울산대학교 사회과학논집 제13권 1호 pp. 149~158, 2003.
Journal of Social Sciences Vol.13 No.1 pp. 149~158, 2003.
University of Ulsan.

# The Impact of International Market Integration on Wages in Unionized Economy

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**<Abstract>**

This paper developed a generalized model to analyze the relationship between product market integration and wages in the unionized labor market. By considering product market integration as a reduction in trade costs, we showed that product market integration has an ambiguous effect on wages determined by labor unions. A reduction in fixed trade costs leads to an unambiguous decrease in wages, while a reduction in variable trade costs has an ambiguous effects on wages.

## 1. Introduction

The establishment of North American Free Trade Agreement and integration in Europe unify and enlarge international product market. Many Asian countries including Korea is also pursuing the establishment of free trade zone or bilateral free trade agreement. A major concern, under this kind of situation,. is how product market integration affects wages and employment in the unionized sector.[1)]

An integration of product markets is a change in market structure that implies a simultaneous increase in the number of competing firms and in market size, and a decrease in trade costs. Dorwick(1989) shows that if there is an increase in the degree of competition in the product market, then it spills over to the labor market and wages are reduced. Huizinga(1993) and Sørensen(1993), by using a simple oligopolistic model, also show that product market integration may incur lower wages. Recently, however, Naylor(1998) shows that a marginal increase in product market integration represented

1) In this paper, we just focused on the effect of product market integration on wages in the unionized labor market. But we can easily extend the model by changing bargaining structure and consider wages and employment simultaneously.

by a decrease in trade cost can cause higher wages in the unionized labor markets.

This paper tries to clarify how product market integration affects wages when labor markets are unionized and suggest a general model incorporating Huizinga(1993), Sørensen(1993) and Naylor(1998).

Huizinga(1993), Sørensen(1993) and Naylor(1998) are using a similar simple oligopoly model. Huizinga and Sørensen compare an extreme cases of no trade with the cases of full trade without introducing any trade costs. Naylor analyzed the implication of a marginal reduction in trade costs. By differentiating trade costs into two types, variable trade costs and fixed trade costs,2) this paper generalizes Naylor(1998) and shows that it is ambiguous whether wages increase or decrease according to product market integration. This paper shows that reduction in these two types of costs have different effects on wages. A reduction in fixed trade costs leads to an unambiguous decrease in wage, whereas a reduction in variable trade costs has an ambiguous effect on wage.

The remainder of the paper is organized as follows. The basic model is outlined in section 2. In section 3, we solves the model and derives several meaningful results. In section 4, we analyze some static comparative results and the final section concludes the paper.

## 2. The Model

Assume that there are two symmetric countries, home country and foreign country, and there is a continuum of goods produced under Cournot competition. Each good is produced by one firm in each country, and the goods are indexed on an interval, $[0, 1]$, and ranked with rising fixed costs of exporting. Not all goods are exported due to differences in this fixed cost, and goods produced in home country with index $i \in [0, \lambda]$ are exported, whereas good with $i \in [1-\lambda, 1]$ are only sold at the domestic market. Similarly, goods produced in foreign country with index $i \in [0, \lambda^*]$ are exported while goods $i \in [1-\lambda^*, 1]$ are only sold at the market in foreign country. In addition to the fixed cost of trade there is a cost, t, per unit of the good exported. In line with Brander and Krugman(1983), it is assumed that each firm considers the markets separately, i. e. goods markets are segmented, and chooses a profit maximizing quantity for each market.

Demand

Demand in home country for a specific good is given by

2) The example of variable trade costs is transportation costs, and those of fixed costs are information gathering costs about foreign market and costs for quality approval, which are independent of quantity exported.

