A Note on Free Trade Agreement and Wage Bargaining Structure

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Abstract

Mezzeti and Dinopoulos (1991) show that a free trade agreement (trade liberalization) decreases wage rate. However, Naylor (1998) shows that trade liberalization increases wage rate. Both papers consider tariff as exogenously given. In this paper we show that these conflicting results can be nested into a model of international duopoly with a more general wage bargaining structure. Tariff is endogenously determined in our model. In addition, we also derive crucial implications of the wage bargaining structure on the sustainability of trade liberalization.

Keywords: wage bargaining structure, optimal tariff regime, free trade agreement

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1 Introduction

Mezzeti and Dinopoulos (1991), using a Cournot international duopoly model with a domestic unionized firm and a foreign non-unionized firm, suggest that a free trade agreement (trade liberalization) decreases wage rate. However, Naylor (1998), using a Cournot international duopoly model with domestic and foreign unionized firms, shows that trade liberalization increases wage rate. Both papers consider tariff as exogenously given. In this paper we show that these conflicting results can be nested into a model of international duopoly with a more general wage bargaining structure. Tariff is endogenously determined in our model.

Further, this paper demonstrates that the union bargaining structure has important implications on the sustainability of trade liberalization. More specifically, we show that when the domestic and foreign labor markets are unionized (as in Naylor's model), the range of discount factors that support a free trade agreement is wider than when they are not unionized. This implies that it is easier for countries to form a free trade agreement when they have unionized labor markets. However, each country's welfare and the world welfare are lower when labor markets are unionized than when they are not unionized. Evidently, this generates a trade-off between sustaining a free trade agreement and maximizing welfare gains from it. If both countries' goal is to attain the highest welfare possible, then having a non unionized labor market would help countries achieving that goal. Unfortunately, it would make the free trade agreement harder to sustain. To the best of our knowledge, this is a new result in the literature.

We also show that in the case of asymmetric labor market bargaining structure in which only the domestic firm is unionized (as in Mezzeti-Dinopoulo's model), it is difficult for countries to sign a free trade agreement. This is because the unionized domestic country experiences a lower welfare under the free trade regime than under the tariff regime. The only way to sustain the free trade agreement in this particular case is to have the foreign country compensates the domestic country for the welfare losses resulted from the adoption of the free trade regime.

The rest of this paper is organized as follows. In section 2 we present the model, and in section 3 we analyze the results. Then, we discuss the role of the labor market bargaining structure in sustaining a free trade agreement in section 4. Finally, section 5 concludes the paper.

2 The model

There are two countries indexed by $i \in (1, 2)$. We label country 1 and 2 as respectively domestic country and foreign country. Each country has one firm and one labor union representing its workers. Firms produce a homogenous goods and compete in both markets. In the case of export, firm i pays tariff of t_j $(i \neq j)$ per unit of exports. The inverse market-demand function

is linear in the form of;

$$p_1 = 1 - x - y \tag{1}$$

$$p_2 = 1 - u - v \tag{2}$$

where p_i is country i's market price; x and v are quantities sold by firm 1 in country 1 and 2 respectively; and y and u are quantities sold by firm 2 in country 1 and 2 respectively. Labors are needed in the production of the goods. We assume that the technology exhibits a *one-to-one* relationship between output and labor, i.e., $l_1 = x + u$ and $l_2 = v + y$. The wage rate is denoted by w_i. Other than labor costs there are no costs incurred in the production process. A labor union in a country concerns about the total wage, $l_i w_i$, received by its members, where l_i is firm i's derived demand for labor. The labor union and the firm in a country bargain over wage only.[1] For simplicity, we normalize the disagreement payoffs to zero.[2]

The sequence of events is as follows. In stage 1, under an optimal tariff regime, each government sets its tariff (t_i) to maximize its national welfare, whereas under a free trade regime, both governments agree to set a zero tariff. In stage 2, the union and the firm in each country bargain over wage (w_i). Finally, in stage 3, firms compete in a Cournot fashion and set their optimal outputs $(x, y, u$ and $v)$. We solve the game using backward induction.

