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Foreign Direct Investment, Labour Market Regulation and Self-Interested Governments

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ABSTRACT

Foreign Direct Investment, Labour Market Regulation and Self-Interested Governments

This document examines foreign direct investment (FDI) when multinationals and labour unions bargain over labour contracts and lobby the self-interested government for taxation and labour market regulation. We demonstrate that right-to-manage bargaining predicts higher returns for FDI than does non-unionization or efficient bargaining. This advantage is further magnified in the presence of credible wage contracts. When the labour market is non-unionized, or there is a bargain over employment, the ruling elite reaps the surplus of FDI through taxation or regulation. In the absence of credible contracts, unions have incentives to claim a bigger share of the revenue of FDI.

JEL Classification: F21, F23, J51, D78

Keywords: foreign direct investment, labour market regulation, lobbying

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1 Introduction

This paper considers the profitability of foreign direct investment (FDI), when there exist labour unions and self-interested local elites. Because FDI involves sunk costs, the investment risk of a multinational company (MNC) is comprised of changes in wages, taxes, regulations and market conditions that implicitly expropriate the MNC's rents after FDI has taken place. To explain the strategic dependence between unions, authorities and prospective investors, we use a common agency model,[1] and establish a political equilibrium in which the government determines taxes and regulates the labour market. In this environment, lobbies representing unions and MNCs make offers that relate prospective contributions to government policy.

Brander and Spencer (1987) present unemployment as the main reason why an economy promotes job-creating FDI, but they do not construct any real theory of unemployment. In this paper, we explain unemployment through the political equilibrium that involves labour market regulation and wage bargaining.

In the studies that examine the strategic interaction between MNCs and local governments, no foreign investment typically occurs unless taxation is restricted so that MNCs can end up with a positive profit. Bond and Samuelson (1989) assume that an MNC has certain bargaining power which it can use against the government. In Doyle and Van Wijnbergen (1984), and Bond and Samuelson (1986), the government can commit itself to tax holidays in the initial periods, so that foreign investors have an opportunity to recoup their sunk costs before the government imposes new taxes. In Choi and Esfahani (1998), the government's ability to tax FDI is limited by an MNCs ability to withhold an important production asset, which causes the specific capital of the host economy to become idle. Our study differs from

[1]See e.g. Bernheim and Whinston (1986), Grossman and Helpman (1994), and Dixit, Grossman and Helpman (1997).

these papers in the following respects:

- In the papers referred to above, the government is entirely benevolent (i.e., it has no interests of its own), but we assume that the ruling elite is self-interested, and receives contributions from interest groups (e.g., MNCs and labour unions) in return for modifications in public policy.

- We demonstrate that the political process prevents the expropriation of profits, even without institutional restrictions on taxation.

The following papers examine the relationship between labour unions and MNCs with inward FDI. Naylor and Santoni (1999) suggest that because high wages reduce potential rents associated with investment, a decrease in relative union bargaining power in a potential host economy subsequently increases the likelihood of FDI within that economy. Zhao (1998) shows that because FDI increases MNCs' mobility between economies, it improves MNC's position in collective bargaining and depresses union wages in every economy. These results are, however, based on the assumption that MNCs make their investment decisions (strategically) *before* wages are determined through bargaining. In other words, they assume *non-credible* contracts under which the employers know wages can be changed after investment has taken place. In this document, we examine how the credibility of contracts affects the competitiveness of an economy as regards attracting FDI.

Ellingsen and Wärneryd (1999) examine a case where FDI results from the protection of domestic output, and the benevolent government represents the interests of the home industry alone. They show that with perfect information the foreign investor is kept out by protection, but with incomplete information FDI can arise. Leahy and Montagna (2000) show that an MNC may prefer industry-wide over firm-specific wage bargaining. With firm-specific bargaining, there is no link between the MNC and home firms. With industry-wide bargaining, the wage setting process in fact represents such a link, and wage increases induced by FDI also hurt the MNC's competitors. For this reason, the MNC is better off with industry-wide bargaining than with firm-specific bargaining. We focus on the role of a self-interested government and, to avoid excessive complications, we ignore product market competition between domestic firms and the MNC.

Zhao (1998), Naylor and Santoni (1999) and Leahy and Montagna (2000) also assume that relative union bargaining power is exogenously given, and that there is bargaining over wages only. We assume that relative union bargaining power is determined by labour market regulation, and is therefore endogenous in the political equilibrium. Following Manning (1987), we also assume a MNC and a labour union can bargain over both wages and employment. This creates a richer framework for the study.

Haaparanta (1996) examines inward FDI in a common agency framework. Because he focuses on a case in which a number of benevolent governments try to attract an MNC to make FDI, he assumes the governments to be principals, and the MNC he designates as the agent. In this paper, we consider the case where an MNC's willingness to invest in a country depends on both labour market institutions and the response of a self-interested government. Hence, we assume that the MNC and the union representing its workers are principals, while the government is the agent.

This paper is organized as follows. Section 2 presents the basic structure of the model as an extensive game. Section 3 defines technology and income distribution in the economy. Sections 4 and 5 examine collective bargaining with non-credible and credible contracts. These two regimes are compared in section 6. The government's behaviour is endogenized in section 7. The political equilibrium is constructed in sections 8 and 9. Finally, section 10 considers the attractiveness of an economy as the host of FDI.

2 Institutions as an extensive game

Palokangas (2003) examines the political economy of collective bargaining through the use of the following framework. The economy is closed and output is produced from labour only. First, there is a bargain over wages, then a bargain over employment between the producer and the labour union. Depending on government regulations, union power may be different within these two bargains. Workers and producers lobby the government. In this document, we modify and extend Palokangas' (2003) model as follows.

The economy is open. An MNC produces its output from labour, capital and some indivisible resource, and accumulates capital through FDI. After FDI has occurred, capital goods cannot be sold.[2] Hence, capital cost is sunk for the MNC. The MNC and the labour union bargain first over wages and then over employment. The contracts on wages and employment are *credible*, if made (strategically) *before*, but *non-credible*, if made *after* the MNC's investment. In the former case the union can renege on its promises after FDI has occurred, but in the latter case it cannot do so. We characterize labour market institutions by three probabilities: in probability $p_w \in (0, 1)$ there is a bargain over wages; in probability $p_e \in (0, 1)$ a bargain over employment; and in probability $p_c \in (0, 1)$ the union can commit itself to credible contracts. The MNC perceives these probabilities by earlier experience or by observing other MNCs in the economy, for example.

