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ABSTRACT

Trade, FDI and Unions*

In this Paper we study the location behaviour of a foreign and a domestic footloose firm competing in output in the domestic product market. Both firms produce a homogenous good using a labour intensive technology. While the domestic country is unionized, the foreign country is not. Location equilibria are studied as a function of the foreign wage level, both under free trade and under an optimal domestic trade policy. We find that when foreign wage levels are relatively low, both firms agglomerate in the foreign market (North-South FDI) and the optimal government intervention by the North is a zero tariff on imports from the South. For intermediate wage levels abroad, both firms prefer to locate in their own market and the optimal domestic government intervention is a positive tariff on foreign imports. For relatively high foreign wage levels, the optimal tariff policy is such that both firms agglomerate in the domestic country (North-North FDI).

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NON-TECHNICAL SUMMARY

In this Paper we show that a domestic government, acting in the interest of social welfare, wants to affect firms' location decisions through trade policy. Our model consists of two firms, a home and foreign, that both supply the home market. While the home country is unionized, the foreign country is not. We present the results as a function of the relative wage cost in the two countries allowing for productivity differences. When a domestic firm considers location in a very low wage foreign country, the domestic government allows the firm to go without intervention because the additional profits they can earn abroad outweigh the union rent lost in the domestic country. As long as the wage difference between the foreign location and the home country is large enough, the government does not have an incentive to affect that location behaviour.

For an intermediate range of foreign wage levels, where the home firm still wants to move abroad, the domestic government opts for a positive tariff that actually serves three different purposes. On the one hand, the tariff on imports is meant to prevent the domestic firm from moving abroad and serving the domestic market from a distance. In addition, the tariff is aimed at rent extraction from the foreign firm. And at the same time the tariff is set low enough in order not to trigger tariff jumping by the foreign firm. The trade policy literature has mainly been focussed on the rent-extracting incentive for protection. Our model shows however, that a tariff may also be aimed at dissuading domestic firms from serving home markets from a distance, an argument for import protection that has been overlooked so far. By using an optimal trade policy, the home country can avoid the losses that would occur under free trade as a result of outward FDI. The domestic trade policy for this intermediate range of foreign wage costs is mainly driven by the loss in union rent in the case of domestic firm production abroad. For this intermediate range of foreign wage costs, the increase in domestic firm profit from moving abroad can not overcome the loss in union rent.

Our model is an illustration of a situation where the domestic firm loses from domestic import protection while the union gains. This may seem counterintuitive at first since protection against imports is often regarded in the interest of domestic producers. But here we show that when the domestic firm is a footloose firm, this need not be the case. Arguably, our model could be used to understand why the opening of Central Europe did not initially induce many West European firms to locate assembly activities there. Our model suggests that the many antidumping duties in place on imports from Central Europe may partly explain the less than expected relocation of EU manufacturing activities. While wage differences were in principle large enough for EU firms to set up production in Central Europe and to serve the EU from a distance, the use of EU antidumping protection may have

prevented that outward FDI of West European firms. The same argument may apply to Mexico for US firms before NAFTA.

The results also indicate that for imports from relatively high wage countries, the optimal domestic trade policy is to set a tariff such that tariff-jumping by the foreign firm into the domestic market will occur. The reason is that by attracting foreign investors, union rents will go up. Both wages and employment in the domestic country will increase as a result of inward FDI. This implies that the cost difference between the home and the foreign firm becomes too small for rent-extraction through an import tariff to be interesting. A tariff to encourage tariff-jumping is more interesting because the increase in union rent as a result of inward FDI is now higher than the amount of rent the domestic government could have extracted through an import tariff. This result could at least explain in part why tariff levels and antidumping duties from the US and the EU against a country like Japan have always been high. Our model suggests that the tariffs and duties may have been set in order to attract inward Japanese FDI both in the EU and US.

Our findings may also explain why a positive relationship between tariff levels and tariff-jumping FDI is difficult to establish empirically (Blonigen, 1998; Belderbos, 1997). Our model shows that a negative relationship between tariffs and inward FDI is possible. We find that high tariffs will occur in the regime with no FDI whereas low tariffs will occur in the regime with inward FDI. This provides an explanation for why a negative correlation between tariffs and inward FDI can be observed in the empirical data. Note also that for a high foreign wage cost, the 'threat' of protection is sufficient to trigger inward FDI. Actual protection in this case will never be observed. Nevertheless, it is the threat of the import tariff that persuades the foreign firm to locate in the home market. This suggests that empirical studies trying to establish a link between protection and FDI should use indicators for the 'threat' of protection or a measure of a 'government's willingness' to take protection, rather than actual tariffs or duties.

According to the traditional view, FDI and trade are substitutes since the relocation of production facilities abroad was generally thought to correspond with a reduction in the trade flows. Our findings suggest however, that trade and FDI may be complements since when outward FDI occurs in our model, trade follows FDI. After the home firm has relocated a trade flow arises that previously was not there. Recent empirical evidence also goes in the direction that FDI need not necessarily reduce trade flows.

1. Introduction

According to the Economist (October 3rd 1998) the growth in FDI between 1990 and 1997 was about 100%, compared to a growth figure of 'only' 60% of trade in dollars. Further evidence suggests that while most FDI still goes to developed countries, a growing share is going to developing countries. The empirical importance of FDI has triggered a growing number of both empirical and theoretical papers trying to identify the determinants of FDI. An early empirical study by Lun (1980) on US FDI in the EC concluded by stating that 'FDI is concerned with the decisions made by the managers of large multinational firms (MNEs) and the best way to study FDI is to study MNEs'. Since MNEs are usually large firms with market power, theoretical analysis has predominantly relied on the use of imperfect competition to study their behaviour, and this is also the purpose of our paper.

We develop a simple partial equilibrium model that could easily be embedded into a more elaborate general equilibrium model, consisting of two footloose firms, one domestic and one foreign. The firms sell a homogenous product and engage in output competition in the domestic market but can locate either in the domestic or in the foreign country. Focussing on the domestic product market is similar to assuming that the foreign product market size is relatively small which greatly facilitates the analysis. We assume the domestic country to be unionised with a monopoly union setting the wage for the imperfectly competitive sector. The domestic wage level is endogenous depending upon the number of firms that locate in the domestic market. The wage in the foreign country is exogenous and can be higher or lower than the domestic wage level.

We first study the firms' location pattern in the case of free trade. FDI, both inward and outward are however not always in the domestic country's interest. Since there is a strong presumption that tariff barriers to trade directly affect FDI, we allow the domestic

government to use a tariff to affect firms' locations. Although under current WTO rules it is increasingly difficult for a country or trade bloc to unilaterally impose a tariff, the use of alternative protection in the form of antidumping measures for example continues to be possible.

The trade off both firms are facing is whether to produce in the foreign country at a competitive wage, but possibly incurring a tariff cost when shipping their goods to the domestic country, or to produce in the domestic country at a wage set by the monopoly union for the entire industry. We find that when foreign wage levels are relatively low, both firms agglomerate in the low wage foreign country, a scenario we refer to as North-South FDI. Both firms then serve the domestic market from a distance. The tariff both firms are facing when shipping their goods to the North turns out to be zero, since the domestic government does not find it in the interest of social welfare to levy a tariff on imports.

