Policy Evaluation in the Presence of Outsourcing: Global Competitiveness versus Political Feasibility[1]

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Abstract

We analyze the effects of outsourcing in the presence of a minimum wage by presenting a general-equilibrium model with an oligopolistic export sector and a competitive import-competing sector. An outsourcing tax is politically popular because it switches jobs to unemployed natives. It is also economically sound because it raises national income. An export subsidy may or may not be justified on welfare grounds. Increased international competition has no effect on the level of outsourcing, but the direction of its effect on unemployment and national income depends on the relative factor intensities of the two sectors.

The views expressed are those of the authors and do not necessarily represent official positions of the Federal Reserve Bank of St. Louis or of the Federal Reserve System.

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1. Introduction

Outsourcing has become the focus of many recent discussions of policies governing international commerce. In the United States, for example, there is much concern that, while outsourcing may give an edge to US firms in terms of their global competitiveness, its effect on welfare is ambiguous because it hurts US labor. A dominant component of outsourcing is in labor services that can be directly used from foreign locations through advances in telecommunication. For example, Bhagwati, Panagariya, and Srinivasan (2004) point out that, unlike in the 1980s when outsourcing was principally viewed as fragmentation of the production process, the current pattern of outsourcing involves "long-distance" purchase of services from abroad. One such example is call centers that support bank credit cards. The person who answers your questions as a customer service representative can easily be located in Bangalore in India rather than in South Dakota in the United States. In this sense, US and foreign labor are close substitutes in the production of many of the goods and services that are traded in the current marketplace.

In this context, US labor-market policies have a direct impact on US competitiveness, income distribution, and national welfare. Also, US policies that might help enhance the strategic position of US firms (*à la* Brander and Spencer, 1985) will have effects on the labor market. To address these issues, we consider a two-sector model with an oligopolistic export sector and an import-competing competitive sector. The model includes three types of labor: domestic skilled labor, domestic unskilled labor, and foreign unskilled labor. So that the model focuses on the tradeoff between global competitiveness and labor, we allow the oligopolistic sector to outsource some production to foreign unskilled labor.[2] Within this framework, we look first at the effects of outsourcing when the labor market is distorted by a minimum wage.[3]

In a minimum-wage economy, the presence of unemployment makes outsourcing a sensitive political issue. There is likely to be substantial pressure on the home government to restrict it, so that more local workers can be hired. We address this issue by considering a minimum-wage economy where restrictions on outsourcing come in the form of an outsourcing tax. An interesting finding of the paper is that along with a reduction in unemployment, the outsourcing tax also raises national income. Therefore, what is politically expedient is also economically sensible. The rise in national income is possible because the tax raises the cost of outsourcing, thereby inducing the firms to hire from the unemployment pool. As jobs are switched from foreign workers to natives, there is a net gain in national income because at the margin some natives are being moved from their opportunity value of leisure to a strictly higher marginal product of labor (equaling the minimum wage).[4]

In a minimum-wage economy the three types of labor are tightly linked: The presence of a competitive importing sector operating under constant returns to scale (CRS) fixes the skilled

[2] A referee notes that outsourcing is more common in skilled or semi-skilled labor. The context of our paper is not outsourcing of software development, which is common and falls into the skilled/semi-skilled category. Our focus is on outsourcing of labor that is a substitute for (say) customer service representatives. There is an asymmetry of skills required in such jobs between developed and developing nations. Any high school graduate (or less) in the United States can perform such a job. On the other hand, for Indians to serve as customer service representatives for US customers, special skills are necessary. First, they must know English, which is not their native language. They must also acquire an accent that is understood by the US customer. Overall, they must have some familiarity socially/culturally with the US customer. So, while we agree with the referee that these workers are semi-skilled in the developing nations, they are for all practical purposes unskilled in the developed (i.e., the outsourcing) nation.

[3] For a treatment of minimum wages in general-equilibrium trade models, see Brecher (1974a and 1974b).

[4] This effect is reminiscent of Ethier (1986), where he shows that national income can be raised in a minimum-wage economy by restricting illegal immigration. The source of the gain there is a switching of jobs from unskilled illegal immigrants to unskilled (and unemployed) natives.

wage and, through the zero-profit condition, the unskilled/skilled wage ratio. Given a fixed wage ratio, the labor intensities of both sectors are fixed also. In equilibrium, the relative marginal productivities of unskilled domestic labor and unskilled outsourced labor must equal their relative wages. The marginal wage cost of outsourcing is the foreign wage plus the outsourcing tax, while the marginal wage cost of domestic unskilled labor is the minimum wage. Thus, for a given tax on outsourcing, the ratio of marginal wage costs is independent of the rest of the model. The marginal productivity ratio is shown to be a decreasing function of the level of outsourcing alone. Further, the equality between the marginal productivity ratio and the marginal wage cost ratio dictates that the level of outsourcing is a function only of the outsourcing tax and is independent of the rest of the model. Consequently, we find that a rise in foreign competition or a rise in the domestic export subsidy will have no effect on outsourcing.