The government sets taxes, provides public services to households and regulates the labour market. Any public policy measures that strengthen (weaken) the position of unions in collective bargaining are called labour market *regulation (deregulation)*. Unions and MNCs lobby the government, and offer contributions that are conditional on prospective public policy.

[2]Grout (1984) and Palokangas (2000), Chapter 5, assume that capital can be sold abroad as old investment goods after machines have been installed. Because this extension would excessively complicate the model, we prefer to assume that capital is wholly country-specific.

The economy is so small that it takes the relative prices as given from the rest of the world. Hence, we can consider all values in terms of a composite traded good. The share of each MNC's product out of domestic expenditure is so small that it can be effectively ignored. In the economy, there exists a competitive sector which produces b units of traded goods from one labour unit. Because workers are free to move to that sector, their opportunity wage is equal to b. Given these assumptions, we can focus on an economy in which there is only one MNC and one worker. These two agents bargain over labour conditions and lobby the government. The government is free to set any income tax rate $t \in (-\infty, 1)$ for the worker, and is free to place any *ad valorem* tax rate $\tau \in (-\infty, 1)$ on the MNC's investment. Because the MNC can use transfer pricing to avoid profit taxes, we assume, for simplicity, that there is no direct tax on the MNC's profit.[3]

We present the institutional characteristics of the economy as an extended game with the following sequence of events:

1. The worker and the MNC lobby the government (or the political elite) by announcing contributions.

2. The government sets taxes, regulates relative union power in the bargains over the wage and employment, and collects the contributions.

3. In probability $1 - p_c$ the MNC decides on its investment.

4. In probability p_w the worker and the MNC bargain over the wage, and in probability $1 - p_w$ the MNC alone determines the wage.

5. In probability p_e the worker and the MNC bargain over employment, and in probability $1 - p_e$ the MNC alone chooses employment.

[3] It would be only a minor modification of the model to extend it, in line with Palokangas (2003), to the case where the MNC pays profit taxes but conceals its profits from the government at some cost. The profit tax would then be set according to the Ramsey rule (see proposition 4). Otherwise, the results would be the same as in this paper.

6. The MNC determines its output, and in probability p_c it also decides on its investment.

This extensive game is now solved through backward induction.

3 Production and income

We assume that the MNC produces its output y from capital k, labour l and some indivisible resource a through CES technology:

$$y(l,k) = \left[\gamma l^{1-1/\sigma} + \delta k^{1-1/\sigma} + (1-\gamma-\delta)a^{1-1/\sigma}\right]^{\sigma/(\sigma-1)}, \quad \gamma+\delta<1,$$

where $\gamma \in (0,1)$ and $\delta \in (0,1)$ are constants and $\sigma \in (0,1)$ is the constant elasticity of substitution. Denoting $y_l \doteq \partial y/\partial l,\ y_k \doteq \partial y/\partial k,\ y_{ll} \doteq \partial^2 y/\partial l^2$, $y_{lk} \doteq \partial^2 y/(\partial l \partial k)$ and $y_{kk} \doteq \partial^2 y/\partial k^2$, we obtain properties:

$$y_l = \gamma(y/l)^{1/\sigma},\ y_k = \delta(y/k)^{1/\sigma},\ y = \gamma^{-\sigma} y_l^{\sigma} l,\ y_{lk} > 0,\ y_{kk} < 0,\ y_{ll}y_{kk} > y_{lk}^2,$$
$$\frac{k}{l} = \left(\frac{\delta y_l}{\gamma y_k}\right)^{\sigma}, \quad y_{ll} = \frac{1}{\sigma l}(\gamma^{\sigma} y_l^{2-\sigma} - y_l) < 0, \quad l\frac{y_{lk}^2}{y_{kk}} = \frac{\gamma^{\delta}\delta^{\sigma} y_l^{2-\sigma}}{\delta^{\sigma} - y_k^{\sigma-1}}, \tag{1}$$

The MNC's unit capital cost c is given from abroad. In the case of production, the MNC's profit Π is equal to revenue y minus wages wl and capital cost $(1+\tau)ck$, where τ is the investment tax. If there is no production, the MNC suffers a loss which is equal to capital cost $(1+\tau)ck$. Hence, the MNC's total profit is given by

$$\pi \doteq \begin{cases} \Pi \doteq y(l,k) - wl - (1+\tau)ck, & \text{with production,} \\ \underline{\Pi} \doteq -(1+\tau)ck & \text{without production.} \end{cases} \tag{2}$$

The worker's income in the MNC's service, V, is given by

$$V \doteq (1-t)wl - bl = [(1-t)w - b]l, \tag{3}$$

where wl is total wages, t the labour tax and b the competitive wage.

4 Non-credible contracts

In this section, we assume that the worker and the MNC can change their wage and employment policy after the MNC has made its investment k. Since the worker (or union) can prevent production from taking place, then, noting (2), the MNC's status quo income is given by $\underline{\Pi}$. Since without production the worker earns nothing, his/her status quo income is zero.

The MNC chooses first its investment k, before the bargains take place over the wage w and employment l. The worker attempts to maximize his/her income V, while the MNC attempts to maximize its profit Π minus its status quo income $\underline{\Pi}$. There is asymmetric Nash bargaining over the wage w and employment l. First, the product $V^{\alpha}(\Pi - \underline{\Pi})^{1-\alpha}$ is maximized by the wage w, where parameter $\alpha \in [0, 1]$ is the measure of union relative bargaining power. Finally, the product $V^{\beta}(\Pi - \underline{\Pi})^{1-\beta}$ is maximized by employment l, where parameter $\beta \in [0, 1]$ is the measure of union relative bargaining power.

The sequential subgame is solved backwards as follows. At the final stage, given (2) and (3), employment l is determined by

$$\begin{aligned}\max_{l} V^{\beta}(\Pi - \underline{\Pi})^{1-\beta} &= \max_{l}\big[\beta \log V + (1-\beta)\log(\Pi - \underline{\Pi})\big] \\ &= \max_{l}\big\{\beta \log l + (1-\beta)\log[y(k,l) - wl]\big\}.\end{aligned}$$