(1) $q_i = a - bp_{i,}$

and in foreign country it is

(2) $Q_i = a - bP_{i,}$

The price at the domestic market for a good for which there is competition from foreign country is then

(3) $p_i = (a/b) - (1/b)(y_i + X_i) = \alpha - \beta(y_i + X_i), I \le \lambda^{*}.$

where the quantity $y_i$ denotes the amount of good i produced in home and sold at the domestic market. $X_i$ is the amount of good i imported from foreign to home country. For products that are not subject to foreign competition the price becomes

(4) $p_i = \alpha - \beta y_i,\ i > \lambda^{*}.$

Similarly, in foreign country the price of goods for which there is import from home is given as

(5) $p_i = \alpha - \beta(Y_i + x_i),\ i \le \lambda,$

where $Y_i$ is the amount sold by a foreign producer, and xi is the amount sold by a home producer at the foreign market. For goods that do not face competition from home firms, the price is

(6) $p_i = \alpha - \beta Y_i,\ i > \lambda,$

Firms

Each firm chooses whether to engage in export and operate at the foreign market as well as at the domestic market or just to sell goods at the domestic market. However, in order to export, the firm has to pay a fixed set up cost. This cost may be due to information gathering concerning the foreign market, or it may be costs of product approval in the foreign country. We could easily introduce fixed set up costs that must be payed in order to operate at the domestic market, but for simplicity we ignore these costs and instead assume that there is room for one firm producing each good in each country. As noted earlier, the fixed set up cost of exporting differs among firms, and the firms are ranked so that the cost is increasing in the index number of the firm.

Specifically, the fixed set up cost for home firms is given as

$$(7) \quad C_i = C(i, Z),\ \partial C/\partial i > 0,\ i \in [0, 1],$$

where Z is a vector of variables, for instance globalization variables that make access to information about foreign markets easier. There is a similar cost function for firms located in the foreign country.

The profit of an exporting firm in the home country producing good i is given as

$$(8) \quad \pi_i = p_i y_i + P_i x_i - w l_i - t x_i - C_{i,}\ i \le \lambda, \qquad (8)$$

where $l_i$ is labor input, w is the wage rate in home and t is variable trade costs. The profit of a non-exporting firm in home is

$$(9) \quad \pi_i = p_i y_i - w l_{i,\ i} > \lambda,$$

and similar profit expressions hold for the firms in the foreign country.

The labor input is simply taken to be equal to production, i. e.

$$(10) \quad l_i = y_i + x_{i,} \qquad i \le \lambda$$

$$(11) \quad l_i = y_i \qquad i > \lambda$$

and analogous expressions hold for the labor input in the foreign country.

Wage and employment

We assume that in each country there is a single trade union that covers all sectors and hence supplies workers to all firms. The trade union seeks to maximize the total income of trade union members which is equivalent to maximizing

$$(12) \quad \Omega = (w - w_a) L. \qquad (12)$$

$L = \int_0^1 l_i d_i$ is total employment in the home country, and $w_a$ is the alternative income of trade union members which may be determined by unemployment benefits, the wage in an alternative employment or disutility of work. $w_a$ is identical across countries, and the objective function of the foreign trade union takes a similar form.

For simplicity we assume that the home (foreign) trade union unilaterally sets the wage in the home (foreign) country, that is we apply the monopoly union model (see e. g. Oswald (1985)).

Game structure

The structure of actions in the model can most easily be described as a sequential game evolving over three stages. In stage 1, each firm decides whether it wants to pay the fixed set up cost, $C_i$ and becomes an exporting firm. In stage 2 the trade union in each country chooses the wage rate. Since the wages in the two countries are interdependent, we take the outcome to be a Bertrand-Nash equilibrium in wages. Finally, in stage 3, firms determine output, and when foreign and home firms supply to the same market, they engage in Cournot competition so that the outcome is a Cournot-Nash equilibrium.

## 3. Solving the model

In stage 3, firms have decided whether or not to enter the market abroad and wages have been determined. Hence, maximizing profits for the home and foreign firm in sector i (i. e. (8)), and solving for the Cournot-Nash equilibrium yields the following quantity produced by a home firm and sold at the market in home:

$$(13)\quad y_i = \frac{a + w^* - 2w + t}{3\beta}, \qquad i \le \lambda^*.$$

The quantity sold by a foreign firm in the home country is

$$(14)\quad X_i = \frac{a + w - 2w^* - 2t}{3\beta}, \qquad i \le \lambda^*.$$

Similarly, the quantity sold by a home firm at the market in the foreign country can be found to be