For intermediate wage levels abroad, both firms prefer to stay in their own market. The foreign firm serving the domestic market from a distance faces a positive tariff. This tariff serves several purposes. On the one hand it is meant to dissuade the domestic firm from locating in the foreign country. On the other hand it is also aimed at rent-extraction from the foreign firm but at the same time avoiding tariff-jumping. We show this tariff level always to be lower or equal to the tariff that would be set when the foreign firm would have a fixed location. For relatively high foreign wage levels, the optimal domestic tariff in the presence of monopoly unions is aimed at tariff-jumping such that both firms agglomerate in the domestic country, a scenario we refer to as North-North FDI. The reason is that from a certain level of the foreign wage onwards, a monopoly union is in a better position to extract rent from the foreign firm than a tariff.

The empirical evidence on the importance of relative wage costs in explaining FDI is mixed. While Barrell and Pain (1996) find a significantly positive relationship between the level of US unit labour cost and the level of outward investment, Wheeler and Moody (1992) find labour costs to be relatively unimportant in explaining US FDI. Norman (1998) suggest that it may be difficult to generalise about push and pull factors of FDI since they may vary across sectors. Case evidence definitely suggests that for a number of activities wage costs play a crucial role in choosing location. Recently, four well known MNE's (Renault, Levis Jeans, Duparc stockings and Boston Scientific) relocated their activities from Belgium to low wage countries, publicly stating that the high Belgian wage costs were the reason for their departure.¹

Our paper is one of the few that looks at the effect of unions on FDI. Other papers in this area are a theoretical analysis by Bughin and Vannini (1995) that finds that central union bargaining, whereby the MNE is subject to union wage setting, acts as an effective deterrent for FDI. Also, a recent empirical paper by Pain and Wakelin (1998) suggests a negative relationship between unionisation and the degree of US FDI in Europe.

The evidence on the effect of tariff barriers is more divided. Blonigen (1997) and Belderbos (1997) find only weak empirical evidence of antidumping tariff jumping FDI by Japanese firms in the US and the EC respectively. This goes against what one would expect on the basis of the conventional trade theory. However, This 'empirical puzzle' as Blonigen (1997) puts it, becomes less puzzling in a framework that allows firms to engage in FDI in response to the 'threat' of tariff protection in their export market. From our analysis it is clear that the threat of protection can be sufficient to trigger inward FDI, in which case a tariff is never actually observed.

The analysis we present below draws upon three strands of literature which differ in their degree of maturity. The first consists of the theory of trade policy under oligopoly (Brander and Spencer, 1981) that has been developed since the early nineteen eighties. In this literature firms are assumed to have fixed locations and the existence of footloose firms is largely ignored. In contrast, the role of the government in setting optimal trade policy is well developed. One of the main results arising from this literature is that a domestic government has an incentive to unilaterally set an optimal rent-extracting tariff on foreign imports, thereby increasing domestic welfare. In our model we allow both firms to be footloose and show that the optimal trade policy is always lower or equal in the case of footloose firms than in the case of firms with fixed location.

A second strand of literature we draw upon is the one that studies the decision of firms either to provide a distant market through exports or to engage in FDI (Smith, 1987; Horstmann and Markusen, 1992; Rowthorn, 1992; Motta, 1992; and Bughin and Vannini, 1995). In this literature the equilibrium location of firms typically depends on the level of the fixed costs and the wage rate abroad versus the transport and tariff costs. The role of product differentiation has also been discussed more recently (De Fraja and Norman, 1998 and Cordella and Grilo (1998)). Typically in this literature it is assumed that the role of the government is limited. Tariff barriers usually consist of a parameter varying between zero and the prohibitive level in order to model extreme degrees of market integration.

A third strand of literature we draw upon is concerned with the effect of economic integration on labour markets (Mezzetti and Dinopoulos 1991; Huizinga 1992; Wes 1995; Bughin and Vannini, 1995; Naylor, 1998; and Zhao, 1995). A number of papers have argued that firm mobility curbs union power and leads to lower wages (Mezzetti and Dinopoulos,

1991; Wes, 1995; and Zhao, 1995). This result is obtained when the location decision of firms occurs after unions bargain over wages. In the model we develop below we assume a domestic monopoly union to set the wage after the location decision of the firms which excludes the ‘threat of relocation’ possibility of firms vis-a-vis the domestic union. An interesting extension of our present analysis however would consist in reversing these two stages.

At least three important insights evolve from this paper. First, in the presence of domestic union rents, a tariff that deters outward FDI by a domestic firm can be welfare improving. Similarly we can also say that in the presence of domestic unions, a tariff that induces inward FDI can be welfare improving. Second, when firms are footloose, the optimal domestic tariff is always lower or equal to the tariff policy in the absence of relocation possibilities. Third, our findings support the notion that trade and FDI are not substitutes. When the domestic firm locates in the foreign country, FDI results in an increase rather than a reduction in cross border trade flows. The complementary nature of FDI and trade largely absent in traditional trade theory, has also been established empirically (Pain and Wakelin, 1998).

2. The Model

In a two-country model, the home market is supplied with a homogeneous product by a Cournot duopoly consisting of a home firm and a foreign firm. The home firm, labelled as firm one, is owned by shareholders in the home country while the foreign firm, labelled as firm two, is owned by shareholders in the foreign country. Each firm has to decide where to locate production. The wage for the imperfectly competitive sector in the home country is set by a monopoly union that maximises union rent, while the labour market in the foreign

country is perfectly competitive. All consumption of the oligopolistic product occurs in the home market where the market price, P , is given by the linear inverse demand function: $P = \alpha - \beta(q_1 + q_2)$ where q_1 is the output of firm one and q_2 is the output of firm two. Total production in the home country is q_H while total production in the foreign market is q_F so $q_H + q_F = q_1 + q_2$. The labour required to produce one unit of the oligopolistic product is a_H in the home country and a_F in the foreign country. The wage set by the monopoly union in the home country is w_H while the competitive wage is \bar{w}_H in the home country and w_F in the foreign country. Hence, the unit labour cost of the oligopolistic industry is $\omega_H = a_H w_H$ in the home country and $\omega_F = a_F w_F$ in the foreign country.² Unit labour costs in the two countries may differ due to differences in productivity and/or wage rates.

Although our model has a strong partial equilibrium flavour, we implicitly assume the existence of a perfectly competitive numeraire sector that pays the competitive wage rate in both countries. The numeraire sector is assumed to absorb labour freed up in the imperfectly competitive sector at the competitive wage rate. Trade in the numeraire good also ensures that trade between the two countries is balanced.

In terms of the labour market, we assume that domestic workers in the oligopolistic sector belong to a monopoly union that sets the wage rate to maximise union rent while foreign workers are not unionised and are paid the competitive wage rate.

As usual in the literature on trade under imperfect competition, we assume quasi-linear preferences for the domestic consumers so that income effects are zero and hence consumer surplus is a valid welfare measure. Relaxing this assumption and allowing for income effects could lessen or strengthen the results we get but would not change the direction of the results. This assumption implies that domestic workers surplus and shareholders profits do not affect

total demand. This is equivalent to assuming that the number of domestic workers and shareholders in the oligopolistic industry is small compared to the total number of consumers.