Given this, the wage w is equal to the weighted sum of the average product y/l and the marginal product y_l of labour, where the weights are the worker's and the employer's relative bargaining power:

$$w = \beta y(l,k)/l + (1-\beta)y_l(l,k). \tag{4}$$

At the second stage of bargaining, the wage w is chosen to maximize the Nash product $V^{\alpha}(\Pi - \underline{\Pi})^{1-\alpha}$ by l, given the response at the second stage (4). Because there exists a one-to-one correspondence from w to l through (4), then, given (1), (2) and (3), one can equivalently maximize the logarithm

$$\Lambda^{nc}(l,k,\alpha,\beta,t) \doteq \log\big[V^{\alpha}(\Pi-\underline{\Pi})^{1-\alpha}\big] = \alpha\log V + (1-\alpha)\log(\Pi-\underline{\Pi})$$
$$= \alpha\log[(1-t)wl - bl] + (1-\alpha)\log[y-wl]$$
$$= \alpha\log\big\{\beta y(l,k) + (1-\beta)ly_l(l,k) - bl/(1-t)\big\} + \alpha\log(1-t)$$
$$+ (1-\alpha)\log[y(l,k) - ly_l(l,k)] + (1-\alpha)\log(1-\beta)$$

by employment l. This yields the equilibrium condition of the labour market:

$$\frac{\partial\Lambda^{nc}}{\partial l} = \frac{\alpha}{v}\frac{dV}{dl} + \frac{1-\alpha}{\Pi-\underline{\Pi}}\frac{d\Pi}{dl} = \alpha\frac{y_l + (1-\beta)ly_{ll} - b/(1-t)}{\beta y + (1-\beta)ly_l - bl/(1-t)} - \frac{(1-\alpha)ly_{ll}}{y - ly_l}$$
$$= \left\{\alpha\frac{y_l + (1-\beta)(\gamma^{\sigma}y_l^{2-\sigma} - y_l)/\sigma - b/(1-t)}{\beta\gamma^{-\sigma}y_l^{\sigma} + (1-\beta)y_l - b/(1-t)} - \frac{1-\alpha}{\sigma}\frac{\gamma^{\sigma}y_l^{2-\sigma} - y_l}{\gamma^{-\sigma}y_l^{\sigma} - y_l}\right\}\frac{1}{l}$$
$$= 0. \tag{5}$$

Equation (5) defines the marginal product of labour, y_l, as a function of the government's policy instruments t, α and β:

$$y_l(l,k) = W^{nc}(t,\alpha,\beta). \tag{6}$$

At the first stage of bargaining, the MNC maximizes its profit with production, Π, by investment k, given the equilibrium conditions (4) and (6). Inserting (4) and (6) into (2) yields profit

$$\Pi = y - wl - (1+\tau)ck = (1-\beta)[y(l,k) - W^{nc}l] - (1+\tau)ck, \tag{7}$$

where W^{nc} is constant by (6). Profit maximization by investment k yields $\partial\Pi/\partial k = (1-\beta)y_k - (1+\tau)c = 0$, which defines the marginal product of capital, y_k, as a function of the government's policy instruments τ and β:

$$y_k(l,k) = r^{nc}(\tau,\beta) \doteq (1+\tau)c/(1-\beta). \tag{8}$$

Inserting (8) into (7) and (4) into (3), and noting the production function (1), we obtain that with non-credible contracts, the MNC's profit Π^{nc} and the worker's income V^{nc} are determined by

$$\Pi^{nc}(\tau,t,\alpha,\beta) \doteq (1-\beta)\max_{l,k}\big[y(l,k) - W^{nc}(t,\alpha,\beta)l - r^{nc}(\tau,\beta)k\big],$$
$$V^{nc}(\tau,t,\alpha,\beta) \doteq (1-t)\big[\beta y(l^{nc},k^{nc}) + (1-\beta)W^{nc}(t,\alpha,\beta)l^{nc}\big] - bl^{nc}, \text{ where}$$
$$(l^{nc},k^{nc}) \doteq \arg\max_{l,k}\big[y(l,k) - W^{nc}(t,\alpha,\beta)l - r^{nc}(\tau,\beta)k\big]. \tag{9}$$

5 Credible contracts

In this section, we assume that the worker and the MNC cannot change their wage and employment policy after the MNC's investment. This means that the MNC maximizes profit Π by investment k, given employment l and the wage w. Given (1) and (2), this maximization yields the first-order condition $\partial\Pi/\partial k = y_k(l,k) - (1+\tau)c = 0$, which defines the marginal product of capital, y_k, as a function of the investment tax τ:

$$y_k(l,k) = r^c(\tau) \doteq (1+\tau)c. \tag{10}$$

The comparison of this with (8) yields that credibility of contracts may decrease the marginal product of capital, $r^{nc} = (1+\tau)c \geq (1+\tau)c/(1-\beta) = r^c$. Given properties (1), constraint (10) defines the following reaction function:

$$k = K(l,\tau), \quad K_l \doteq \partial K/\partial l = -y_{lk}/y_{kk} > 0,$$
$$\epsilon(y_l,\tau) \doteq l y_{lk} K_l = -l\frac{y_{lk}^2}{y_{kk}} = \frac{\gamma^\delta\delta^\sigma y_l^{2-\sigma}}{y_k^{\sigma-1} - \delta^\sigma} = \frac{\gamma^\sigma\delta^\sigma y_l^{2-\sigma}}{(1+\tau)^{\sigma-1}c^{\sigma-1} - \delta^\sigma} > 0,$$
$$y_{ll} + y_{lk}K_l = (y_{ll}y_{kk} - y_{lk}^2)/y_{kk} < 0, \quad K_\tau \doteq \partial K/\partial\tau = c/y_{kk} < 0. \tag{11}$$

With credible contracts, the status quo income is zero for both the worker and the MNC. The worker attempts to maximize his/her income V, while the MNC attempts to maximize its profit Π. The contracts are credible only if the worker has an incentive to keep his/her promises. Otherwise, they will be non-credible and the equilibrium will be the same as in the preceding section. Consequently, in the presence of credible contracts, the worker's utility must not be lower than in the presence of non-credible contracts:

$$V \geq V^{nc}(\tau, t, \alpha, \beta). \tag{12}$$

There is asymmetric Nash bargaining over the wage w and employment l in two stages. First, the outcome of bargaining is obtained through maximizing the product $V^\alpha \Pi^{1-\alpha}$ by the wage w, where constant $\alpha \in [0,1]$ is the worker's relative bargaining power. Second, the outcome of bargaining is obtained through maximizing the product $V^\beta \Pi^{1-\beta}$ by employment l, where constant $\beta \in [0,1]$ is the worker's relative bargaining power. At both stages, the parties take the participation constraint (12) into account.