$$(15)\quad x_i = \frac{a + w - 2w - 2t}{3\beta}, \qquad i \le \lambda.$$

By maximizing (9), production in home of goods for which there is no foreign competition amounts to

$$(16)\quad y_i = \frac{a - w}{2\beta}, \qquad i > \lambda^*.$$

Prices at markets in the home country are now easily found to be

(17) $p_i = \dfrac{a+w+w^*+t}{3}, \qquad i \leq \lambda^*,$

and

(18) $p_i = \dfrac{a+w}{2}, \qquad i > \lambda^*.$

Similarly, prices in the foreign country are

(19) $p = \dfrac{a+w+w^*+t}{3}, \qquad i \leq \lambda,$

and

(20) $p = \dfrac{a+w^*}{2}, \qquad i > \lambda^*.$

Total labor demand in the home country turns out to be

(21) $L = \lambda^* \dfrac{a+w^*-2w+t}{3\beta}, +(1-\lambda^*)\dfrac{a-w}{2\beta} + \lambda \dfrac{a+w^*-2w+t}{3\beta}.$

In stage 2 the trade union in the home country maximizes (12) taking into account that total employment is determined as in (21), and the first order condition becomes:

(22) $(2\lambda-\lambda^*+3)a=2(\lambda+\lambda^*)w^*-2(4\lambda+\lambda^*+3)w-2(2\lambda-\lambda^*)t+(4\lambda+\lambda^*+3)w_a = 0.$

There is a similar first order condition for the trade union in the foreign country, but before solving for the equilibrium wage rates, let us turn to stage 1.

In stage 1, each firm decides whether to pay the fixed st up cost $C_i$ thereby being able to export its product. The variable profit of a firm in the home country from exporting is given as

(23) $\pi_i^{ex} = (p_i^* - w - t)x_i,$

where $p_i^*$ and xi is determined as in (19) and (15) respectively. Then if $\pi_i^{ex} \geq C_i$ the firm finds it optimal to export, whereas if $\pi_i^{ex} < C_i$ the firm chooses just to operate at the local market. Now λ can be found as the index of the firm for which the variable profit from exporting exactly covers the fixed set up cost, i.e.

(24) $\pi_{\lambda}^{ex} = C(\lambda, Z)$,

and we will assume that this defines a unique value of $\lambda$.

The firms in the foreign country face exactly the same problem, and since the two countries are symmetric, it follows that $\lambda^* = \lambda$. Wage rates must be identical across countries for the same reason, and using these facts in (22), implies that the wage rate in the Bertrand-Nash equilibrium of stage 2 becomes

$$(25) \quad w = w^* = \frac{(3+5\lambda)a+(3+5\lambda)w_a-2\lambda t}{6(1+\lambda)}.$$

By substituting for price, wage and quantity in (23), it follows from (24) that $\lambda$ in equilibrium is determined by the following condition:

$$(26) \quad \frac{1}{9\beta}\left\{\frac{(3+5\lambda)(a-?)-12t-10\lambda t}{6(1+\lambda)}\right\}^2 = C(\lambda, Z).$$

The left hand side of this expression is labelled $MB$ as it is the marginal benefit of increasing $\lambda$ in the sense that it is the variable profit from exporting of the marginal firm that chooses to become an exporting firm, i.e.

$$(27) \quad MB=\frac{1}{9\beta}\left\{\frac{(3+5\lambda)(a-?)-12t-10\lambda t}{6(1+\lambda)}\right\}^2.$$

Similarly, $C(\lambda, Z)$ can be interpreted as the marginal cost of increasing $\lambda$. $C(\lambda, Z)$ is increasing in $\lambda$ by construction, and from (27), it is easily found that MB is also increasing in $\lambda$. As illustrated in Figure 1, we assume that $\partial MB/\partial \lambda < \partial C(\lambda, Z)/\partial \lambda$ as this is necessary in order to have a stable equilibrium. If $\lambda$ as this is necessary in order to have a stable equilibrium. If $\lambda$ is lower than the equilibrium value, $\lambda^e$, then $MB > C(\lambda, Z)$, and more firms have an incentive to engage in export implying that $\lambda$ increases towards the equilibrium. Conversely, when $MB < C(\lambda, Z)$, $\lambda$ decreases.