The structure of the game is as follows: At stage one, the home government sets a tariff to maximise the social welfare of the home country. Then, at the second stage, the two firms each decide either to locate in their own country or to locate production in the other country³. Wherever each firm decides to locate, both the home and the foreign country involve a fixed cost which we will not explicitly take on board in the analysis but which secures that production will only take place in one location (either the home country or the foreign country). After the firms have committed to their locations, in the third stage of the game, the monopoly union in the home country sets its wage to maximise its union rent. Finally, at the fourth stage of the game, the firms compete as Cournot duopolists taking the union wage and the tariff as given. As usual, the game is solved by backward induction to obtain the sub-game perfect equilibrium.

In the final stage of the game, the two firms compete as Cournot duopolists taking as given the tariff (t), the union wage (w_H) in the home country and the fixed cost (F) which is equal in both the home and the foreign country.⁴ As costs depend upon location, the profits of the two firms will depend upon where the firms are located. Hence, the profits of the two firms are:

$$\begin{aligned} \pi_1 &= \begin{cases} (P - \omega_H)q_1 - F & \text{if firm 1 locates in the home country} \\ (P - \omega_F - t)q_1 - F & \text{if firm 1 locates in the foreign country} \end{cases} \\ \pi_2 &= \begin{cases} (P - \omega_F - t)q_2 - F & \text{if firm 2 locates in the foreign country} \\ (P - \omega_H)q_2 - F & \text{if firm 2 locates to the home country} \end{cases} \end{aligned} \quad (1)$$

Each firm independently and simultaneously sets its output to maximise its profits, and this yields the first-order conditions for profit maximisation. Since demand is assumed to be

linear, it is straightforward to solve for the Cournot equilibrium outputs and market price in the four possible outcomes:

Equation (2)	Firm 1 stays in home country	Firm 1 relocates to foreign country
Firm 2 stays in the foreign country	$q_1^{SS} = (\alpha - 2\omega_H + \omega_F + t)/3\beta$ $q_2^{SS} = (\alpha + \omega_H - 2\omega_F - 2t)/3\beta$ $P^{SS} = (\alpha + \omega_H + \omega_F + t)/3$	$q_1^{RS} = (\alpha - \omega_F - t)/3\beta$ $q_2^{RS} = (\alpha - \omega_F - t)/3\beta$ $P^{RS} = (\alpha + 2\omega_F + 2t)/3$
Firm 2 relocates to the home country	$q_1^{SR} = (\alpha - \omega_H)/3\beta$ $q_2^{SR} = (\alpha - \omega_H)/3\beta$ $P^{SR} = (\alpha + 2\omega_H)/3$	$q_1^{RR} = (\alpha + \omega_H - 2\omega_F - 2t)/3\beta$ $q_2^{RR} = (\alpha - 2\omega_H + \omega_F + t)/3\beta$ $P^{RR} = (\alpha + \omega_H + \omega_F + t)/3$

At the third stage of the game, the monopoly union in the home country sets its wage to maximise union rent given the locations of the firms. Union rent is equal to the total wage premium paid to union members: $U = (w_H - \bar{w}_H)l_H$, where employment in the oligopolistic sector is $l_H = a_H q_H$, so in terms of the unit labour cost: $U = (\omega_H - \bar{\omega}_H)q_H$, where $\bar{\omega}_H \equiv a_H w_H$ is the competitive unit labour cost in the home country. Obviously, if both firms are located in the home country then the monopoly union is in a strong position whereas if no firms locate in the home country then it has no monopoly power whatsoever. Maximising union rent with respect to the unit labour cost yields the following first-order condition:

$$\frac{\partial U}{\partial \omega_H} = q_H + (\omega_H - \bar{\omega}_H) \frac{\partial q_H}{\partial \omega_H} = 0 \quad (3)$$

Since the Cournot equilibrium outputs (2) are linear functions of the unit labour cost it is straightforward to solve this first-order condition in the four possible outcomes for the monopoly unit labour cost in the home country:

Equation (4)	Firm 1 stays in home country	Firm 1 relocates to foreign country
Firm 2 stays in the foreign country	$\omega_H^{SS} = (\alpha + 2\bar{\omega}_H + \omega_F + t)/4$	$\omega_H^{RS} = \bar{\omega}_H$
Firm 2 relocates to the home country	$\omega_H^{SR} = (\alpha + \bar{\omega}_H)/2$	$\omega_H^{RR} = (\alpha + 2\bar{\omega}_H + \omega_F + t)/4$

Having solved for the Cournot equilibrium outputs, market price, and the monopoly-unit labour cost, (2) and (4), it is now possible to solve for the maximised profits of the two firms in the four possible outcomes:

At the second stage of the game, the firms have to decide whether to locate in their own country or locate in the other country. Depending upon relative unit labour costs in the two countries there are three possible outcomes. First, for relatively low foreign wage levels, we get a location equilibrium that we refer to by *Outward FDI* because this is a Nash equilibrium where the home firm decides to locate production to the foreign country. Secondly, for intermediate foreign wage levels, we get the *No FDI* outcome where both firms produce in their own country. And thirdly, for relatively high foreign wage levels we get a location equilibrium of *Inward FDI* where the foreign firm locates production to the home country.⁵

Equation (5)	Firm 1 stays in home country	Firm 1 relocates to foreign country
Firm 2 stays in the foreign country	$\Pi_1^{SS} = \frac{(\alpha - 2\bar{\omega}_H + \omega_F + t)^2}{36\beta} - F$ $\Pi_2^{SS} = \frac{(5\alpha + 2\bar{\omega}_H - 7\omega_F - 7t)^2}{144\beta} - F$	$\Pi_1^{RS} = \frac{(\alpha - \omega_F - t)^2}{9\beta} - F$ $\Pi_2^{RS} = \frac{(\alpha - \omega_F - t)^2}{9\beta} - F$
Firm 2 relocates to the home country	$\Pi_1^{SR} = \frac{(\alpha - \bar{\omega}_H)^2}{36\beta} - F$ $\Pi_2^{SR} = \frac{(\alpha - \bar{\omega}_H)^2}{36\beta} - F$	$\Pi_1^{RR} = \frac{(5\alpha + 2\bar{\omega}_H - 7\omega_F - 7t)^2}{144\beta} - F$ $\Pi_2^{RR} = \frac{(\alpha - 2\bar{\omega}_H + \omega_F + t)^2}{36\beta} - F$

When describing the three equilibria listed above we will use the *No FDI* equilibrium, for intermediate foreign wage levels, with each firm located in its own market, as a point of reference. A change to that equilibrium (regime) either involves the home firm moving abroad or the foreign firm moving in the home country's borders, hence the labels *inward FDI* and *outward FDI* respectively.