Stage 3

Firms' profits are;

$$\pi_1 = x(1 - x - y - w_1) + u(1 - u - v - w_1 - t_2) \tag{3}$$

$$\pi_2 = v(1 - u - v - w_2) + y(1 - x - y - w_2 - t_1) \tag{4}$$

Cournot-Nash quantities can be derived as; $x = \frac{1}{3}(1 - 2w_1 + w_2 + t_1)$; $u = \frac{1}{3}(1 - 2w_1 + w_2 - 2t_2)$; $v = \frac{1}{3}(1 - 2w_2 + w_1 + t_2)$; and $y = \frac{1}{3}(1 - 2w_2 + w_1 - 2t_1)$. Hence, profits of both firms can be simplified into $\pi_1 = x^2 + u^2$ and $\pi_2 = v^2 + y^2$.

Stage 2 The wage bargaining process between a union and a firm follows a generalized Nash bargaining framework. Thus, the wage is determined by the following maximization problem.

$$\max_{w_i} (l_i w_i)^{\beta_i} (\pi_i)^{1-\beta_i} \tag{5}$$

,where $\beta_i \in [0, 1]$ indicates the bargaining power of the labor union in country i. It is obvious that the case of $\beta_i = 0$ is equivalent to the case of non-unionized labor market.

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[1] There are two modelling approaches on the union bargaining. The first approach assumes that unions and firms bargain over the wage and then firms respond by determining employment according to their labor demand function. The second approach assumes that unions and firms bargain over the wage and employment. Layard et al. (1991) argue that bargaining over employments is rarely observed and hence it is not quite realistic to be used as a modelling approach. Furthermore, they also show that the wage rate determined under the employment bargaining model will eventually approach the wage rate determined under the wage bargaining model. For these reasons, in this paper we use the wage bargaining approach.

[2] In an earlier version of the paper, we consider a positive outside option. Unfortunately, such a consideration made the analysis overly complicated without adding new insights.

Stage 1 Under a free trade regime, each government sets a zero tariff, $t_i = 0$. Under an optimal tariff regime, each government sets t_i to maximize its welfare. We define country i's national welfare, W_i, as the sum of consumers' surplus, the producer's surplus, the union's total wage bills, and the government's tariff revenue;

$$W_i = \frac{1}{2}(1 - p_i)Q_i + \pi_i + l_i w_i + t_i q_i \tag{6}$$

,where Q_i denotes total outputs in country i ($Q_i = x + y$ if $i = 1$, and $Q_i = u + v$ if $i = 2$), and q_i denotes imports ($q_i = y$ if $i = 1$, and $q_i = u$ if $i = 2$).

3 Results and Analysis

Solving the maximization problem at stage 2 for all possible values of $\beta_i \in [0,1]$ yields overly complicated high-order polynomials wage reaction-functions. Therefore, without loss of generality and in order to simplify the analysis, we focus on the following three most interesting cases.

Case 1 *Unionized Labor Markets ($\beta_1 = \beta_2 = 1$)*

Case 2 *Non-Unionized Labor Markets ($\beta_1 = \beta_2 = 0$)*

Case 3 *Unionized Domestic Labor Market and Non-Unionized Foreign Labor Market ($\beta_1 = 1$, $\beta_2 = 0$).*

Note that case 1 is similar to the one analyzed by Naylor (1998), whereas case 3 is similar to the one analyzed by Mezzeti and Dinopoulous (1991). The case of $\beta_1 = 0$ and $\beta_2 = 1$ is the mirror image of case 3, hence it suffices to focus only on case 3. Table 1 summarizes all results.[3]