In general, the purpose of an export subsidy to the domestic oligopolist is to increase national income by shifting profits from overseas oligopolists. When the domestic oligopolist operates in an economy whose labor market is distorted by a minimum wage, there is the additional concern of how the export subsidy affects the labor market. Depending on the relative labor intensities, the labor-market distortion may call for an augmentation of the profit-shifting subsidy. In the case in which the oligopolistic sector is more unskilled-labor intensive than the competitive sector, a subsidy expands the oligopolist’s output, thereby drawing resources from the competitive sector. As the competitive sector contracts, it releases more unskilled labor than can be absorbed by the oligopolistic sector at a fixed wage, thereby aggravating the unemployment problem. The optimal export policy will then be to reduce the export subsidy below the profit-shifting level and maybe even to impose an export tax.

There is a lot of concern regarding the effects of globalization and how it may be affecting the US economy. It is argued that with greater international competition, US workers are losing. We capture increased international competition within an oligopolistic context by analyzing the effects of an increase in the number of foreign firms (relative to the number of domestic firms in the export market).[5] While the output of the domestic oligopolistic sector must fall, it is not clear what happens to domestic employment. If the oligopolistic sector is more skilled-labor intensive, aggregate employment must rise because as the oligopolistic sector shrinks, more skilled labor is laid off relative to unskilled labor. Given that labor intensities are fixed and that the competitive sector is relatively unskilled-labor intensive, it can absorb all of the excess skilled labor only if it can match it by a correspondingly high unskilled labor absorption. This is possible only if the competitive sector draws from the unemployed pool of workers. Thus, in this particular case, a rise in international competition can reduce domestic unemployment, alleviate the labor-market distortion, and raise national income. However, if the oligopolistic sector is less skill intensive, the unemployment problem is aggravated by increased international competition and national income must fall. Section 2 of the paper presents the basic structure of the model. Section 3 analyzes a minimum-wage economy. Section 4 concludes.

2. The Model

We present a two-sector model in which the exporting sector is oligopolistic and the import-competing sector is competitive. For analytical simplicity, we assume that the

[5] Qualitatively similar results are obtained when considering a reduction in the marginal costs of foreign firms.

oligopolistic sector consists of one domestic firm exporting a pure export good (i.e., there is no domestic consumption) and competes with foreign firms as a Cournot oligopolist in a third nation's market. We first describe the oligopolistic sector and then incorporate the competitive sector (Section 2.2) into the analysis.

2.1 The Oligopolistic Sector

The exporting firm uses two inputs, unskilled labor and skilled labor. Unskilled labor may be domestic or foreign (outsourced unskilled labor). If it is foreign, it is assumed to be less productive than domestic labor. Also, this productivity is assumed to diminish as more foreign labor is hired. The latter effect captures increasing costs that employers may face in trying to hire workers in less developed nations with institutional constraints such as a lack of a modern communication network, electricity services, etc.

Let a unit of foreign labor provide the equivalent of $\delta < 1$ units of domestic labor. Suppose that the firm hires n units of foreign labor (the level of outsourcing). We have assumed already that δ falls with n. Furthermore, while the effective units of labor rise with n, we assume that this increase becomes smaller as n rises. Thus the function $\delta(n)$ may be described as

$$\delta = \delta(n) < 1,\ \delta'(n) < 0,\ \delta + n\delta' > 0, \text{ and } 2\delta' + n\delta'' < 0. \quad (1)$$

The domestic production function is

$$q = F\{L_E + n\delta(n), S_E\}, \quad (2)$$

where $F(.)$ is CRS, S_E is the level of skilled labor employed by the exporting firm, and L_E is the level of domestic unskilled labor hired by the firm. Let the inverse demand function for the product be

$$P = P(Q), \ Q = q + q^*, \ P'(Q) < 0, \tag{3}$$

where q is the output of the domestic firm and q^* is the sum of the output levels of the foreign firms. Foreign-firm *j*'s profit is

$$\pi_j^* = (P - c_j^*)q_j^*, \tag{4a}$$

where c_j^* and q_j^* are, respectively, the constant marginal cost and the output level of firm *j*. The first-order condition of profit maximization for a foreign firm is

$$P - c_j^* + q_j^* P' = 0. \tag{4b}$$

Adding the first-order conditions across the m foreign firms, we obtain

$$mP - c^* + q^* P' = 0, \text{ where } q^* = \sum q_j^* \text{ and } c^* = \sum c_j^*. \tag{4c}$$

Suppressing c^*, (4c) implicitly defines the foreign reaction function in terms of the aggregate foreign output $q^* = q^*(q, m)$, with a slope of

$$\rho^* = \partial q^* / \partial q = -(mP' + q^* P'')/\{(m+1)P' + q^* P''\}. \tag{4d}$$