Outward FDI is a Nash equilibrium if $\Pi_1^{RS} > \Pi_1^{SS}$ and $\Pi_2^{RS} > \Pi_2^{RR}$ but, since $\Pi_1^{RS} = \Pi_2^{RS}$ and $\Pi_1^{SS} = \Pi_2^{RR}$, these two inequalities are equivalent; hence, outward FDI is a Nash equilibrium if unit labour costs in the foreign country are sufficiently low: $\omega_F + t < A \equiv (\alpha + 2\bar{\omega}_H)/3$. No FDI is a Nash equilibrium if $\Pi_1^{SS} > \Pi_1^{RS}$ and $\Pi_2^{SS} > \Pi_2^{SR}$; hence, no FDI is a Nash equilibrium if $A < \omega_F + t < B \equiv (3\alpha + 4\bar{\omega}_H)/7$. Inward FDI is a Nash equilibrium if $\Pi_1^{SR} > \Pi_1^{RR}$ and $\Pi_2^{SR} > \Pi_2^{SS}$ but, since $\Pi_1^{SR} = \Pi_2^{SR}$ and $\Pi_1^{RR} = \Pi_2^{SS}$, these two inequalities are equivalent; hence, inward FDI is a Nash equilibrium if unit labour costs in the foreign country are sufficiently high: $\omega_F + t > B$.

Proposition 1. Outward FDI by the home firm occurs if $\omega_F + t < A$; no FDI occurs if $A < \omega_F + t < B$; and inward FDI by the foreign firm occurs if $\omega_F + t > B$.

Note that outward FDI occurs if the foreign unit labour cost is less than the monopoly unit labour cost in the home country. With inward FDI, the foreign firm realises that if it relocates to the home country then the monopoly unit labour cost in the home country will increase as inward FDI increases the power of the monopoly union. Therefore, inward FDI will not occur when the monopoly unit labour cost in the home country is just less than the foreign unit labour cost. Only when the monopoly unit labour cost in the home country is significantly lower than the foreign unit labour cost will the foreign firm have an incentive to relocate. Thus, there is a region where no FDI occurs.

In the next section we analyse firms' private location incentives under free trade ($t=0$). In section 4 we then analyse to what extent the domestic government by means of a tariff policy may want to affect firms' private location decisions in the interest of social welfare.

3. Free Trade

Let us start by analysing the effects of outward and inward FDI on consumer surplus, profits, union rent, and welfare under free trade, $t = 0$. Above it was shown that as the foreign unit labour cost rises there are regime switches from outward FDI to no FDI then from no FDI to inward FDI. Again in our description of the welfare components we will use the No FDI regime as a point of reference. The jumps in variables that occur at the regime switches will be interpreted as the effects of inward or outward FDI. The analytical results that are presented are entirely general for the particular functional form of linear demand, but

particular parameter values will be used to illustrate these results in a number of graphs (the particular parameter values are $\alpha = 10$, $\beta = 1$, $\bar{\omega}_H = 1$, $a_H = a_F = 1$, and $F = 0$).

From proposition 1 it is clear that for $t = 0$ there are two critical values of ω_F labelled as A and B , where regime switches occur. These regime switches at A and B are illustrated in figure 4 where the free trade situation applies along the horizontal axis for $t=0$. It is good to keep in mind that for all foreign unit costs below A , there is *outward FDI*. In this regime both firms agglomerate in the foreign country where wages are low (so called North-South FDI). For all foreign labour costs ranging between A and B , there is *No FDI*, with each firm staying in its own market. And the third regime of *inward FDI* occurs for all foreign labour costs higher than B with the foreign firm relocating to the home country. Hence for high foreign labour costs we get a regime where both firms agglomerate in the home country (so called North-North FDI). The corresponding domestic wage level in each of the equilibria described above can be found by looking at the corresponding scenarios listed in equation 4.

We now analyse all the welfare components in these three FDI regimes under free trade starting with firms' profits.

The profits of home firm under free trade for the three FDI regimes can be shown to be:

$$\Pi_1^{FT} = \begin{cases} (\alpha - \omega_F)^2 / 9\beta - F & \text{if } \omega_F < A \\ (\alpha - 2\bar{\omega}_H + \omega_F)^2 / 36\beta - F & \text{if } A < \omega_F < B \\ (\alpha - \bar{\omega}_H)^2 / 36\beta - F & \text{if } \omega_F > B \end{cases} \quad (6)$$

Figure 1 shows the profits of firm one as a function of the foreign labour cost for the particular parameter values. In general, the profits of the home firm are continuous at point A where $\Pi_1^{FT} = 4(\alpha - \bar{\omega}_H)^2 / 81\beta - F$ so *outward FDI* has no effect on the profits of the home

firm. There is a discontinuity at point B that divides the No FDI regime from the inward FDI regime. There the profits of the home firm fall from $25(\alpha - \bar{\omega}_H)^2/441\beta - F$ under *No FDI* down to $(\alpha - \bar{\omega}_H)^2/36\beta - F$ under *inward FDI*. The domestic wage is a function of the number of firms located in the domestic market. In the inward FDI regime, the domestic union determines the wage rate paid by the two firms which is higher than the home wage prevailing in the *No FDI* regime when there is only one firm in the home country. This explains the reduction in home firm's profits going from the *No FDI* to the *inward FDI* regime.

The profits of the foreign firm under free trade can be shown to be:

$$\Pi_2^{FT} = \begin{cases} (\alpha - \omega_F)^2/9\beta - F & \text{if } \omega_F < A \\ (5\alpha + 2\bar{\omega}_H - 7\omega_F)^2/144\beta - F & \text{if } A < \omega_F < B \\ (\alpha - \bar{\omega}_H)^2/36\beta - F & \text{if } \omega_F > B \end{cases} \quad (7)$$

In general, the profits of the foreign firm are continuous at point A where $\Pi_2^{FT} = 4(\alpha - \bar{\omega}_H)^2/81\beta - F$ and at point B where $\Pi_2^{FT} = (\alpha - \bar{\omega}_H)^2/36\beta - F$. Hence, both outward and inward FDI have no effect on the profits of the foreign firm.

Consumer surplus in the domestic country under free trade in the three FDI regimes can be shown to be:

$$V^{FT} = \begin{cases} 2(\alpha - \omega_F)^2/9\beta & \text{if } \omega_F < A \\ (7\alpha - 2\bar{\omega}_H - 5\omega_F)^2/288\beta & \text{if } A < \omega_F < B \\ 2(\alpha - \bar{\omega}_H)^2/36\beta & \text{if } \omega_F > B \end{cases} \quad (8)$$

Consumer surplus as a function of the foreign unit labour cost for the particular parameter values is continuous at point A where $V^{FT} = 8(\alpha - \bar{\omega}_H)^2 / 81\beta$. Hence *outward FDI* has no effect on market price or consumer surplus. There is a discontinuity at point B where consumer surplus drops from $289(\alpha - \bar{\omega}_H)^2 / 3528\beta$ under *No FDI* down to $(\alpha - \bar{\omega}_H)^2 / 18\beta$ under *inward FDI*. As explained above, inward FDI increases the home wage level which in turn results in higher domestic price level. This explains the reduction in home consumer welfare going from the *No FDI* to the *inward FDI* regime.