## 4. Static comparative analysis

It is very easy to replicate the results in Huzinga(1993), Sørensen(1993) and Naylor (1993). Naylor assumes that $\lambda = 1$, which in our model is the case if $C(i, Z)$ is so low that all firms find it profitable to export their goods. Differentiating the wage rate in (25) yields

(28) $\frac{\partial w}{\partial t} \mid_{\lambda=1} = -\frac{1}{6}$.

This is exactly the Naylor result, i. e. product market integration in the sense that t decreases leads to higher wages. The intuition is that, for given wages the firms face lower costs on export goods, which tends to increase labor demand. The trade unions then exploit the higher labor demand to obtain higher wages.

In Huizinga(1993) and Sørensen(1993) there are no variable export costs (i. e. t = 0). Moreover, they compare the case where λ = 1 to the case where λ = 0, which in our model can be interpreted as a comparison of the case where C(i, Z) is sufficiently low to ensure that all firms export, to the case where *C*(i, *Z*) is sufficiently high so that no firms export. By using (25), we find that

(29) $W \mid_{t=0,\lambda=1} - W \mid_{t=0,\lambda=1} = -\frac{a - w_a}{6} < 0.$

Since $a$ > $w_a$ it follows that product market integration leads to a decrease in the wage rate. The reason is here that firms in the two countries start to compete at a common market, and this increase in the degree of competition spills over to the labor market.

The result of Huizinga and Sørensen can easily be generalized. More specifically, any change in the *Z* variables that reduces the fixed cost of trade, *C*(λ, *Z*), tends to increase the share of goods that are traded, λ. This is also seen in Figure 1; there will be a downward shift in the *C*(λ, *Z*) function implying a higher equilibrium value of λ (unless λ = *1* in which case λ will be unchanged). A higher λ in turn, affects the equilibrium wage rate, (25), in the following way :

(30) $\frac{\partial w}{\partial \lambda} = -\frac{a - w_a + t}{3(1+\lambda)^2} < 0,$

i. e. the wage rate must fall. An increase in λ corresponds to more goods being subject to international competition. This is taken into account by the trade unions, so more competition at the product markets again spills over to the labor market.

As mentioned above, Naylor assumes that λ is given and independent of t but this is in our more general set up not the case. From (27) it follows that *MB* rises if t falls, and when the *MB* curve shifts upwards, it is easily seen that λ rises( $\partial \lambda / \partial t \leq 0$). That is, when the variable cost of trade falls, then more firms find that the variable profit from exporting is sufficient to cover the fixed cost. Now, by totally differentiating the equilibrium wage rate, (25), we find that

$$(31)\quad \frac{dw}{dt} = \frac{\partial w}{\partial t} + \frac{\partial w}{\partial \lambda}\frac{\partial \lambda}{\partial t}$$
$$= -\frac{1}{6} - \frac{a - w_a + t}{3(1+\ )^2}\frac{\partial \lambda}{\partial t}$$

A reduction in variable trade costs, t, has two effects on the wage rate. First, there is the direct Naylor effect, $\partial w/\partial t$, which tends to increase wages. Second, there is the indirect effect, $(\partial w/\partial \lambda)(\partial \lambda/\partial t)$, which has a negative impact on wages through spill over effects to the labor market, that arise from the introduction of international competition for some goods. Hence, the sign of dw/dt is ambiguous as it for instance depends on the magnitude of $\partial \lambda/\partial t$. If a change in t has a great effect on λ then product market integration, modelled as a decrease in t gives rise to higher? wages. Contrary to that, if λ is not affected very much by a change in t then we have the result of Naylor, that a reduction in t increases wages.

## 5. Concluding Remarks

This paper developed a generalized model of Huizinga(1993), Sørensen(1993) and Naylor(1998), and analyzed the relationship between product market integration and wages in the unionized labor market. By considering product market integration as a reduction in trade costs, we showed that product market integration has an ambiguous effect on wages determined by labor unions. A reduction in fixed trade costs leads to an unambiguous decrease in wages, while a reduction in variable trade costs has an ambiguous effects on wages.

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