The domestic firm is provided a unit export subsidy σ and faces an outsourcing tax of t per unit of foreign labor. Let the domestic wages be w for unskilled labor and w_s for skilled labor. The firm is assumed to be small in factor markets and buys foreign labor at the price of w_0. The domestic firm's profit is

$$\pi = (P + \sigma)q - wL_E - (w_0 + t)n - w_s S_E. \tag{5}$$

Using (2) and (3) and making the Cournot-Nash assumption that the home firm assumes that q^* is not affected by its choice of q, the first-order conditions of profit maximization for the home firm are

$$\partial\pi / \partial L_E = (P + \sigma + qP')F_1(.) - w = 0, \tag{6a}$$

$$\partial\pi / \partial n = (P + \sigma + qP')F_1(.)(\delta + n\delta') - (w_0 + t) = 0, \text{ and} \tag{6b}$$

$$\partial\pi / \partial S_E = (P + \sigma + qP')F_2(.) - w_s = 0. \tag{6c}$$

Using (6a) in (6b), we see that outsourcing is reduced by an outsourcing tax:[6]

$$\delta(n) + n\delta'(n) = (w_0 + t) / w \Rightarrow n = n(t, w),$$

$$\partial n / \partial t = n_t = 1/\{w(2\delta' + n\delta'')\} < 0. \tag{7}$$

Using (6a) and (6c),

$$F_1(.) / F_2(.) = w / w_s. \tag{8a}$$

Given the homotheticity of $F(.)$, (8a) implies that with w and w_s given, the oligopolist's unskilled-labor intensity λ_E is determined from (8b) and is independent of other parameters of the model:

$$\{L_E + n\delta(n)\} / S_E = \lambda_E = \lambda_E(w / w_s), \ \lambda_E' < 0. \tag{8b}$$

Using (3) and (4d), the domestic oligopolist's marginal revenue as a function of its own output and the number of foreign oligopolists is

$$R(q, m) = P\{q + q^*(q, m)\} + qP'\{q + q^*(q, m)\}, \ R_q = \partial R / \partial q < 0. \tag{9}$$

[6] We assume that both (6a) and (6b) hold as equalities. That is, an interior solution exists where both types of unskilled labor are simultaneously used by the firm.

Substituting (9) into (6a), we obtain the domestic oligopolist's output as a function of the export subsidy, the number of foreign oligopolists, and wages:

$$q = q(\sigma, m, w, w_s), \text{ where } \partial q / \partial \sigma = -1 / R_q > 0. \quad (10)$$

Using (2), (8b), and the CRS property of the production function, we obtain the total differential of the production function:

$$q = S_E F(\lambda_E, 1) \Rightarrow dq = F(\lambda_E, 1) dS_E + S_E F_1 \lambda_E' d(w / w_s). \quad (11)$$

2.2 The Competitive Import-Competing Sector

Let the competitive sector produce the import-competing numeraire good M. It is produced using skilled labor (S_M) and unskilled labor (L_M) through CRS technology. The zero-profit condition dictates that

$$C^M(w, w_s) = 1, \quad (12a)$$

where $C^M(w, w_s)$ is the average cost function for a competitive firm. Relation (12a) defines[7]

$$w_s = f(w). \quad (12b)$$

Let the production function for M be

$$M = \phi(L_M, S_M). \quad (13)$$

Competitive profit-maximization conditions imply that the unskilled-labor intensity for sector M, λ_M, is such that

[7]This suggests that once the unskilled wage is fixed, the skilled wage is also determined. This is not in conflict with equilibrium in the market for skilled labor. This is a small open economy as far as the competitive good is concerned. In other words, the derived demand for skilled labor in this sector becomes infinitely elastic if the unskilled wage is fixed, and any supply-side changes in the market for skilled labor are absorbed without any change in the skilled wage.

$$\phi_1(L_M, S_M)/\phi_2(L_M, S_M) = w/w_s = w/f(w) \Rightarrow \lambda_M = L_M/S_M = \lambda_M(w). \qquad (14)$$

3. A Minimum-Wage Economy

3.1 Second-Best Policies

Let w_s be fixed by a minimum wage set at $\bar{w}$. Using (12b),

$$w_s = f(\bar{w}) = \bar{w}_s. \qquad (15a)$$

From (12b) we can see that the imposition of the minimum wage for unskilled labor will in turn fix the skilled wage. Noting this and using (8b), (14), and (15a), the unskilled-labor intensities in both sectors are fixed:

$$\lambda_E = \bar{\lambda}_E, \text{ and, } \lambda_M = \bar{\lambda}_M. \qquad (15b)$$