Union rent in the home country under free trade can be shown to be:

$$U^{FT} = \begin{cases} 0 & \text{if } \omega_F < A \\ (\alpha - 2\bar{\omega}_H + \omega_F)^2 / 24\beta & \text{if } A < \omega_F < B \\ (\alpha - \bar{\omega}_H)^2 / 6\beta & \text{if } \omega_F > B \end{cases} \quad (9)$$

Figure 2 shows the home union rents as a function of the foreign labour cost for the particular parameter values. In general, there are discontinuities in union rent at point A where it jumps from 0 under *outward FDI* up to $2(\alpha - \bar{\omega}_H)^2 / 27\beta$ under *No FDI* and at point B where it jumps up from $25(\alpha - \bar{\omega}_H)^2 / 294\beta$ under *no FDI* to $(\alpha - \bar{\omega}_H)^2 / 6\beta$ under *inward FDI*. Hence, taking the No FDI regime as a reference point, outward FDI reduces union rent and inward FDI increases union rent. The domestic firm relocates production facilities when unit labour costs abroad are lower than in the home country. This outward FDI results in a loss of domestic union rent. It will become clear in the next section that the home government will want to affect the home firm's private incentive to relocate whenever the efficiency gain (lower wages) from relocating abroad is lower than the union rent lost.

Welfare in the home country under free trade consisting of consumer surplus, profits of firm one and union rents $W_H = V(P) + \Pi_1 + U$, can be shown to be:

$$W_H^{FT} = \begin{cases} 2(\alpha - \omega_F)^2 / 9\beta - F & \text{if } \omega_F < A \\ \frac{(7\alpha - 2\bar{\omega}_H - 5\omega_F)^2}{288\beta} + \frac{5(\alpha - 2\bar{\omega}_H + \omega_F)^2}{72\beta} - F & \text{if } A < \omega_F < B \\ (\alpha - \bar{\omega}_H)^2 / 4\beta - F & \text{if } \omega_F > B \end{cases} \quad (10)$$

Figure three shows welfare of the home country as a function of the foreign unit labour cost for the particular parameter values. In general, home welfare is continuous and strictly decreasing in the foreign unit labour cost until point A where home welfare is discontinuous and jumps up from $4(\alpha - \bar{\omega}_H)^2 / 27\beta - F$ under *outward FDI* to $2(\alpha - \bar{\omega}_H)^2 / 9\beta - F$ under *no FDI*. At point B home welfare again jumps up from $263(\alpha - \bar{\omega}_H)^2 / 1176\beta - F$ under *no FDI* to $(\alpha - \bar{\omega}_H)^2 / 4\beta - F$ under *inward FDI*. Hence, taking No FDI as a point of reference, outward FDI reduces home welfare and inward FDI increases home welfare. Since we saw that outward FDI has no effect on home profits and no effect on consumer surplus, the reduction in home welfare at point A , is solely caused by the reduction in union rents.

Welfare in the foreign country under free trade is just equal to the profits of the foreign firm. Aggregate world welfare is therefore given by $\Omega^{FT} = W_H^{FT} + \Pi_2^{FT}$. Since the profits of firm two are continuous, the jumps in world welfare are due to the jumps in home welfare. World welfare falls with outward FDI and increases with inward FDI.

The results of this section for *outward FDI* under free trade are summarised in the following proposition:

Proposition 2: *Outward FDI reduces union rent so consequently reduces the welfare of the home country and aggregate world welfare.*

Since outward FDI occurs when the foreign unit labour cost is just equal to the monopoly unit labour cost in the home country (point A), it has no effect on the marginal cost of firm one so does not affect the profits of firm one or the market price. Hence, the only effect is to eliminate the union rent and thereby to reduce the welfare of the home country.⁶ Aggregate world welfare falls because the actual costs of producing in the home country are lower than in the foreign country but the union wage has driven firm one to relocate production to the foreign country.

The results of this section for *inward FDI* under free trade are summarised in the following proposition:

Proposition 3: *Inward FDI by the home firm increases union rent, reduces the profits of the home firm and consumer surplus. Inward FDI by the foreign firm increases the welfare of the home country and aggregate world welfare.*

With inward FDI, the foreign firm realises that if it relocates to the home country then the power of the monopoly union will be increased and both firms will face a higher union wage than if there is no FDI. Hence, the foreign firm will relocate production to the home country even though the monopoly unit labour cost when it relocates will be higher than the foreign unit labour cost. It faces a higher unit labour cost but so does its competitor, and these two effects exactly offset each other for firm two. The home firm faces a higher monopoly union wage as a result of firm two's relocation so its profits are reduced, the market price is increased and consumer surplus is reduced. Although consumer surplus and the profits of the home firm are reduced, the welfare of the home country increases because the increase in

union rent outweighs the other two effects. This is because the reduction in the profits of the home firm and consumer surplus mainly represent transfers from the home firm and consumers to the union so they have no effect on the welfare of the home country. (Note that there is an efficiency loss due to the increase in the power of the monopoly union but this is relatively small). The welfare gain comes from the union rent earned by workers employed by the foreign firm, but this is not at the expense of the foreign firm since it comes from the union capturing part of the home country's efficiency advantage.

4. Optimum Tariff

The private relocation of firms under free trade are not always in the interest of the domestic country as measured by the sum of profits of the home firm, consumer surplus and union rents. Hence, we turn our attention to the first stage of the model where we assume the home country to pursue an optimal trade policy. Consider the optimum tariff of the home country assuming that the foreign country passively pursues a policy of free trade. Since the tariff will affect the firms' location decisions, the optimum policy will be rather complex and will involve comparisons of welfare in different regimes. The situation is best described in figure four where the tariff is plotted against the foreign unit labour cost. In the region below the OO curve, which has a slope of minus one, there will be outward FDI, $\omega_F < A - t$, while in the region above the II curve, which also has a slope of minus one, there will be inward FDI, $\omega_F > B - t$. In the region in between the lines OO and II there will be no FDI. And, this holds for the range of foreign wage lying in between $A - t < \omega_F < B - t$.

In the region with outward FDI (below OO), both firms are located in the foreign country so imports are equal to $q_F = q_1 + q_2 = Q$. With outward FDI, the rent of the home monopoly

union is equal to zero since there is no production in the home country. Hence, the welfare of the home country is given by the sum of consumer surplus, the profits of the home firm, and tariff revenue:

$$W_H^{RS} = V(P) + \Pi_1^{RS} + tQ \quad (11)$$

Maximising the welfare of the home country with respect to the tariff yields the first-order condition:

$$\frac{\partial W_H^{RS}}{\partial t} = -q_2 \frac{\partial P}{\partial t} + (P - \omega_F) \frac{\partial q_1}{\partial t} + t \frac{\partial Q}{\partial t} + Q = 0 \quad (12)$$

Using the result from (2) to solve this first-order condition yields the optimal tariff $t^{RS} = 0$. Hence when the foreign unit labour cost is low, the optimal policy for the home government is to set a zero tariff and to allow outward FDI occur. The optimal policy of a zero tariff for low foreign unit labour costs is indicated in figure four by the line between the origin and point C (see below) along the horizontal axis⁷. The reason why the domestic government allows the domestic firm to locate in the low wage market abroad (foreign unit cost between 0 and C) is that while union rent is lost, the efficiency gain to the domestic firm in terms of higher profits outweighs this loss. However, as the foreign unit labour cost increases, the efficiency gain to the home firm from moving abroad is reduced. The critical value of foreign unit labour cost where home government policy will change is $\omega_F = C \equiv \left((38 - 4\sqrt{82})\alpha + (4\sqrt{82} - 16)\overline{\omega}_H \right) / 22$. At this level of foreign unit labour cost, the home firm still has a private incentive to relocate ($C < A$) but relocation is not in the home country's interest. Therefore, the home government will set a tariff so that it is no longer profitable for the home firm to relocate to the foreign country.

