Extra appendix

Not intended for publication, but to be made available upon request

1 Architecture I

Architecture I in which the two domestic lobby groups lobby their own government and the two governments do not cooperative represents a common agency as in Grossman and Helpman [1995]. Political competition in each country takes place in two stages. First, the two lobby groups simultaneously offer contribution schedules to their government. Second, the government selects a labour standard $s_i \in [0,1]$ taken as given the contribution schedules as well as the labor standard of the other country. An equilibrium is then a situation in which neither of the two lobby groups wants to offer a different contribution schedule given the labor standard implemented by the government in their own country and the labour standard implemented in the other country, and the two governments do not want to select a different labour standard given contributions offered by the two lobby groups in their country and the labour standard selected by the other government. We focus on equilibria with an interior labour standard, i.e., $s_i \in (0,1)$ $i = 1,2$ and where contribution schedules are differentiable.

We begin by defining an equilibrium response of country i to an equilibrium policy implementation of the other country as follows.

Lemma 1 (*adopted from Grossman and Helpman [1995]*) *Let s_j be an arbitrary level of the labour standard set by country j. Then a set of feasible non-negative contribution function $\{\widehat{c}_i^m\}$ and a labour standard $\widehat{s}_i^I \in S_i$ are an equilibrium response to s_j if (a) where $W_i(s_i, s_j)$ is given in (11) of the paper. (b) for every interest group in country i, there cannot be a feasible contribution function $c_i^m(s_i; s_j)$ and a labour standard s_i^m such that (i)*

$$s_i^m = \arg\max_{s_i} c_i^m(s_i; s_j) + \widehat{c}_i^{-m}(s_i; s_j) + \delta W_i(s_i, s_j)$$

and (ii)

$$v_i^m(s_i^m, s_j) - c_i^m(s_i^m; s_j) > v_i^m\left(\widehat{s}_i^I, s_j\right) - \widehat{c}_i^m\left(\widehat{s}_i^I; s_j\right)$$

where if $m = u\,(or\ \pi)$, then $-m = \pi\ (or\ u)$.

The lemma says that the equilibrium contribution functions and the policy choice of each government should satisfy the following conditions. Condition

(a) says that the policy maker chooses the labour standard that maximizes the weighted sum of social welfare and the aggregate campaign contributions collected from the interest groups, given the labour standard of the other country. Condition (b) prescribes that, given the contribution function of the other interest group $(\widehat{c_i}^{-m})$, no individual group can benefit by offering a contribution function c_i^m which induces the policy maker to choose a different labour standard s_i^m.

Taken the labour standard of country j as given, we can use the equilibrium characterization provided by Grossman and Helpman [1995] to derive the equilibrium labor standard of country i. The standard must satisfy two intuitive conditions. First, it must maximize the welfare of government i:

$$\widehat{s}_i^I = \arg\max_{s_i} \textstyle\sum_{m_i} \widehat{c}_i^m (s_i) + \delta W_i (s_i, s_j) \tag{1}$$

Second, it must maximize the joint welfare of each of the two lobby groups in that country and the government:

$$\begin{aligned} \widehat{s}_i^I = \quad \arg\max_{s_i} \quad & v_i^m (s_i, s_j) - \widehat{c}_i^m (s_i; s_j) + \\ & \widehat{c}_i^m (s_i; s_j) + \widehat{c_i}^{-m} (s_i; s_j) + \delta W_i (s_i, s_j) \end{aligned} \tag{2}$$

for every m and $-m$. By assuming that the contribution functions are differentiable around the equilibrium, the first order conditions of (1) and (2) generate the so-called "local truthfulness" condition, i.e.,

$$\frac{\partial v_i^m (\widehat{s}_i, s_j)}{\partial s_i} = \frac{\partial \widehat{c}_i^m (\widehat{s}_i; s_j)}{\partial s_i} \quad \text{for each } m. \tag{3}$$

By summing the conditions of local truthfulness up and substituting the result into the first order condition of equation (1), the equilibrium labor standards in the two countries are characterized by the solutions to the two equations as shown in (12) of the paper.

2 Architecture II

To characterize the equilibrium policy, we adopt the following definition from Grossman and Helpman [1995].