Using (10), (11), (15a), and (15b), the output and the use of skilled labor of the domestic oligopolist are unaffected by the outsourcing tax:

$$\partial q/\partial t = 0 \Rightarrow F(\lambda_E, 1)(\partial S_E/\partial t) = 0 \Rightarrow \partial S_E/\partial t = 0. \qquad (16a)$$

Using (16a) and considering the factor-market equilibrium condition for skilled labor,

$$S_E + S_M = \bar{S} \Rightarrow \partial S_M/\partial t = 0. \qquad (16b)$$

Using (10) and (11), an export subsidy shifts skilled labor from the import-competing sector to the oligopolist:

$$\partial S_M/\partial\sigma = -(\partial S_E/\partial\sigma) = -(\partial q/\partial\sigma)/F(\lambda_E, 1) = 1/\{R_q(q, m)F(\lambda_E, 1)\} < 0. \qquad (17)$$

Using (17) and noting from (15b) that λ_M and λ_E are fixed, we have

$d\ln\lambda_M = 0 \Rightarrow \partial L_M/\partial t = \partial S_M/\partial t = 0$ and $\partial L_M/\partial\sigma = \lambda_M(\partial S_M/\partial\sigma) < 0$, along with

$$d\ln\lambda_E = 0 \Rightarrow \partial L_E/\partial t = -(\delta + n\delta')n_t > 0 \text{ and } \partial L_E/\partial\sigma = \lambda_E(\partial S_E/\partial\sigma) > 0. \qquad (18)$$

Unskilled labor in the import-competing sector is unaffected by an outsourcing tax but is decreased by an export subsidy. In contrast, unskilled labor in the exporting sector is increased by both the outsourcing tax and the export subsidy.

Let L and $\bar{L}$ denote total employed unskilled labor in the home nation and the endowment of unskilled labor, respectively. Let b denote the amount that is obtained by the unemployed workers (same as the marginal social cost of employing one more unit of labor) and L_u denote units of labor hours that are unemployed. National income is then

$$NI = \pi - \sigma q + wL + bL_u + tn + w_s S \,. \tag{19}$$

Note that

$$L = L_E + L_M \text{ and } L_E + L_M + L_u = \bar{L} \,. \tag{20}$$

Using (15a), (16b), (20), and the expression for the domestic firm's profit, (19) reduces to

$$NI = Pq + (\bar{w} - b)L_M - w_0 n + \bar{w}_s S_M + b(\bar{L} - L_E) \,. \tag{21}$$

Total differentiation of (21) yields

$$dNI = (qP'\rho^* + R)dq + (\bar{w} - b)dL_M - w_0 dn + \bar{w}_s dS_M - bdL_E \,. \tag{22a}$$

Using (7), (10), (11), and (16a) through (18), we can reduce (22a) to

$$dNI = \{(qP'\rho^* + R)F(\lambda_E, 1) - (\bar{w} - b)\lambda_M - \bar{w}_s - b\lambda_E\}(\partial S_E / \partial\sigma)d\sigma$$

$$+\{b(\delta + n\delta') - w_0\}n_t dt \,. \tag{22b}$$

Using (7) and (22b), we can derive the optimal outsourcing tax as

$$b(\delta + n\delta') = w_0 \Rightarrow t_{opt.} = (w_0 / b)(\bar{w} - b) > 0 \,. \tag{23}$$

Relation (23) shows that the optimal outsourcing tax equates the marginal social cost of hiring an extra unit of domestic labor (b, the opportunity value of leisure) to the effective marginal cost to the nation of hiring an extra unit of outsourced labor ($w_0/(\delta + n\delta')$).[8] If there is no wage distortion (i.e., $w = b$, in equation (7)), then the firm's optimization achieves this outcome and no outsourcing tax is required (i.e., $t_{opt.} = 0$). By using (7), (18), and (20), we can see that the outsourcing tax reduces the number of unemployed unskilled workers:

$$\partial L_u / \partial t = -\{(\partial L_E / \partial t) + (\partial L_M / \partial t)\} = -(\partial L_E / \partial t) = (\delta + n\delta')n_t < 0 . \tag{24}$$

Note from (10) and from (15a) through (16b) that q, λ_E, and S_E do not change with t (given σ). However, notice from (7) that the outsourcing tax must reduce n, so L_E must rise enough to keep the labor intensity unchanged. From (18), we can see that L_M does not change with t. Therefore, with the imposition of an outsourcing tax, all of the extra domestic employment in sector *E* comes from the pool of unemployed workers, partially alleviating the labor-market distortion and raising welfare. Let us now consider the national-income-maximizing first-order condition for the export subsidy:

$$(qP'\rho^* + R)F(\lambda_E, 1) - (\bar{w} - b)\lambda_M - \bar{w}_s - b\lambda_E = 0 . \tag{25}$$