Given (2) and (3), the sequential game is solved backwards as follows. Assume for a moment that $V > V^{nc}$ and $\Pi(w,l) > \Pi^{nc}$. At the second stage of bargaining, employment l is determined by

$$\begin{aligned}\max_l V^\beta \Pi^{1-\beta} &= \max_l \big\{\beta \log V + (1-\beta)\log[y(l,k) - (1+\tau)ck - wl]\big\} \\ &= \max_l \big\{\beta \log l + (1-\beta)\log[y(l,k^*) - (1+\tau)ck^* - wl]\big\},\end{aligned}$$

where, given (10) and duality, we can take k^* fixed. Given this, the wage w is equal to the weighted sum of the average product $[y(l,k^*) - (1+\tau)ck^*]/l$ and the marginal product y_l of labour, where the weights are respectively the worker's and the employer's relative bargaining power:

$$w = \beta[y(l,k^*) - (1+\tau)ck^*]/l + (1-\beta)y_l(l,k). \tag{13}$$

At the first stage of bargaining, the wage w is chosen to maximize the Nash product $V^\alpha \Pi^{1-\alpha}$ by l subject to (13) and (12). Since there exists a one-to-one correspondence from w to l through (13), then, given (2), (3), (10) and (11), one can equivalently maximize

$$\begin{aligned}&\Lambda^c(l,\alpha,\beta,\tau,t) \doteq \log\big[V^\alpha \Pi^{1-\alpha}\big] = \alpha \log V + (1-\alpha)\log \Pi \\ &= \alpha \log[(1-t)wl - bl] + (1-\alpha)\log[y(l,k^*) - wl - (1+\tau)ck^*]\end{aligned}$$

$$
\begin{aligned}
&= \alpha \log\bigl\{\beta[y(l,k^*) - (1+\tau)ck^*] + (1-\beta)ly_l(l,K(l,\tau)) - bl/(1-t)\bigr\} \\
&\quad + (1-\alpha)\log[y(l,k^*) - (1+\tau)ck^* - ly_l(l,K(l,\tau))] \\
&\quad + (1-\alpha)\log(1-\beta) + \alpha\log(1-t) \qquad (14)
\end{aligned}
$$

where k^* can be taken as fixed, by employment l, subject to (12). Given (11), the equilibrium condition of the labour market takes the form

$$
\partial\Lambda^c/\partial l = 0 \text{ for } V > V^{nc}, \tag{15}
$$

where

$$
\begin{aligned}
\frac{\partial\Lambda^c}{\partial l} &= \frac{\alpha}{V}\frac{dV}{dl} + \frac{1-\alpha}{\Pi}\frac{d\Pi}{dl} \\
&= \alpha\frac{y_l + (1-\beta)l(y_{ll} + y_{lk}K_l) - b/(1-t)}{\beta[y - (1+\tau)ck] + (1-\beta)ly_l - bl/(1-t)} - \frac{(1-\alpha)l(y_{ll} + y_{lk}K_l)}{y - (1+\tau)ck - ly_l} \\
&= \left\{\alpha\frac{y_l + (1-\beta)[(\gamma^\sigma y_l^{2-\sigma} - y_l)/\sigma + \epsilon(y_l,\tau)] - b/(1-t)}{\beta\gamma^{-\sigma}y_l^\sigma - \beta[(1+\tau)c]^{1-\sigma}y_l^\sigma + (1-\beta)y_l - b/(1-t)}\right. \\
&\qquad \left. -(1-\alpha)\frac{(\gamma^\sigma y_l^{2-\sigma} - y_l)/\sigma + \epsilon(y_l,\tau)}{\gamma^{-\sigma}y_l^\sigma - [(1+\tau)c]^{1-\sigma}y_l^\sigma - y_l}\right\}\frac{1}{l}. \qquad (16)
\end{aligned}
$$

6 The comparison of the regimes

Now, we can compare the cases of non-credible and credible contracts. Given (8) and (10), the marginal product of capital is determined by

$$
y_k(l,k) = r(\tau,\beta,\eta) \doteq (1-\eta)r^{nc} + \eta r^c = \Bigl(\frac{1-\eta}{1-\beta} + \eta\Bigr)(1+\tau)c, \tag{17}
$$

where $\eta = 0$ with non-credible contracts and $\eta = 1$ with credible ones.

We now define the marginal product of labour, $W = y_l$, as a new variable. Noting (5), (16) and the definition of η, we can then construct the function

$$
\begin{aligned}
\Upsilon(W,\tau,t,\alpha,\beta,\eta) &\doteq l\Bigl[\frac{\alpha}{V}\frac{dV}{dl} + \frac{1-\alpha}{\Pi - (1-\eta)\underline{\Pi}}\frac{d\Pi}{dl}\Bigr] \\
&= \alpha\frac{y_l + (1-\beta)l(y_{ll} + y_{lk}K_l\eta) - b/(1-t)}{\beta[y - (1+\tau)ck\eta] + (1-\beta)ly_l - bl/(1-t)} - \frac{(1-\alpha)l(y_{ll} + y_{lk}K_l\eta)}{y - (1+\tau)ck\eta - ly_l}
\end{aligned}
$$

$$= \alpha \frac{W + (1-\beta)[(\gamma^\sigma W^{2-\sigma} - W)/\sigma + \epsilon(W,\tau)\eta] - b/(1-t)}{\beta\gamma^{-\sigma}W^\sigma - \beta[(1+\tau)c]^{1-\sigma}W^\sigma\eta + (1-\beta)W - b/(1-t)} - \frac{(1-\alpha)(\gamma^\sigma W^{2-\sigma} - W)/\sigma + \epsilon(W,\tau)\eta}{\gamma^{-\sigma}W^\sigma - [(1+\tau)c]^{1-\sigma}W^\sigma\eta - W}, \tag{18}$$

where $\Upsilon = l[\partial\Lambda^{nc}/\partial l]$ for $\eta = 0$ and $\Upsilon = l[\partial\Lambda^c/\partial l]$ for $\eta = 1$. The equilibrium conditions of the labour market, (5) and (15), can now be unified as:

$$\Upsilon(W,\tau,t,\alpha,\beta,\eta) = 0 \text{ for } V > V^{nc}. \tag{19}$$

This and (18) imply

$$\frac{d\Pi}{dl} > 0, \quad \frac{dV}{dl} = \Big(1 - \frac{1}{\alpha}\Big)\frac{V}{\Pi - (1-\eta)\underline{\Pi}}\frac{d\Pi}{dl} < 0 \text{ for } V > V^{nc}.$$

Since $dW/dl = y_{ll} + y_{lk}K_l < 0$ by (11), there must be

$$\frac{d\Pi}{dW} = \frac{d\Pi}{dl}\Big/\frac{dW}{dl} < 0 \text{ and } \frac{dV}{dW} = \frac{dV}{dl}\Big/\frac{dW}{dl} > 0 \text{ for } V > V^{nc}.$$