Lemma 2 (*adopted from Grossman and Helpman [1995]*) *An international labour standard agreement consists of sets of political contribution functions* $\{\widehat{c}_1^m\}_{m\in\{u,\pi\}}$ *and* $\{\widehat{c}_2^m\}_{m\in\{u,\pi\}}$ *and a pair of labour standards* $\widehat{s}_1^{II}$ *and* $\widehat{s}_2^{II}$ *and is an equilibrium if*

(a)
$$\left\{\widehat{s}_1^{II}, \widehat{s}_2^{II}\right\} = \arg\max_{s_1,s_2} \begin{array}{l} \sum_m \widehat{c}_i^m (s_i, s_j) + \sum_m \widehat{c}_j^m (s_j, s_i) + \\ \delta \left[W_i (s_i, s_j) + W_j (s_j, s_i)\right] \end{array} \tag{4}$$

where $i, j = 1, 2$ *and* $i \neq j$.

(b) $\forall$ *lobby group* m_1 *in country 1*, $\nexists$ *a feasible contribution function* $c_1^{m_1}(s_1, s_2)$ *and a pair of policy vectors* $(s_1^{m_1}, s_2^{m_1})$ *such that* (i)

$$\left\{s_1^{m_1}, s_2^{m_1}\right\} = \arg\max_{s_1,s_2} \begin{array}{l} \left[c_1^{m_1}(s_1, s_2) + \widehat{c}_1^{-m_1}(s_1, s_2)\right] + \sum_{m_2} \widehat{c}_2^{m_2}(s_2, s_1) + \\ \delta \left[W_1 (s_1, s_2) + W_2 (s_2, s_1)\right] \end{array}$$

where $m_1 = u_1$ *(or* π_1*) and* $-m_1 = \pi_1$ *(or* u_1*) and* (ii) $v_1^{m_1}(s_1^{m_1}, s_2^{m_1}) - c_1^{m_1}(s_1^{m_1}, s_2^{m_1}) > v_1^{m_1}\left(\widehat{s}_1^{II}, \widehat{s}_2^{II}\right) - \widehat{c}_1^{m_1}\left(\widehat{s}_1^{II}, \widehat{s}_2^{II}\right)$, *and*

(c) $\forall$ *lobby group* m_2 *in country 2*, $\nexists$ *a feasible contribution function* $c_2^{m_2}(s_2, s_1)$ *and a pair of policy vectors* $\left(s_1^{m_2}, s_2^{m2}\right)$ *such that* (i)

$$\left\{s_1^{m_2}, s_2^{m_2}\right\} = \arg\max_{s_1,s_2} \begin{array}{l} \sum_{m_1} \widehat{c}_1^{m_1}(s_1, s_2) + \left[c_2^{m_2}(s_2, s_1) + \widehat{c}_2^{-m_2}(s_2, s_1)\right] + \\ \delta \left[W_1 (s_1, s_2) + W_2 (s_2, s_1)\right] \end{array}$$

where $m_2 = u_2$ *(or* π_2*) and* $-m_2 = \pi_2$ *(or* u_2*) and* (ii) $v_2^{m_2}(s_2^{m_2}, s_1^{m_2}) - c_2^{m_2}(s_2^{m_2}, s_1^{m_2}) > v_2^{m_2}\left(\widehat{s}_2^{II}, \widehat{s}_1^{II}\right) - \widehat{c}_2^{m_2}\left(\widehat{s}_2^{II}, \widehat{s}_1^{II}\right)$.

Condition (a) indicates that the equilibrium labour standard should maximize the joint payoff of the two governments. Condition (b) rules out the case in which a lobby (m_1) in country 1 can benefit by reformulating its contribution schedule, and inducing a change in the agreement between the governments (from $(\widehat{s}_1^{II}, \widehat{s}_2^{II})$ to $(s_1^{m_1}, s_2^{m_2})$). So, the condition ensures that there is no incentive for any interest group in country 1 to deviate from the equilibrium contribution schedule. The interpretation of condition (c) is similar.[1]

3 Architecture IV

Consider the case of asymmetric lobbying as represented by architecture IV: the trade unions of countries 1 and 2 agree to form an international lobby, while each firm acts as a domestic interest group. A pure strategy equilibrium of the asymmetric lobbying game can be characterized as follows.

[1] Technically speaking, the game between the lobby groups and the government represents a common agency, as in regime I.