From (6c), we have $\bar{w}_s = (\sigma + R)F_2(.)$. Substituting this expression for $\bar{w}_s$ into (25) and using (6a) and the CRS property that $F(\lambda_E, 1) = \lambda_E F_1 + F_2$, we get the optimal export subsidy

$$\sigma_{opt.} = \{(\bar{w} - b)(\lambda_E - \lambda_M) / F(\lambda_E, 1)\} + qP'\rho^* . \tag{26}$$

There is a similarity between this expression for the optimal subsidy and the one derived in the unionized oligopoly paper of Brander and Spencer (1988). In that paper, the distortion due to unionization (i.e., the difference between the union wage w and the competitive wage b), called for a subsidy that is higher than the profit-shifting level. If in that model, the unionized wage

[8] A referee suggests another useful way to think about the role of the optimal outsourcing tax. Notice that it leads to the equalization of $\{(w_0 + t)/w_0\}$ to $(\bar{w}/b)$. Thus, the tax equates the relative distortions between outsourced labor and native labor.

collapses to the competitive wage, the optimal subsidy reverts to the standard Brander-Spencer (1985) level. Analogously, the first term on the right hand side of (26) is a subsidy (or tax) that corrects for the labor-market distortion. Aside from the issue of the labor-market distortion originating from a minimum wage in our paper, a major departure in our optimal subsidy is its concern for general-equilibrium factor allocations. This shows up notably in the term $(\lambda_E - \lambda_M)$, which multiplies the effect of wage distortion. In other words, under an economy-wide minimum wage, an export subsidy cannot alleviate the labor-market distortion if the two sectors have the same factor intensity. The expansion of the export sector is exactly offset by the contraction of the other sector with no reduction in unemployment. We explain this more carefully below.

Given that $\bar{w} > b$, it is distortion-reducing to raise aggregate employment (i.e., $L_E + L_M = \bar{L} - L_u$). A subsidy to the exporting sector achieves this if and only if $\lambda_E > \lambda_M$.[9] In this case, the expansion of the exporting sector raises L_E by more than the fall in L_M due to the contraction of the import-competing sector (note that because $\bar{S}$ is fixed, as sector *E* expands, sector *M* must contract). Therefore, aggregate employment ($L_E + L_M$) rises, reducing unemployment (L_u) and thereby easing the adverse effects of the minimum wage. On the other hand, if $\lambda_E < \lambda_M$, the expansion of sector *E* raises unemployment and aggravates the labor-market distortion. In this case, it is optimal to tax sector *E* (rather than subsidize it) to reduce the labor-market distortion. This shows up in the right hand side of (26) as the first term that is negative (if $\lambda_E < \lambda_M$). Of course, in this latter case, *a priori*, one cannot say whether $\sigma_{opt.}$ is positive or negative. Indeed, if the labor-market distortion dominates the profit-shifting motive, a tax may be optimal.

[9] We have proved this carefully below (following the intuitive explanation of the optimal export subsidy).

Here we prove (and explain) carefully how L_u is affected by an export subsidy. Using (18) and (20),

$$\partial L_u / \partial \sigma = -\{(\partial L_E / \partial \sigma) + (\partial L_M / \partial \sigma)\} = -\{q'(\sigma) / F(\lambda_E, 1)\}(\lambda_E - \lambda_M) . \qquad (27)$$

Thus, a rise in the export subsidy will reduce unemployment if and only if the unskilled-labor intensity in the oligopolistic sector is higher than that in the import-competing sector ($\lambda_E > \lambda_M$). When an export subsidy expands output in the oligopolistic sector, it needs more of both types of labor because the labor intensity is fixed by w. However, n is independent of the subsidy, and therefore, the expansion of unskilled-labor employment in the oligopolistic sector comes entirely from native labor. As *E* expands, *M* contracts to provide skilled labor and does so at unchanged labor intensity (given w). If the oligopolistic sector has higher unskilled-labor intensity, it will need more of it than is released by *M*. This is provided by the pool of unemployed workers. The argument reverses if $\lambda_E < \lambda_M$. At an extreme, this may call for a tax if the labor-market distortion dominates the profit-shifting motive. Of course, it may not be feasible to employ a tax because it reduces firm profit and may lead the home firm to exit the country.[10] Finally we note that we show in Bandyopadhyay and Wall (2005) that the results of this section are qualitatively unaltered if we were to consider Bertrand rather than Cournot competition between the domestic and the foreign firm.