Given this result, constraint (12) takes the form

$$W \geq \underline{W}(\tau,t,\alpha,\beta), \text{ where } \underline{W}(\tau,t,\alpha,\beta) \doteq \min\{W | V \geq V^{nc}\}, \tag{20}$$

and the equilibrium condition of the labour market, (19), the form

$$\Upsilon(W,\tau,t,\alpha,\beta,\eta) = 0 \text{ for } W > \underline{W}(\tau,t,\alpha,\beta). \tag{21}$$

We can use parameter η as the measure of credibility. The second-order conditions of the cases of non-credible and credible contracts yield

$$\frac{\partial\Upsilon}{\partial W}y_{ll} = \begin{cases} \frac{\partial^2\Lambda^{nc}}{\partial l^2} < 0 & \text{for } \eta = 0, \\ \frac{\partial^2\Lambda^c}{\partial l^2} < 0 & \text{for } \eta = 1. \end{cases}$$

This and (1) imply $\partial\Upsilon/\partial W > 0$. Solving for the marginal product of labour, W, from the equilibrium condition (21) then yields (see the Appendix)

$$y_l(l,k) = W(\tau,t,\alpha,\beta,\eta), \quad \frac{\partial W}{\partial\alpha}\Big|_{\beta=0} > 0, \quad \frac{\partial W}{\partial t}\Big|_{\beta=0} > 0, \quad \frac{\partial W}{\partial\eta}\Big|_{\beta=0} < 0,$$
$$W\Big|_{\beta=0} = w\Big|_{\beta=0}, \quad W(\tau,t,\alpha,0,1) < W(\tau,t,\alpha,0,0). \tag{22}$$

Finally, from (1), (17) and (22) it follows that employment l, investment k, profit π and the worker's income v are determined by

$$
\begin{aligned}
&k(W,r), \quad \partial k/\partial W < 0, \quad \partial k/\partial r < 0,\\
&l(\tau,t,\alpha,\beta,\eta) = \ell(W,r), \quad \partial \ell/\partial W < 0, \quad \partial \ell/\partial r < 0,\\
&\pi(\tau,t,\alpha,\beta,\eta) \doteq (1-\beta)\max_{l,k}\big[y(l,k) - Wl - rk\big],\\
&\Pi^{nc}\big|_{\beta=0} = \Pi\big|_{\beta=0,\,\eta=0} = \pi(\tau,t,\alpha,0,0) = \max_{l,k}[y(l,k) - W(\tau,t,\alpha,0,0)l - rk]\\
&< \max_{l,k}[y(l,k) - W(\tau,t,\alpha,0,1)l - rk] = \pi(\tau,t,\alpha,0,1) = \Pi\big|_{\beta=0,\,\eta=1} = \Pi^{c}\big|_{\beta=0},\\
&v(\tau,t,\alpha,\beta,\eta) \doteq \beta y(l^*,k^*) + \big[(1-\beta)W - b/(1-t)\big]l^*, \text{ where}\\
&(l^*,k^*) \doteq \arg\max_{l,k}\big[y(l,k) - W^*l - r^*k\big]. \qquad (23)
\end{aligned}
$$

Because a change from non-credible to credible contracts (i.e., the increase of η from 0 to 1) reduces the investor's uncertainty, then with right-to-manage bargaining $\beta = 0$ it also increases the MNCs profit, $\Pi^{nc}\big|_{\beta=0} < \Pi^{c}\big|_{\beta=0}$.

7 Public policy

The government produces a quantity g of public services from traded goods, and finances this by tax revenue $twl + \tau ck$, where t is the tax on wage income wl and τ is the tax on investment expenditure ck. Given this, (22) and (23), we obtain the tax revenue function

$$g(\tau,t,\alpha,\beta,\eta) \doteq twl + \tau ck. \qquad (24)$$

We denote the worker's and the MNC's contributions by R^w and R^f respectively. Subtracting R^f from the MNC's profit π yields the MNC's consumption C^f. Subtracting R^w from the worker's total income v yields the worker's consumption C^w. Given (23), we specify differentiable functions

$$
\begin{aligned}
&C^w(\tau,t,\alpha,\beta,\eta,R^w) \doteq v(\tau,t,\alpha,\beta,\eta) - R^w, \quad \partial C^w/\partial R^w = -1,\\
&C^f(\tau,t,\alpha,\beta,\eta,R^f) \doteq \pi(\tau,t,\alpha,\beta,\eta) - R^f, \quad \partial C^f/\partial R^f = -1. \qquad (25)
\end{aligned}
$$

Government services benefit domestic workers. The utility functions of the worker and the MNC are then given by[4]

$$
\begin{aligned}
&U^w(C^w) + U^g(g), \quad (U^w)' > 0, \quad (U^w)'' < 0, \quad (U^g)' > 0, \quad (U^g)'' < 0, \\
&U^f(C^f), \quad (U^f)' > 0, \quad (U^f)'' < 0. \qquad (26)
\end{aligned}
$$

Following Grossman and Helpman (1994), and noting (24)-(26), we obtain the government's objective function as:

$$
G(\tau, t, \alpha, \beta, \eta, R^w, R^f) = R^w + R^f + \eta U^f(C^f) + \zeta[U^w(C^w) + U^g(g)], \quad (27)
$$

where parameters $\eta \geq 0$ and $\zeta > 0$ are the weights given to the welfare of the MNC and the worker. The government receives contributions from the worker and the MNC only if the MNC's and the worker's consumption, C^f and C^w, are non-negative. Otherwise, the MNC does not invest $k = y = 0$ or the worker refuses to work for the MNC, $l = y = 0$. Given this and (23), the government chooses its policy parameters from the set

$$
\begin{aligned}
\Gamma \doteq \big\{(\tau, t, \alpha, \beta)\big| \; & C^f\big(\tau, t, \alpha, \beta, \eta, R^c(\tau, t, \alpha, \beta, \eta)\big) \geq 0, \\
& C^w\big(\tau, t, \alpha, \beta, \eta, R^w(\tau, t, \alpha, \beta, \eta)\big) \geq 0\big\}. \qquad (28)
\end{aligned}
$$

Now, we will explore the effects of lobbying by the MNC and the worker on taxation and labour market regulation (i.e., on variables τ, t, α and β). The contribution schedule of the worker is given by $R^w(\tau, t, \alpha, \beta, \eta)$, and that of the MNC by $R^f(\tau, t, \alpha, \beta, \eta)$. The government maximizes its welfare (27) by choosing $(\tau, t, \alpha, \beta) \in \Gamma$. Following proposition 1 of Dixit, Grossman and Helpman (1997), a subgame perfect Nash equilibrium for this game is a set of contribution schedules $R^{w*}(\tau, t, \alpha, \beta, \eta)$ and $R^{c*}(\tau, t, \alpha, \beta, \eta)$ and public policy $(\tau^*, t^*, \alpha^*, \beta^*)$ such that the following conditions are satisfied:

(i) Contributions are non-negative but less than the contributor's income.