For the home government to prevent *outward FDI* beyond point C , it will have to set a tariff higher than that given by the line OO . To derive the optimal tariff policy, first consider what is the home welfare in the interior of the region with *no FDI*, (in between OO and II).

The home welfare now includes home union rent and is given by:

$$W_H^{SS} = V(P) + \Pi_1^{SS} + U^{SS} + tq_2 = V(P) + (P - \bar{\omega}_H)q_1 + tq_2 \quad (13)$$

where $\Pi_1^{SS} + U^{SS} = (P - \bar{\omega}_H)q_1$. Maximising the welfare of the home country with respect to the tariff yields the first-order condition:

$$\frac{\partial W_H^{SS}}{\partial t} = -q_2 \frac{\partial P}{\partial t} + (P - \omega_F) \frac{\partial q_1}{\partial t} + t \frac{\partial Q}{\partial t} + Q = 0 \quad (14)$$

Thus, solving this first-order condition using equations (2) to (5) yields the optimal tariff prevailing in the *no FDI* area lying in between the lines OO and II :

$$t^{SS} = \frac{1}{41} (15\alpha - 2\bar{\omega}_H - 13\omega_F)$$

In figure four, this optimal tariff is given by the line TT . This line corresponds with the optimal rent extracting tariff derived by Brander and Spencer (1981) when firms have fixed locations. In figure four, the *no FDI* area is the only area where firms do not have an incentive to move. Hence, the tariff given by the line labelled TT here is only relevant for that part of TT that lies between the lines OO and II , and for values of the foreign unit labour cost greater than C .

For values of the foreign unit labour cost greater than D , $\omega_F > D \equiv (9\alpha + 89\bar{\omega}_H)/98$, the tariff given by the line TT no longer yields an interior solution and the home country has to compare welfare under *no FDI* with welfare under *inward FDI*. It turns out that for values of the foreign unit cost between the foreign wage level D and E in figure four, $D \leq \omega_F \leq E$

where $D \equiv (9\alpha + 89\bar{\omega}_H)/98$ and $E \equiv (53\alpha + 143\bar{\omega}_H)/196$, the No FDI regime with a tariff that just prevents the foreign firm from engaging in inward FDI is optimal. This is achieved through a tariff just ε below the line *II*. By setting this tariff the home country ensures that the foreign firm does not want to relocate. For this range of the foreign unit costs the home country is better off by extracting rent from the foreign firm through a tariff than through higher union rents.

However, once the foreign unit cost level exceeds a critical value, $\omega_F > E$, the optimum tariff changes. For values of the foreign unit cost greater than E , it is optimal for the home government to set a tariff level above the level given by the *II* curve. For this range of foreign unit costs, the foreign firm will relocate to the home country and the home union can extract more rent from the foreign firm than a tariff can if the foreign firm had remained in the foreign country. This is why the home government decides to set a tariff which is high enough to alter the foreign firm's private incentives to relocate compared to free trade. By choosing any tariff above line *II*, the foreign firm will want to relocate to the home country. In Figure 4 we have assumed an 'efficient' home government that sets a tariff just ε above the *II* line. Note that the foreign wage level at which the inward FDI regime starts under the optimal tariff policy (E) is smaller than the foreign wage level at which the inward FDI regime started under free trade (indicated by B in figure 4). The optimal tariff policy derived above can be summarised in the following proposition:

Proposition 4: *The optimum tariff is: $t = 0$ for $\omega_F < C$; $t = (15\alpha - 2\bar{\omega}_H - 13\omega_F)/41$ for $C < \omega_F < D$; $t = (3\alpha + 4\bar{\omega}_H - 7\omega_F)/7 - \varepsilon$ for $D < \omega_F < E$; and $t \geq (3\alpha + 4\bar{\omega}_H - 7\omega_F)/7$ for $\omega_F > E$.*

The optimal tariff policy is illustrated in figure 4 for a particular set of parameter values: for $0 < \omega_F < C$, there is outward FDI and the optimal home tariff is zero, for $C < \omega_F < E$, there is No FDI and the optimal tariff is positive. The No FDI regime can be divided into two parts namely for $C < \omega_F < D$, the tariff corresponds with the Brander and Spencer (1981) optimal profit shifting tariff while for $D < \omega_F < E$, the tariff is the highest tariff in the No FDI regime. For $\omega_F > E$, there is inward FDI and the optimal tariff can be set at any level that induces inward FDI, which includes a zero tariff for $\omega_F > B$.

5. Discussion of Results

Comparing the results in the previous two sections it is clear that a domestic government, acting in the interest of social welfare, wants to affect firms' location decisions by means of trade policy. First, our model suggests that domestic firms that are considering location in very low wage countries (up to C in figure 4), are likely to face free trade when shipping their goods back to the home market. The domestic government allows firms to go because the additional profits they can earn abroad outweigh the union rent lost in the domestic country. Empirically this implies that relocation activity from the 'North' towards the 'South' should be observed. As long as the wage difference between the foreign location and the home country is large enough, the government does not have an incentive to affect that location behaviour.

Second, for an intermediate range of foreign wage levels (between C and E in figure 4), where the home firm still wants to move abroad, the domestic government opts for a positive tariff that actually serves three different purposes. On the one hand, the tariff on imports is meant to prevent the domestic firm from moving abroad and serving the domestic market

from a distance. In addition, the tariff is aimed at rent-extraction from the foreign firm. And at the same time the tariff is set low enough in order not to trigger tariff jumping by the foreign firm. In the trade policy literature mainly the rent-extracting incentive for protection has been focussed on. Our model shows however, that a tariff may also be aimed at dissuading domestic firms from serving home markets from a distance, an argument for import protection that has been overlooked so far. By using an optimal trade policy, the home country can avoid the losses that would occur under free trade as a result of outward FDI. The domestic trade policy for this intermediate range of foreign wage costs, is mainly driven by the loss in union rent in the case of domestic firm production abroad. For foreign wage costs between C and E, the increase of domestic firm profit from moving abroad can not overcome the loss in union rent. Our model is an illustration of a situation where the domestic firm loses from domestic import protection while the union gains. This may seem counterintuitive at first since protection against imports is often regarded in the interest of domestic producers. But here we show that when the domestic firm is a footloose firm, this need not be the case. Arguably, our model could be used to understand why the opening of Central-Europe did not initially induce many West European firms to locate assembly activities there. Our model suggests that the many antidumping duties in place on imports from Central-Europe may partly explain the less than expected relocation of EU manufacturing activities. While wage differences were in principle large enough for EU firms to set up production in Central-Europe and to serve the EU from a distance. The use of EU antidumping protection may have prevented that outward FDI of West-European firms. The same argument may apply to Mexico for US firms before NAFTA.