Lemma 3 (*adopted from Bernheim and Winston [1986], Grossman and Helpman [1995] and Prat and Rustichini [1999], [2003]*) *A set of feasible contribution functions* $\left\{\widehat{c}_i^{\widetilde{u}}, \widehat{c}_i^{\pi}\right\}_{i=1,2}$ *and a labour standard policy* $\widehat{s}_i^{IV}$ *is an equilibrium response to the policy* s_j *taken by the other government* j *if the following conditions are satisfied:* (a) $\forall i \in I$ *and* $s_i \in S_i$,

$$\widehat{c}_i^{\pi}\left(\widehat{s}_i\right) + \widehat{c}_i^{\widetilde{u}}\left(\widehat{s}_i\right) + \delta W_i\left(\widehat{s}\right) \geqslant \widehat{c}_i^{\pi}\left(s_i\right) + \widehat{c}_i^{\widetilde{u}}\left(s_i\right) + \delta W_i\left(s_i\right). \tag{5}$$

(b) *for every interest group in country* i*, there cannot be a feasible function* $c_i^{\pi}\left(s_i; s_j\right)$ *and* $c_i^{\widetilde{u}}\left(s_i; s_j\right)$ *and labour standards* $\left(s_i^{\pi}, s_i^{\widetilde{u}}\right)$ *such that* $[i]$ $\forall s \in S$ *and for the international trade union lobby,*

$$\begin{gathered} s_i^{\widetilde{u}} = \arg\max_{s_i} \widehat{c}_i^{\pi}\left(s_i; s_j\right) + c_i^{\widetilde{u}}\left(s_i; s_j\right) + \delta W_i\left(s\right) \text{ and} \\ v^{\widetilde{u}}\left(s_i^{u}, s_j\right) - \textstyle\sum_i c_i^{\widetilde{u}}\left(s_i^{u}; s_j\right) > v^{\widetilde{u}}\left(\widehat{s}_i^{IV}, s_j\right) - \textstyle\sum_i \widehat{c}_i^{\widetilde{u}}\left(\widehat{s}_i^{IV}; s_j\right). \end{gathered} \tag{6}$$

$[ii]$ $\forall s \in S$ *and for the domestic firm lobby of country* i,

$$\begin{gathered} s_i^{\pi} = \arg\max_{s_i} c_i^{\pi}\left(s_i; s_j\right) + \widehat{c}_i^{\widetilde{u}}\left(s_i; s_j\right) + \delta W_i\left(s\right) \text{ and} \\ v_i^{\pi}\left(s_i^{\pi_i}, s_j\right) - c_i^{\pi}\left(s_i^{\pi}; s_j\right) > v_i^{\pi}\left(\widehat{s}_i^{IV}, s_j\right) - \widehat{c}_i^{\pi}\left(\widehat{s}_i^{IV}; s_j\right). \end{gathered} \tag{7}$$

(c) *international trade union lobby group* u *should offer the cost-minimising contribution to each government* i *such that*

$$\textstyle\sum_{\widetilde{u}} \widehat{c}_i^{\widetilde{u}}\left(\widehat{s}_i\right) + \delta W_i\left(\widehat{s}\right) = \max_{s_i \in S_i}\left(\widehat{c_i^{-}}^{\widetilde{u}}\left(s_i\right) + \delta W_i\left(s\right)\right). \tag{8}$$

Condition (a) is the agent maximization condition; each policy maker decides on a level of the labour standard that maximizes his payoff, given the contributions of the interest groups. Condition (b) $[i]$ states that, given the contribution by the domestic firm, the international trade union lobby cannot improve its payoff by offering a contribution schedule $c_i^{\widetilde{u}}\left(s_i; s_j\right)$ which is different from $\widehat{c}_i^{\widetilde{u}}\left(s_i; s_j\right)$. In the same token, condition (b) $[ii]$ also states that, given the contribution by the international trade union lobby, each from lobby cannot improve its payoff by offering a contribution schedule $c_i^{\pi}\left(s_i; s_j\right)$, which is different from $\widehat{c}_i^{\pi}\left(s_i; s_j\right)$.

Theorem 1 in Prat and Rustichini [2003] indicates that the equilibrium labour standard policy in country i must maximize the joint welfare of the international trade union lobby and the two governments such that

$$\begin{aligned} \widehat{s}_i^{IV} = \quad \arg\max_{s_i} \quad & v^{\widetilde{u}}\left(s_i, s_j\right) - \widehat{c}_i^{\widetilde{u}}\left(s_i; s_j\right) - \widehat{c}_j^{\widetilde{u}}\left(s_j; s_i\right) + \\ & \widehat{c}_i^{\widetilde{u}}\left(s_i; s_j\right) + \widehat{c}_i^{\pi}\left(s_i; s_j\right) + \delta W_i\left(s_i, s_j\right) + \\ & \widehat{c}_j^{\widetilde{u}}\left(s_j; s_i\right) + \widehat{c}_j^{\pi}\left(s_j; s_i\right) + \delta W_j\left(s_j, s_i\right). \end{aligned} \tag{9}$$