3.2 Endogenizing the Minimum Wage: A Political Support Function Approach

The analysis in the previous sections has assumed that the minimum wage is exogenously given. In this sub-section we endogenize the minimum wage by assuming that the government's

[10] As a referee notes, in a model where entry and exit are explicitly modeled, the level of the optimal tax will be set so as not to cause exit. So, in such a situation a tax will probably still remain optimal, although it will be set at a sufficiently low level not to trigger exit.

objective function provides additional weight to the unskilled wage to account for political pressures that the government faces from labor (unskilled) groups. We follow the political support function approach used in this literature.[11] Let the government's objective function be[12]

$$G = NI + \theta\bar{w}, \ \theta > 0. \tag{28}$$

Thus, the government considers both national income and unskilled labor interests and the trade-offs involved. At the optimum, the government will seek to balance the efficiency-reducing effect of the minimum wage by the positive impact it has on unskilled wages. Notice that

$$G = NI(\sigma, t, \bar{w}) + \theta\bar{w} = G(\sigma, t, \bar{w}; \theta). \tag{29}$$

Thus, given θ,

$$dG = G_\sigma d\sigma + G_t dt + G_{\bar{w}} d\bar{w}. \tag{30}$$

At the optimum,

$$G_\sigma(\sigma, t, \bar{w}; \theta) = 0, \ G_t(\sigma, t, \bar{w}; \theta) = 0, \text{ and } G_{\bar{w}}(\sigma, t, \bar{w}; \theta) = 0. \tag{31}$$

From (31), the optimal (in this context) subsidy, outsourcing tax, and minimum wage are obtained as

$$\sigma = \sigma(\theta), \ \ t = t(\theta), \text{ and } \bar{w} = \bar{w}(\theta). \tag{32}$$

Notice from (29) that $G_\sigma \equiv \partial NI / \partial\sigma$ and $G_t \equiv \partial NI / \partial t$. Thus, (31) implies that the expressions for the optimal export subsidy and the outsourcing tax are as in the previous section. Notice that $G_{\bar{w}} = 0 \Rightarrow -(\partial NI / \partial\bar{w}) = \theta$. Thus, at the optimum, the marginal payoff for the government from a higher minimum wage is balanced by the negative effect on national income. Totally differentiating (31) we obtain

$$d\bar{w} / d\theta = (G_{\sigma\sigma}G_{tt} - G_{\sigma t}^2)/(-Z) > 0, \tag{33}$$

[11] See Hillman (1982) and Rodrik (1995, pages 1464-65) for simple expositions.
[12] We take the simplest formulation that allows us to present this approach and highlight the important results.

where Z is the determinant of the matrix of second derivatives of the $G(.)$ function and must be negative at a strict maximum for G. Also, for the same reason, $(G_{\sigma\sigma}G_{tt} - G_{\sigma t}^2)$ is positive. Thus, a rise in the political support weight (i.e., θ) will raise the minimum wage. Using this in equation (23), which still holds, we can say that the optimal outsourcing tax must rise with θ because it raises $\bar{w}$. On the other hand, the effect on the optimal subsidy is less clear because there are more endogenous variables in that expression. Consider a simple case where $\lambda_E = \lambda_M$. In this case, from (26) we see that $\sigma_{opt.} = qP'\rho^*$. If demand is linear, P' is constant and ρ^* is a function only of the number of foreign firms (see equation (4d)). Thus, $(P'\rho^*)$ is independent of θ. If θ rises, thereby raising $\bar{w}$, both sectors will want to raise their skilled-labor intensity. At the initial iso-quants, this should raise the use of skilled labor beyond $\bar{S}$. This cannot happen, so at the higher skilled-labor intensity, both sectors shrink (assuming that the new intensities are also equal between the sectors). As the output of the exporting industry falls, this should reduce $\sigma_{opt.}$ (because the profit-shifting subsidy is scaled by the level of q). On the other hand, if $\lambda_E > \lambda_M$, a higher minimum wage may call for a greater subsidy to reduce the labor-market distortion. In this latter case, there are two opposing effects of θ on the optimal export subsidy.

To summarize, greater lobbying pressure from the groups representing interests of unskilled labor results in a higher minimum wage, a higher outsourcing tax, and an ambiguous effect on the optimal export subsidy.

3.3 Increased Foreign Competition

We can capture the effects of increased foreign competition either by raising the number of foreign firms or by reducing the foreign marginal cost of production. They have qualitatively similar effects. We focus here on the case in which the number of foreign firms in the oligopolistic market, *m*, rises. Recall from (4d) and (9) that

$$P\{q+q^*(q,m)\}+qP'\{q+q^*(q,m)\}=R(q,m)\,. \tag{34}$$

Using (6a), (15b), and (34),

$$\{R(q,m)+\sigma\}F_1(\bar{\lambda}_E,1)=\bar{w}\Rightarrow q=q(m,\sigma)\,,\ \partial q/\partial m=-R_m/R_q\,,$$

where $R_m=\partial R/\partial m$. (35)

From (9) we know that $R_q<0$. Also, the marginal revenue of the domestic firm falls with an increase in the number of foreign firms:

$$R_m=-\{(P'+qP'')P\}/\{(m+1)P'+q^*P''\}<0\,. \tag{36}$$

Using (36) in (35), $\partial q/\partial m<0$. Using (11) and (36), we can see that employment of skilled workers falls when there is increased foreign competition:

$$\partial S_E/\partial m=\{(\partial q/\partial m)/F(\lambda_E,1)\}<0\,. \tag{37}$$