	The Optimal Tariff Regime			The Free Trade Regime		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
t_1	0.26	0.33	0.36	0	0	0
t_2	0.26	0.33	0.22	0	0	0
w_1	0.29	0	0.24	0.33	0	0
w_2	0.29	0	0	0.33	0	0
x	0.32	0.44	0.29	0.22	0.33	0.17
u	0.06	0.11	0.25	0.22	0.33	0.17
v	0.32	0.44	0.49	0.22	0.33	0.42
y	0.06	0.11	0.18	0.22	0.33	0.42
W_1	0.31	0.40	0.33	0.35	0.44	0.31
W_2	0.31	0.40	0.41	0.35	0.44	0.52
$W_1 + W_2$	0.62	0.80	0.74	0.70	0.88	0.82

Table 1: Equilibrium Results

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[3]The complete derivations of results can be obtained from us upon request.

Proposition 1 (a) *Moving from the case of non-unionized labor markets to the case of unionized labor markets increases w_1 and w_2; and decreases t_1 and t_2 (b) Moving from the case of non-unionized labor market to the case of unionized domestic labor market and non unionized foreign labor market increases both w_1 and t_1 and decreases t_2. However, it does not change w_2.*

The intuition for the decrease in tariff levels in point (a) is quite straightforward. When labor markets become unionized, firms' labor costs increase. Firms will then reduce their output. This leads to a higher price of the goods and lower firms' profits. Obviously, the consumers' surplus decreases. By reducing the tariff barrier imposed on the foreign exporter, governments can offset the increase in the domestic price and improve the consumers' surplus.

The intuition for point (b) is also straightforward. Here, the foreign firm does not face any labor cost pressure, instead the domestic firm does. Consequently, the foreign firm can increase its output sold in both domestic and export markets, whereas the domestic firm faces a difficulty in doing so. Since the volume of foreign imports increases, the domestic welfare can be further boosted by increasing the tariff level imposed on the foreign firm. This enables the domestic country to enjoy higher terms of trade gains. Meanwhile, the foreign country whose labor market is non-unionized can further lower its tariff barrier in order to attract more exports from the domestic firm and thus to gain higher tariff revenues.

By comparing the optimal tariff regime and the free trade regime (the trade liberalization regime), it can be seen that the impacts of a trade liberalization on wages are not necessarily the same in case 1 and case 3. In case 1 a trade liberalization leads to a wage increase, while in case 3 a trade liberalization leads to a decrease in the country 1's wage and no change in country 2's wage. The former result is equivalent to that of Naylor (1998), while the latter is equivalent to that of Mezzeti and Dinopoulos (1991). Our analysis thus shows that both conflicting results can be nested in our model which has a more generalized union bargaining structure. In addition to our previous result, we also have the following result.

Proposition 2 (a) *As long as countries are symmetric in terms of the union bargaining power, the world welfare is higher under the free trade regime than under the optimal tariff regime, regardless of the bargaining strength of labor unions. (b) However, if countries are asymmetric, i.e. $\beta_1 = 1$ and $\beta_2 = 0$, then country 1's welfare is smaller and country 2's welfare is higher under the free trade regime than under the optimal tariff regime.*

As is conventionally accepted, a free trade regime usually increases the aggregate welfare level. However, in case 3 above the domestic country with the unionized labor market suffers welfare losses when it moves from the optimal tariff regime to the free trade regime. The main reason is that the loss in the firm's profits due to the presence of unionization is exacerbated by the terms of trade deterioration brought about by the free trade regime. The results clearly

point out that when countries are asymmetric in terms of the labor market bargaining structure, it is hard to sustain a free trade agreement between the two countries, even if they know that the free trade regime may increase the world welfare as a whole. To facilitate and sustain the agreement, the foreign country needs to compensate the domestic country for the welfare losses.