The similar problem for the firm and the government of country i is

$$\widehat{s}_i^{IV} = \arg\max_{s_i} \quad v_i^{\pi}(s_i, s_j) - \widehat{c}_i^{\pi}(s_i; s_j) + \widehat{c}_i^{\widetilde{u}}(s_i; s_j) + \widehat{c}_i^{\pi}(s_i; s_j) + \delta W_i(s_i, s_j). \tag{10}$$

The first order conditions associated with eq. (5), (9), and (10) generate the following two conditions, i.e.,

$$\begin{aligned} \frac{\partial v^{\widetilde{u}}}{\partial s_i} - \frac{\partial \widehat{c}_i^{\widetilde{u}}}{\partial s_i} + \frac{\partial \widehat{c}_j^{\pi}}{\partial s_i} + \delta \frac{\partial W_j}{\partial s_i} &= 0, \text{ for } u \\ \frac{\partial v_i^{\pi}}{\partial s_i} - \frac{\partial \widehat{c}_i^{\pi}}{\partial s_i} &= 0, \text{ for } \pi_i. \end{aligned}$$

Using that $\partial \widehat{c}_j^{\pi}(s_j; s_i)/\partial s_i = 0$ and adding up these conditions yields

$$\frac{\partial v^{\widetilde{u}}}{\partial s_i} - \frac{\partial \widehat{c}_i^{\widetilde{u}}}{\partial s_i} + \frac{\partial v_i^{\pi}}{\partial s_i} - \frac{\partial \widehat{c}_i^{\pi}}{\partial s_i} + \delta \frac{\partial W_j}{\partial s_i} = 0. \tag{11}$$

Condition (c) states that the international trade union lobby's contribution functions must be cost minimizing:

$$\widehat{c}_i^{\widetilde{u}}\left(\widehat{s}_i^{IV}; s_j\right) = \max\nolimits_{a \in S_i} \widehat{T}_i^{\widetilde{u}}(a) - \widehat{T}_i^{\widetilde{u}}\left(\widehat{s}^{IV}\right). \tag{12}$$

The marginal contribution of the international trade union lobby with regard to s_i is

$$\frac{\partial \widehat{c}_i^{\widetilde{u}}}{\partial s_i} = -\frac{\partial \widehat{c}_i^{\pi}}{\partial s_i} - \delta \frac{\partial W_i}{\partial s_i}. \tag{13}$$

By inserting condition (13) into (11), we get:

$$\frac{\partial v^{\widetilde{u}}}{\partial s_i} + \delta \frac{\partial W_i}{\partial s_i} + \frac{\partial v_i^{\pi}}{\partial s_i} + \delta \frac{\partial W_j}{\partial s_i} = 0,$$

which can be written as

$$\phi_i^{IV}(\widehat{s}) = \delta \frac{\partial cs(\widehat{s})}{\partial s_i} + \delta \frac{\partial v_j^{\pi}(\widehat{s})}{\partial s_i} + (1+\delta) \left\{ \frac{\partial v_i^{\pi}(\widehat{s})}{\partial s_i} + \frac{\partial v^{\widetilde{u}}(\widehat{s})}{\partial s_i} \right\} = 0.$$

Then, the equilibrium labour standards under architecture IV $\left(\widehat{s}^{IV}\right)$ are determined by these implicit functions $\phi_i^{IV}(s)$. The functions $\phi_i^{IV}(s)$ gives a lower weight to firm j than to the other players. Thus, this suggests that the equilibrium labour standards under architecture IV is also different from the globally efficient level.

$\overline{w}$	I	II,III	IV	γ	I	II,III	IV	δ	I	II,III	IV
0	0.016	0.771	0.536	**1.22**	0.020	0.724	0.439	**0.5**	0.162	0.874	0.593
0.75	0.078	0.752	0.500	**1.35**	0.311	0.905	0.754	**1.2**	0.091	0.742	0.521
1.5	0.045	0.731	0.458	**1.43**	0.421	0.996	0.878	**2**	0.051	0.659	0.485

Table 1: The equilibrium labour standard in each lobbying regime for different parameter values

Simulation results A representative subset of our simulation results are shown in Table 1. We focus on symmetric equilibria in which the labour standard implemented in each country is the same. Thus, the entries of the Table corresponds to the (common) labour standard adopted in the two countries under each architecture as the three parameters of the model are varied one at the time around the benchmark $a = 10$, $b = 1$, $\gamma = 1.25$, $\delta = 1$, and $\overline{w} = 0$. The range over which each parameter is varied is chosen to insure that interior solutions exist in each regime and that these correspond to global maxima (all second order conditions are satisfied locally and interior equilibrium yields higher utility than either corner solution).