Third, the results in the previous section also indicate that for imports from relatively high wage countries (wage levels above E in figure 4), the optimal domestic trade policy is to set a

tariff such that tariff-jumping by the foreign firm into the domestic market will occur. The reason is that by attracting foreign investors, union rents will go up. Both wages and employment in the domestic country will increase as a result of inward FDI. From a foreign wage of E onwards, foreign unit costs are relatively similar to home unit costs. This implies that the cost difference between the home and the foreign firm becomes too small for rent-extraction through an import tariff to be interesting. A tariff to encourage tariff-jumping is more interesting because the increase in union rent as a result of inward FDI is now higher than the amount of rent the domestic government could have extracted through an import tariff. This result could at least in part explain why tariff levels and antidumping duties from the US and the EU against a country like Japan have always been high (Tharakan, 1991). Our model suggests that the tariffs and duties may have been set in order to attract inward Japanese FDI both in the EU and US.

Our findings may also explain why a positive relationship between tariff levels and tariff-jumping FDI is difficult to establish empirically (Blonigen (1998); Belderbos (1997)). Our model shows that a negative relationship between tariffs and inward FDI is possible. We find that high tariffs will occur in the regime with no FDI (see figure 4, for foreign unit costs between C and D) whereas low tariffs will occur in the regime with inward FDI (see figure 4, for foreign unit costs higher than E). This provides an explanation for why a negative correlation between tariffs and inward FDI can be observed in the empirical data. Note also that for foreign wage costs above E , the ‘threat’ of protection is sufficient to trigger inward FDI. Actual protection in this case will never be observed. Nevertheless, it is the threat of the import tariff that persuades the foreign firm to locate in the home market. This suggests that empirical studies trying to establish a link between protection and FDI should use indicators

for the ‘threat’ of protection or a measure of a ‘government’s willingness’ to take protection, rather than actual tariffs or duties.

According to the traditional view, FDI and Trade are substitutes since the relocation of production facilities abroad was generally thought to correspond with a reduction in the trade flows. Our findings suggest however, that trade and FDI may be complements since when outward FDI occurs in our model, trade follows FDI. After the home firm has relocated a trade flow arises that previously was not there. Recent empirical evidence also goes in the direction that FDI need not necessarily reduce trade flows (Pain and Wakelin 1998).

6. Conclusions

In this paper we have studied the location behaviour of a foreign firm and a home firm competing in output in the domestic product market both under free trade and under the optimal domestic trade policy. Both firms produce a homogenous good using a labour intensive technology. While the domestic country is unionised, the foreign country is not. We found that when foreign wage levels are relatively low, both firms agglomerate in the South and serve the domestic market from a distance (North-South). The optimal domestic trade policy turns out to be a zero tariff on imports. For intermediate wage levels abroad, no FDI occurs and the optimal trade policy is a tariff that extracts maximum rent from the foreign firm but without encouraging it to tariff jump. For relatively high foreign wage levels, the optimal tariff is such that both firms agglomerate in the home country (North-North FDI).

At least three important insights evolved from this paper. First, a tariff, deterring outward FDI or inducing inward FDI can improve domestic welfare. Second, when firms are footloose, the optimal domestic tariff is always lower or equal to the tariff policy in the

absence of relocation possibilities. And third, when the labour market is unionised, trade and FDI are clearly not substitutes.

Our analysis also has empirical implications. It shows why a positive relationship between tariffs and FDI may not show up in empirical work and why government's willingness to take protection rather than actual protection may be a better measure for import protection.

One final remark is in place namely that our analysis should not be seen as a stance for trade policy intervention. By indicating the unilateral incentives that countries have to deviate from free trade we show that a continued effort in multilateral talks at the level of the WTO is called for to refrain countries from pursuing tariff policies. This is necessary to avoid trade wars to attract FDI between countries.