[4]We assume, for simplicity, that only the worker benefits from public services g. The result would not change if the owner of the MNC benefited from g as well.

(ii) The policy $(\tau^*, t^*, \alpha^*, \beta^*)$ maximizes the government's welfare (27) taking the contribution schedules as given,

$$(\tau^*, t^*, \alpha^*, \beta^*) \in \operatorname*{argmax}_{(\tau,t,\alpha,\beta)\in\Gamma} \left\{ G\big(\tau, t, \alpha, \beta, \eta, R^w(\tau, t, \alpha, \beta, \eta), R^f(\tau, t, \alpha, \beta, \eta)\big) \right\}; \tag{29}$$

(iii) The worker (MNC) cannot have a feasible strategy $R^w(\tau, t, \alpha, \beta, \eta)$ $\big(R^f(\tau, t, \alpha, \beta, \eta)\big)$ that yields him a higher level of utility than in equilibrium, given the government's anticipated decision rule,[5]

$$\big(\tau^*, t^*, \alpha^*, \beta^*, R^i(\tau^*, t^*, \alpha^*, \beta^*, \eta)\big) \in \operatorname*{argmax}_{(\tau,t,\alpha,\beta)\in\Gamma} U^i(C^i) \text{ for } i = w, f. \tag{30}$$

(iv) The worker (MNC) provides the government at least with the level of utility that it could get when the worker (MNC) offers nothing $R^w = 0$ $(R^f = 0)$, and the government responds optimally given the MNC's (worker's) contribution function,

$$\begin{aligned}
&G(\tau, t, \alpha, \beta, \eta, R^w(\tau, t, \alpha, \beta, \eta), R^f(\tau, t, \alpha, \beta, \eta)) \\
&\qquad \geq \sup_{(\tilde{\tau},\tilde{t},\tilde{\alpha},\tilde{\beta})\in\Gamma} G(\tilde{\tau}, \tilde{t}, \tilde{\alpha}, \tilde{\beta}, \eta, R^w(\tilde{\tau}, \tilde{t}, \tilde{\alpha}, \tilde{\beta}, \eta), 0)), \\
&G(\tau, t, \alpha, \beta, \eta, R^w(\tau, t, \alpha, \beta, \eta), R^f(\tau, t, \alpha, \beta, \eta)) \\
&\qquad \geq \sup_{(\tilde{\tau},\tilde{t},\tilde{\alpha},\tilde{\beta})\in\Gamma} G(\tilde{\tau}, \tilde{t}, \tilde{\alpha}, \tilde{\beta}, \eta, 0, R^f(\tilde{\tau}, \tilde{t}, \tilde{\alpha}, \tilde{\beta}, \eta)).
\end{aligned} \tag{31}$$

8 The political equilibrium

Given differentiable functions (25) and (26), conditions (30) take the form

$$\begin{aligned}
&\big(\tau^*, t^*, \alpha^*, \beta^*, R^i(\tau^*, t^*, \alpha^*, \beta^*, \eta)\big) \\
&\qquad \in \operatorname*{argmax}_{(\tau,t,\alpha,\beta)\in\Gamma} U^\jmath\big(C^\jmath(\tau, t, \alpha, \beta, \eta, R^\jmath(\tau, t, \alpha, \beta, \eta))\big) \text{ for } \jmath = w, f
\end{aligned} \tag{32}$$

and

$$\frac{\partial C^w}{\partial i} = \frac{\partial R^w}{\partial i} \text{ and } \frac{\partial C^f}{\partial i} = \frac{\partial R^f}{\partial i} \text{ for } i = \tau, t, \alpha, \beta, \tag{33}$$

[5]Here, the utility of the worker (MNC) is independent of his/her contribution schedule.

which suggests that in equilibrium the change in the worker's (MNC's) contribution due to a change in the instrument is equal to the change in the worker's (MNC's) consumption due to this same fact. Thus, the contribution schedules are locally truthful. As in Bernheim and Whinston (1986), or in Grossman and Helpman (1994), this concept can be extended to a globally truthful contribution schedule. This type of schedule represents the preferences of the worker (capitalist) at all policy points. From (25), (31) and (33) it follows that the truthful contribution functions take the form

$$R^w = \max[0, v - v_0], \quad R^f = \max[0, \pi - \pi_0], \tag{34}$$

where v_0 (π_0) is the worker's (MNC's) income when he does not pay contributions but the government chooses its best response given the MNC's (worker's) contribution schedule.

When there are no bargains over labour conditions (i.e., $\alpha = \beta = 0$), the wage and the marginal product of labour are exogenously given from the competitive sector of the economy, $W\big|_{\alpha=\beta=0} = w\big|_{\alpha=\beta=0} = b/(1-t)$. Now, by choosing $\tau = 1/(1-t) - 1 = t(1-t)$ and noting (23), the MNC's profit takes the form

$$\pi = \max_{k,l}[y(l,k) - (1+\tau)(bl + ck)].$$

By increasing τ (and accordingly t) the government can press profit π down to zero. Hence, if the MNC does not pay contributions, $R^f = 0$, the government has an instrument to set $\pi = \pi_0 = 0$. This implies $R^f = \max[0, \pi - \pi_0] = \max[0, \pi] = \pi$ and $C^f = \pi - R^f = 0$. We summarize:

Proposition 1 *If there are no bargains over labour conditions, then the labour and investment taxes* (t, τ) *together comprise a non-distorting instrument by which the government takes all surplus of* FDI*,* $C^f = 0$.

This result is in distinct contrast with the conventional wisdom that MNCs should prefer a fully deregulated (or non-unionized) labour market.