4   The Sustainability of a Free Trade Agreement

Proposition 2 shows that there is indeed an important relationship between the labor market bargaining structure and trade liberalization. In a static setting it is known that sustaining a free trade agreement is difficult because a country may be tempted to deviate from the agreement at the expense of the other country. However, in a repeated setting it is possible to find a condition for which a free trade agreement is sustainable. The following section analyzes such an environment.

We focus on cases 1 and 2, in which a free trade agreement is mutually beneficial for both countries. Denote a country's gains and losses from a deviation by respectively,

$$G(\beta_1, \beta_2) = W_1(t_1; 0 \mid \beta_1, \beta_2) - W_1^f(0; 0 \mid \beta_1, \beta_2)$$
$$L(\beta_1, \beta_2) = W_1^f(0; 0 \mid \beta_1, \beta_2) - W_1(t_1; t_2 \mid \beta_1, \beta_2)$$

We assume that the punishment scheme for a deviation follows the *grim trigger-strategy*. Thus, when a country deviates, there will be a retaliation that lasts forever by the other country. Since the model is symmetric, the result for country 1 applies to country 2 as well. Here t_1 and t_2 denote the optimal tariff levels. A free trade agreement is self-enforcing if and only if,

$$G(\beta_1, \beta_2) \leq \frac{\lambda}{1 - \lambda} L(\beta_1, \beta_2).$$

This condition implies that the gains from a deviation should not exceed the losses from a retaliation by the other country. Note that $\lambda \in [0, 1]$ represents countries' time preference (or discount factor). Solving for λ enables us to derive the threshold level of the discount factor that will sustain the free trade agreement. The threshold values under cases 1 and 2 can be straightforwardly derived as respectively, $\lambda_{case\ 1} \geq 0.43$ and $\lambda_{case\ 2} \geq 0.56$.[4]

It is obvious that when labor markets become unionized, it is *easier* for both countries to sustain the free trade agreement. There will be a wider range of the discount factors that can sustain the free trade agreement. This is because as labor markets become unionized, the optimal tariff levels decrease (see Proposition 1). Hence, the relative size of gains from a deviation decreases, which implies that the threshold of the discount factor that sustains the free trade agreement becomes smaller. However, the resulting world welfare and both countries'

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[4]We also analyzed the case of $\beta_1 = \beta_2 = \frac{1}{2}$. After some tedious numerical analysis using Mathemathica, we obtain $\lambda = 0.46$ as the corresponding threshold value of the discount factor. The complete derivation is available upon request. This result seems to suggest that the threshold of the discount factor is decreasing in the strength of labor unions' bargaining power

welfare will be smaller when labor markets are unionized (see Proposition 2). The following proposition summarizes our result.

Proposition 3 *As long as countries are symmetric in terms of the union bargaining power, it is relatively easier for countries to sustain a free trade agreement when labor markets are unionized than when they are not unionized. However, the resulting welfare when labor markets are unionized is smaller than when they are not unionized.*

Thus, there is a trade-off for both countries. On the one hand, in order to facilitate an easier formation of a free trade agreement, it is better for countries to have a unionized labor market. On the other hand, however, both countries' welfare will be smaller when labor markets are unionized than when they are not unionized.

5   Concluding Remarks

This paper analyzes the relationship between the labor market bargaining structure and trade liberalization. We first investigate the impact of trade liberalization on wage rate. In the literature, there are two conflicting views on it. Mezzetti and Dinopolous (1991) argue that trade liberalization decreases wage rate, whereas Naylor (1998) argues that trade liberalization increases wage rate. We show that these two conflicting results can be nested into a model of international duopoly with a more general wage bargaining structure. Furthermore and more importantly, using our model we investigate the relationship between the labor market bargaining structure and the sustainability of trade liberalization, i.e. a free trade agreement. We show that it is easier to sustain a free trade agreement when labor markets in both countries are unionized then when they are not unionized. However, each country's welfare under the former is lower than under the latter. This generates a trade-off between sustaining a free trade agreement and maximizing welfare.

References

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