Note that $\lambda_E=\bar{\lambda}_E$, $\lambda_M=\bar{\lambda}_M$, $S_M+S_E=\bar{S}$, and n is independent of m. Therefore, when m rises, the domestic firm employs fewer unskilled workers, some of whom are shifted to the import-competing sector:

$$\partial L_E/\partial m=\bar{\lambda}_E(\partial S_E/\partial m)<0\ \text{and}$$

$$\partial L_M/\partial m=\bar{\lambda}_M(\partial S_M/\partial m)=-\bar{\lambda}_M(\partial S_E/\partial m)>0\,.$$

The effect on total employment of unskilled workers depends on the relative unskilled-labor intensities of the two sectors:

$$\partial(L_M + L_E)/\partial m = (\bar{\lambda}_E - \bar{\lambda}_M)(\partial S_E/\partial m) > / < 0 \text{, as } \bar{\lambda}_E < / > \bar{\lambda}_M . \tag{38}$$

Similarly, unemployment is affected in the following way

$$\partial L_u/\partial m = -(\bar{\lambda}_E - \bar{\lambda}_M)(\partial S_E/\partial m) > / < 0 \text{, as } \bar{\lambda}_E > / < \bar{\lambda}_M . \tag{39}$$

Therefore, given t and σ, increased competition in the oligopolistic sector will increase (reduce) unemployment if sector *E* is relatively more (less) intensive in skilled labor. We now explore the effect on national income, which, using (4d) and (21) is

$$NI(\sigma,t,m) = P\{q + q^*(q,m)\}q + (\bar{w} - b)L_M - w_0 n + \bar{w}_s S_M + b(\bar{L} - L_E) . \tag{40}$$

Total differentiation of (40) yields

$$dNI = \{qP'(\partial q^*/\partial m) + A(dq/dm)\}dm + A(\partial q/\partial\sigma)d\sigma$$

$$+\{b(\delta + n\delta') - w_0\}n_t dt , \tag{41a}$$

where $A = (\bar{w} - b)(\lambda_E - \lambda_M)/F(\lambda_E,1) + qP'\rho^* - \sigma$. Relation (40) presents a general expression that is useful for analyzing changes in national income. We focus on two special cases: when there is no government intervention and when government intervention is optimal.

<u>Case 1</u>*: No Intervention* $(\sigma \equiv t \equiv 0)$

$$dNI/dm = qP'(\partial q^*/\partial m) + A(dq/dm)$$

$$= qP'(\partial q^*/\partial m) + [qP'\rho^* + \{(\bar{w} - b)(\lambda_E - \lambda_M)/F(\lambda_E,1)\}](dq/dm) . \tag{41b}$$

Now $\partial q^*/\partial m > 0$ and $dq/dm < 0$. Thus, $dNI/dm < 0$ if $\lambda_E > \lambda_M$ and has an ambiguous sign if $\lambda_E < \lambda_M$. Thus, increased competition from foreign firms will not necessarily reduce home welfare. If it leads to sectoral reallocations such that unemployment is reduced, then national income may actually increase.

Case 2: *Optimal Intervention* $(\sigma = \sigma_{opt.}, t = t_{opt.})$

Under optimal policy intervention, $A(\partial q / \partial \sigma) = 0 \Rightarrow A = 0$ and $b(\delta + n\delta') = w_0$. Therefore,

$$dNI / dm = qP'(\partial q^* / \partial m) < 0 . \qquad (42)$$

If optimal policies are already in place, a rise in foreign competition must reduce national income.

4. Conclusion

To our knowledge this is the first paper that presents a general-equilibrium analysis of the tensions between minimum wage, outsourcing, and unemployment in an oligopolistic context. Inter-sectoral linkages that are ignored in partial-equilibrium analysis are shown to be critical in determining changes in central variables like unemployment, outsourcing, and national income. The labor-market results are robust to the mode of oligopolistic competition. In light of the present analysis, we see that politically expedient measures may also make economic sense. Furthermore, we show that the effect of increased international competition (for the domestic exporting firm) is not necessarily negative for native labor in the presence of an economy-wide minimum wage. This is because unemployment may be reduced through sectoral reallocations. The model is general enough and can be adapted to address issues like the effects of dual labor markets in developing nations and second-best labor-market policies in the context of trade distortions, among others.

Appendix

Here we present a specific factors model of unemployment and strategic trade policy along the lines of Brander and Spencer (1987) and show that our central results are qualitatively unaltered in that context. Following that paper we assume a two-sector specific factors model. We assume that the exporting good E uses a specific factor K instead of the inter-sectorally mobile skilled labor (S_E) that we have analyzed. The model is simpler and more tractable, but we lose the effects of general-equilibrium interactions between the two sectors. The effect is most starkly captured by the presence of the term ($\lambda_E - \lambda_M$) in the optimal subsidy formula (26) of our paper.