Now, assume that the government can freely choose relative union power in the bargain over employment, $\beta \in [0,1]$. If the MNC does not pay contributions, $R^f = 0$, then, given (3), (4), (11) and (13), the government sets $\beta = 1$ to bring the profit down to zero, $\pi_0 = \pi|_{\beta=1} = 0$. We summarize:

Proposition 2 *If there is a bargain over employment, then the government can use labour market regulation (i.e., β) as a non-distorting income transfer by which it takes all surplus of FDI, $C^f = 0$.*

Propositions 1 and 2 yield the following corollary:

Proposition 3 *Only with right-to-manage bargaining (i.e., with no bargain over employment, $\beta = 0$) can the MNC benefit from FDI, $C^f > 0$.*

9 Policy rules

Assume that relative union power in the bargain over employment, β, is kept constant. Conditions (29) then take the form that the government's objective function (27) must be maximized by τ, t and α subject to set (28). Given (26) and (32), this is equivalent to maximizing the function

$$\begin{aligned}\mathcal{L} =& R^w(\tau,t,\alpha,\beta,\eta) + R^f(\tau,t,\alpha,\beta,\eta) + \eta U^f(C^f_*) + \zeta U^w(C^w_*)\\ &+ \zeta U^g\big(g(\tau,t,\alpha,\beta,\eta)\big) + \mu C^w\big(\tau,t,\alpha,\beta,\eta,R^c(\tau,t,\alpha,\beta,\eta)\big)\\ &+ \vartheta C^f\big(\tau,t,\alpha,\beta,\eta,R^c(\tau,t,\alpha,\beta,\eta)\big),\end{aligned} \tag{35}$$

by τ, t and α, where, by the envelope theorem, C^w_* and C^f_* can be taken to be independent of τ, t and α, and the multipliers μ and ϑ satisfy conditions

$$\begin{aligned}&\mu C^w\big(\tau,t,\alpha,\beta,\eta,R^c(\tau,t,\alpha,\beta,\eta)\big) = 0, \quad \mu \geq 0,\\ &\vartheta C^f\big(\tau,t,\alpha,\beta,\eta,R^c(\tau,t,\alpha,\beta,\eta)\big) = 0, \quad \vartheta \geq 0.\end{aligned} \tag{36}$$

The worker's and MNC's total revenue $C \doteq C^w + C^f$ is equal to output y minus capital cost ck minus the worker's opportunity wages bl. Given (17), (22) and (23), we then obtain

$$\begin{aligned} &C(\tau,t,\alpha,\beta) \doteq C^w + C^f = y(l,k) - bl - (1+\tau)ck, \\ &\frac{\partial C}{\partial i}\bigg|_{\beta=0} (w-b)\frac{\partial l}{\partial i} \text{ for } i=\tau,t, \quad \frac{\partial C}{\partial \alpha}\bigg|_{\beta=0} = (w-b)\frac{\partial \ell}{\partial W}\frac{\partial W}{\partial \alpha} < 0. \end{aligned} \tag{37}$$

If $C^w > 0$ and $C^f > 0$, then $\beta = 0$ holds by proposition 3 and noting (33), (35), (36) and (37), we obtain the first-order conditions for the τ and t:

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial i} &= \frac{\partial R^w}{\partial i} + \frac{\partial R^f}{\partial i} + \zeta(U^g)'\frac{\partial g}{\partial i} = \frac{\partial C^w}{\partial i} + \frac{\partial C^f}{\partial i} + \zeta(U^g)'\frac{\partial g}{\partial i} \\ &= \frac{\partial C}{\partial i} + \zeta(U^g)'\frac{\partial g}{\partial i} = (w-b)\frac{\partial l}{\partial i} + \zeta(U^g)'\frac{\partial g}{\partial i} = 0 \text{ for } i=\tau,t. \end{aligned} \tag{38}$$

These conditions yield the following rule:

Proposition 4 *A rational government sets taxes to minimize the deadweight loss of public finance. If both the MNC and the worker benefit from FDI, $C^f > 0$ and $C^w > 0$, then the government sets taxes so that the decrease in employment due to a marginal increase in each tax is in the same proportion to the increase in tax revenue g due to it, $\frac{\partial l}{\partial \tau}\Big/\frac{\partial g}{\partial \tau} = \frac{\partial l}{\partial t}\Big/\frac{\partial g}{\partial t}$.*

There are two sources of the deadweight loss of public finance: a lower profit leads to lower investment and there is an opportunity wage b. These sources make the tax revenue elastic with respect to the labour and investment taxes.

Given (35) and (37), we obtain the first-order condition for α:

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial \alpha} &= \frac{\partial R^w}{\partial \alpha} + \frac{\partial R^f}{\partial \alpha} + \zeta(U^g)'\frac{\partial g}{\partial \alpha} + \mu\frac{\partial C^w}{\partial \alpha} + \vartheta\frac{\partial C^f}{\partial \alpha} \\ &= \frac{\partial C}{\partial \alpha} + \zeta(U^g)'\frac{\partial g}{\partial \alpha} + \mu\frac{\partial C^w}{\partial \alpha} + \vartheta\frac{\partial C^f}{\partial \alpha} = 0, \end{aligned} \tag{39}$$

where $\partial C^w/\partial\alpha > 0$, $\partial C^f/\partial\alpha < 0$ and $\partial C/\partial\alpha < 0$. Assume first $\partial g/\partial\alpha \leq 0$. Given (36) and (39), the worker will not then benefit from FDI:

$$\mu = -\Big[\frac{\partial C}{\partial \alpha} + \zeta(U^g)'\frac{\partial g}{\partial \alpha} + \vartheta\frac{\partial C^f}{\partial \alpha}\Big]\Big/\frac{\partial C^w}{\partial \alpha} > 0, \quad C^w = 0.$$

In the remaining case $\partial g/\partial\alpha > 0$, either $\partial C/\partial\alpha + \zeta(U^g)'\partial g/\partial\alpha = 0$ or $C^f = 0$ holds. We summarize these results as:

Proposition 5 *If deregulation (i.e., a decrease in α) does not reduce tax revenue g, $\partial g/\partial\alpha \leq 0$, the government eliminates through it the worker's benefit from FDI, $C^w = 0$. Only if tax revenue is an increasing function of union power, $\partial g/\partial\alpha > 0$, does there exist a political equilibrium in which the government maintains union power by regulation to minimize the deadweight loss of public finance. When both the MNC and the worker benefit from FDI, $C^f > 0$ and $C^w > 0$, the government increases union power α through regulation until the decrease in employment due to it is in proportion $\frac{\partial l}{\partial t}\Big/\frac{\partial l}{\partial t}$ to the increase in tax revenue g due to it, $\frac{\partial l}{\partial\alpha}\Big/\frac{\partial g}{\partial\alpha} = \frac{\partial l}{\partial t}\Big/\frac{\partial g}{\partial t}$.*

This proposition can be explained as follows. Because labour market deregulation (the decrease in α) decreases union power and wages but increases the MNE's and worker's total revenue C, it is in the government's best interest to implement deregulation as long as this does not decrease tax revenue, $\partial g/\partial\alpha \leq 0$. If regulation (i.e., the increase in α) increases tax revenue g, then the government uses regulation in combination with taxes t and τ as a means of evening out the deadweight loss of public finance. Then, in equilibrium, the decrease in total revenue C must be in the same proportion to the decrease in tax revenue g for a marginal increase of any of the three policy instruments τ, t and α.

