it exceeds this amount, the implication of the Stone-Geary form is that it allocates the "discretionary" or "supernumerary" income such that each one percent of the excess is used to raise real wages by θ percent and employment by $(1-\theta)$ percent." Jackman continues his description of the Stone-Geary objective function by noting that if the union experiences income fluctuations, "θ can be interpreted as measuring the union's preferences for wage stability as against employment stability" (p. 362). Pencavel and Holmlund (1988) and Pehkonen (1990) follow this line of reasoning by interpreting θ as a measure of "the union's relative risk aversion to variations in employment" (Pehkonen, 1990, p. 576).[22]

[22]Higher levels of θ imply a lower variation in employment if the union faces a given income change (see Jackman, 1985).

Relying on these insights, we can assume that the union has an exogenous mass of members, n_j, who differ in their evaluation of wage and employment fluctuations, i.e. in their θ_j-levels. Each worker faces the same probability $l_j/n_j < 1$ of being employed by the firm, but workers evaluate the risk of not getting a job differently. In our model, this heterogeneity can be captured by assuming that each worker i is represented by a specific $\alpha(i)$-level, with $\alpha(i)$-levels being uniformly distributed on interval $[0, \hat{\alpha}_j]$ in country j. Of course, with workers differing in their risk attitudes, we need to impose an assumption regarding the mechanism which transfers individual preferences into a common objective. The simplest way to formalize such a mechanism is to assume a median voter model, in which a union's representative is elected whose preferences are decisive for the union objective. Hence, the α-level used in the bargaining process by the union representative is given by $\alpha_A = \hat{\alpha}_A/2$ and $\alpha_B = \hat{\alpha}_B/2$. Assuming that $\hat{\alpha}_B > \hat{\alpha}_A > 2$ furthermore implies $\alpha_B > \alpha_A > 1$ as in the main text. In this case, the union in country B puts a larger value on supernumerary wages because its members have on average a stronger aversion against employment fluctuations.

For the case of international cooperation, we assume for simplicity that the populations of workers are of equal size in the two countries. Then, the probability density function of $\alpha(i)$ in the total population is $(\hat{\alpha}_A + \hat{\alpha}_B) / (2\hat{\alpha}_A\hat{\alpha}_B)$ for $\alpha(i) \in [0, \hat{\alpha}_A]$ and $1/(2\hat{\alpha}_B)$ for $\alpha(i) \in (\hat{\alpha}_A, \hat{\alpha}_B]$. The β for the international union is also determined by the median of the total population: $\beta = \hat{\alpha}_A\hat{\alpha}_B/(\hat{\alpha}_A + \hat{\alpha}_B)$. Two characteristics of β should be noted. First, $\beta \in (0, \hat{\alpha}_A)$. Hence, there is support in both countries for the bargaining strategy of the international union. Second, $\beta \in (\alpha_A, \alpha_B)$. The median agent of the total population of union members has a relative risk attitude in between the median members in the two countries. In fact, β is a weighed average of the two medians $\alpha_A = \hat{\alpha}_A/2$ and $\alpha_B = \hat{\alpha}_B/2$:

$$\beta = \frac{\hat{\alpha}_B}{(\hat{\alpha}_A + \hat{\alpha}_B)}\frac{\hat{\alpha}_A}{2} + \frac{\hat{\alpha}_A}{(\hat{\alpha}_A + \hat{\alpha}_B)}\frac{\hat{\alpha}_B}{2}. \tag{42}$$

The analysis above relies on two simplifying assumptions: (i) a uniform distribution of workers' relative risk aversion and (ii) an equal mass of union members (not employed production workers) in the two countries. Relaxing these two assumptions would change the respective weights and the value of median preferences in (42). However, even in a more general case, β would still lie in the interval spanned by the median preferences in the two countries and this is a good reason for looking at the two bounds of the interval in the main text.

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