For this specific factors model we also use a more general functional form for the production function of the export sector, where we treat outsourcing (n) as a separate argument. We do not make any assumptions about complementarity or substitutability between the three factors of production (i.e., L_E, n, K) used in the export good. The production function is

$$q = F(L_E, n, K) . \qquad \text{(A1)}$$

Profit in sector E is

$$\pi = \{P(q + q^*) + \sigma\}q - wL_E - (w_0 + t)n - rK . \qquad \text{(A2)}$$

Using (A1) in (A2), the first-order conditions of profit maximization under Cournot assumption are

$$\partial\pi / \partial L_E = (P + \sigma + FP')F_1 - w = 0 ,$$

$$\partial\pi / \partial n = (P + \sigma + FP')F_2 - (w_0 + t) = 0 \text{, and}$$

$$\partial\pi / \partial n = (P + \sigma + FP')F_3 - r = 0 . \qquad \text{(A3)}$$

Assuming $F(.)$ is homogeneous of degree one, using (A3), and suppressing parameters like w, w_0, etc., in the functional forms,

$$F_1 / F_2 = w/(w_0 + t) \Rightarrow \lambda_n = \lambda_n(\lambda_E, t), \text{ where } \lambda_E = L_E / K \text{ and } \lambda_n = n/K \text{; and}$$

$$F_1 / F_3 = w/r \Rightarrow \psi(\lambda_E, \lambda_n) = w/r, \text{ where } F_1 / F_3 \equiv \psi(\lambda_E, \lambda_n). \tag{A4}$$

Using (9) of the text,

$$R(q) \equiv P\{q + q^*(q)\} + qP'\{q + q^*(q)\}. \tag{A5}$$

Noting that K is a specific factor and its endowment is $\bar{K}$ (say), we have

$$q = \bar{K}F(\lambda_E, \lambda_n, 1). \tag{A6}$$

Using (A4) through (A6) and suppressing $\bar{K}$,

$$R = R(\lambda_E, t). \tag{A7}$$

Using (A3), (A4), and (A7),

$$r = (R + \sigma)F_3(.) \Rightarrow r = \{R(\lambda_E, t) + \sigma\}F_3\{\lambda_E, \lambda_n(\lambda_E, t)\} \Rightarrow r = r(\lambda_E, t, \sigma). \tag{A8}$$

Using (A8) in (A4),

$$\psi\{\lambda_E, \lambda_n(\lambda_E, t)\}r(\lambda_E, t, \sigma) - w = 0 \Rightarrow \lambda_E = \lambda_E(t, \sigma). \tag{A9}$$

Using (A9) and the equations above, we can solve for all of the endogenous variables of this model as a function of the policy variables t and σ (given the parameters w, w_0, $\bar{K}$, etc.). Let the alternate sector M use a specific factor T at factor price ρ. Its production function is

$$M = \phi(L_M, T). \tag{A10}$$

Under competitive assumptions and assuming M to be the numeraire good,

$$C^M(w, \rho) = 1. \tag{A11}$$

If a minimum wage is present, such that $w = \bar{w}$, (A11) determines $\rho = \bar{\rho}$. Competitive profit-maximization implies that

$$\phi_1(\lambda_M,1)/\phi_2(\lambda_M,1)=\bar{w}/\bar{\rho}\Rightarrow\lambda_M=L_M/T=\bar{\lambda}_M. \quad \text{(A12)}$$

Assuming that the endowment of the specific factor T is $\bar{T}$ and using (A12),

$$L_M=\bar{T}\bar{\lambda}_M=\bar{L}_M. \quad \text{(A13)}$$

(A13) shows that employment (and therefore output) of M is frozen under the minimum wage. Therefore, the expansion of sector E can only come from drawing labor from the pool of unemployed. The expression for national income in this context can be shown to reduce to

$$NI=Pq-w_0n+\bar{w}\bar{L}_M-b(L_E+\bar{L}_M)+b\bar{L}+\bar{\rho}\bar{T}. \quad \text{(A14)}$$

Totally differentiating (A14) and using the equations above, we can derive the optimal export subsidy and the outsourcing tax as

$$\sigma_{opt.}=\{(\bar{w}-b)/F_1\}+qP'\rho^* \text{ and } t_{opt.}=(\bar{w}-b)w_0/b. \quad \text{(A15)}$$

Comparing (A15) with the optimal export subsidy and the optimal outsourcing tax of the main text, we find that they are qualitatively similar. There is one important difference. The factor intensity differences between the two sectors do not play any role here (in contrast to equation (26)). This is because the general-equilibrium linkage between the two sectors is effectively frozen through the assumptions of specific factors and a minimum wage.

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