10 International investment

Results (23) and propositions 3 and 5 yield the following corollary:

Proposition 6 *In a political equilibrium with free-to-manage bargaining, in which $\beta = 0$ and $\alpha > 0$, the credibility of wage contracts increases the MNC's profit, $\Pi^c > \Pi^{nc}$.*

The credibility of contracts reduces uncertainty associated with FDI and increases the MNCs profit. We have assumed that there is no bargain over employment with Probability $1 - p_e$, there is a bargain over the wage with Probability p_w, there are credible contracts with Probability p_c and non-credible contracts with Probability $1 - p_c$. According to propositions 3 and 6, the MNC's anticipated profit is then given by

$$\pi^e = (1 - p_e)p_w[p_c\Pi^c + (1 - p_c)\Pi^{nc}], \quad \partial\pi^e/\partial p_c = \Pi^c - \Pi^{nc} > 0,$$

where $p_c\Pi^c + (1 - p_c)\Pi^{nc}$ expected profit with right-to-manage bargaining and $(1 - p_e)p_w$ the probability of right-to-manage bargaining (i.e., a bargain over wages, $\alpha > 0$, but no bargain over employment, $\beta = 0$). Hence, we obtain our final result as:

Proposition 7 *The more likely right-to-manage bargaining (i.e., the bigger $(1 - p_e)p_w$), or the more credible wage contracts are expected to be (i.e., the bigger p_c), the higher an MNC's anticipated profit from FDI will be.*

11 Conclusions

This paper examines the MNE's investment risk. The main characteristics of this model are the following. If the labour market is regulated, then the MNC bargains over wages and employment with a labour union. Self-interested governments set taxes to finance public services and regulate the labour market, and lobbies representing the workers and MNCs try to influence government policy. There are sunk costs associated with FDI.

Conventional wisdom has said thus far that labour market deregulation improves the competitiveness of the economy as regards attracting FDI. In contrast, this document suggests that deregulation presents a potential risk for FDI. When wages are competitively determined, the government can use labour and investment taxes as a combined non-distorting instrument, by which it can expropriate all surplus of FDI. When there is bargaining over both wages and employment, governments can use taxation and labour market regulation together as a non-distorting instrument for the same purpose. Hence, only right-to-manage bargaining truly ensures profits for FDI.

When wage contracts are non-credible, unions are able to raise wages by reneging on their promises after FDI has occurred. In such a case, MNCs lose their confidence on unions and reduce their investment. This leads to lower employment, smaller profits and lower labour income. When wage contracts are credible, MNCs can invest more, and employment, profits and labour income are higher than they are with non-credible contracts.

From a MNC's viewpoint, the following results should be interesting. Union power is endogenously determined by the political process. Institutions that support right-to-manage bargaining and the credibility of wage contracts (e.g., stable labour market organizations, binding contracts, industry-wide bargaining), also contribute to the profitability of FDI, because they prevent the local elite from expropriating MNCs' rents.

Appendix

Given (3), (4), (11), (13), (18) and (21), we obtain

$$\begin{aligned} 0 = \Upsilon &= \frac{\alpha}{V}[V + l(y_{ll} + y_{lk}K_l\eta)] - \frac{1-\alpha}{\Pi}[l(y_{ll} + y_{lk}K_l\eta)] \\ &> l(y_{ll} + y_{lk}K_l\eta)[\alpha/V - (1-\alpha)/\Pi] \end{aligned}$$

and $\alpha/V > (1-\alpha)/\Pi$ for $\beta = 0$ and $W > \underline{W}$. This, (1), (11) and (18) produces $y_{ll} + y_{lk}K_l\eta < 0$ and

$$\frac{\partial\Upsilon}{\partial\alpha} = \frac{dV}{dl} - \frac{d\Pi}{dl} < 0, \quad \frac{\partial\Upsilon}{\partial t}\bigg|_{\beta=0,\, W>\underline{W}} = \frac{\alpha b}{(1-t)^2}\,\frac{y_{ll} + y_{lk}K_l\eta}{[y_l - b/(1-t)]^2} < 0,$$

$$\begin{aligned} \frac{\partial\Upsilon}{\partial\eta}\bigg|_{\beta=0,\, W>\underline{W}} &= \alpha\frac{ly_{lk}K_l}{ly_l - bl/(1-t)} - \frac{(1-\alpha)ly_{lk}K_l}{y - (1+\tau)ck\eta - ly_l} \\ &\quad - (1-\alpha)\frac{l(y_{ll} + y_{lk}K_l\eta)(1+\tau)ck}{[y - (1+\tau)ck\eta - ly_l]^2} > ly_{lk}K_l\Big(\frac{\alpha}{V} - \frac{1-\alpha}{\Pi}\Big) > 0. \end{aligned}$$

Noting these inequalities and totally differentiating the equilibrium condition (21), we obtain the marginal product of labour as:

$$y_l = \widetilde{W}(\tau, t, \alpha, \beta, \eta) \text{ with } \frac{\partial \widetilde{W}}{\partial \alpha} \doteq -\frac{\partial \Upsilon}{\partial \alpha} \Big/ \frac{\partial \Upsilon}{\partial W} > 0, \ \frac{\partial \widetilde{W}}{\partial t} \doteq -\frac{\partial \Upsilon}{\partial \alpha} \Big/ \frac{\partial \Upsilon}{\partial W} > 0$$
$$\text{and } \frac{\partial \widetilde{W}}{\partial \eta} \doteq -\frac{\partial \Upsilon}{\partial \eta} \Big/ \frac{\partial \Upsilon}{\partial W} < 0 \text{ for } \beta = 0 \text{ and } \widetilde{W} > \underline{W}. \quad (40)$$

Finally, assume $\beta = 0$. Given (40), the increase of η from 0 to 1 then decreases $\widetilde{W}$. From this and (20) it follows that the marginal product of labour is given by $y_l(l, k) = W(\tau, t, \alpha, \beta, \eta) = \max[\widetilde{W}, \underline{W}]$. Noting this and (40), we obtain $\partial W / \partial \alpha > 0$, $\partial W / \partial t > 0$ and $\partial W / \partial \eta < 0$ for $\beta = 0$.

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