Figure One

Profits of home firm

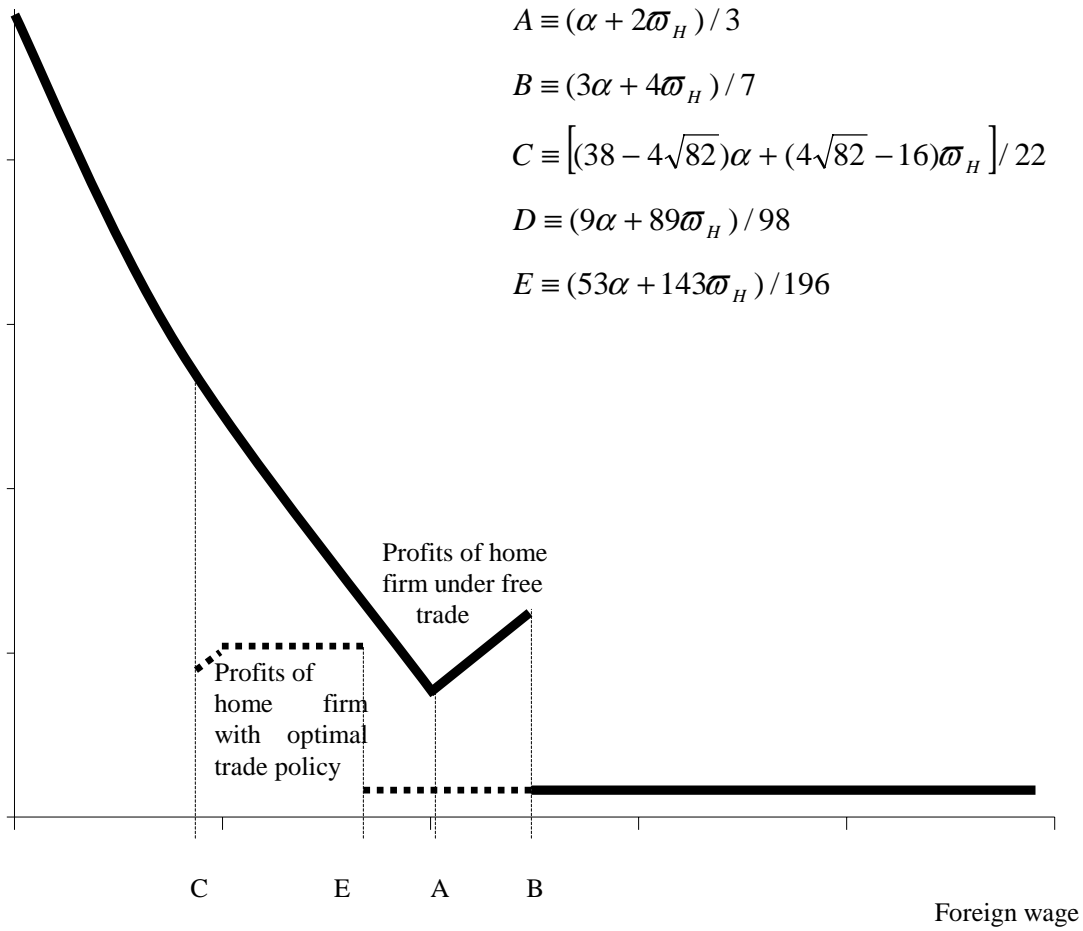


Figure Two

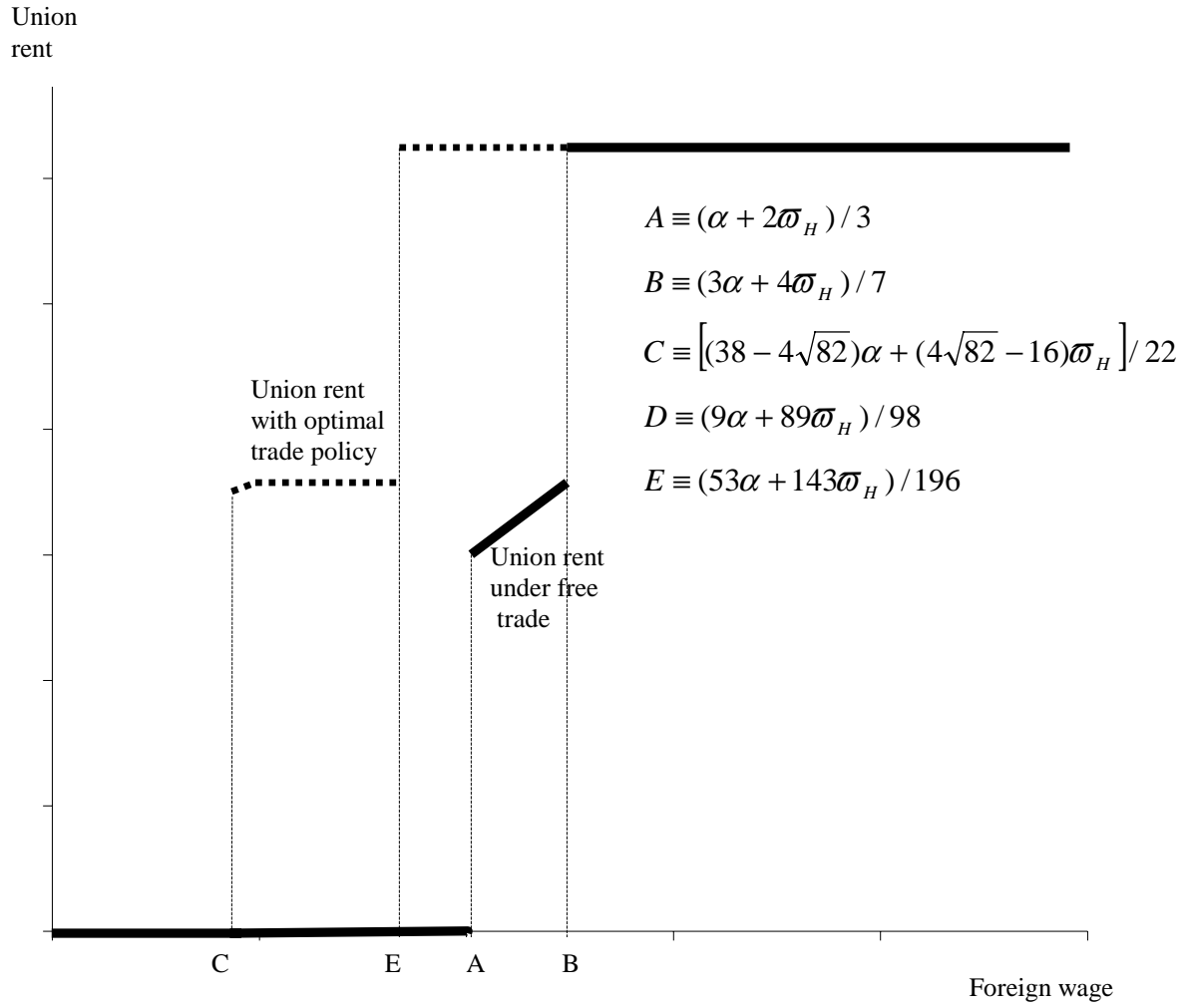


Figure Three

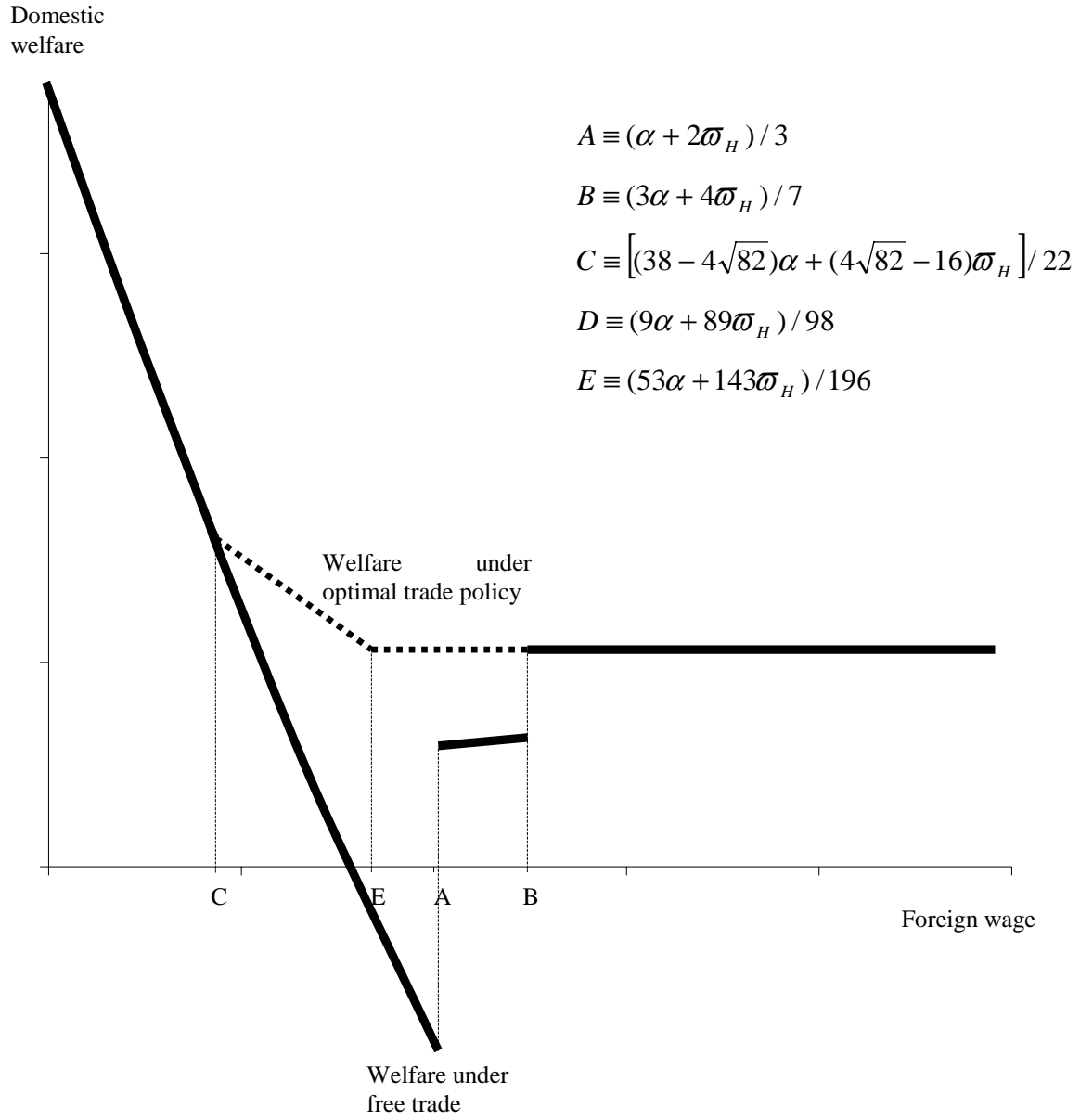
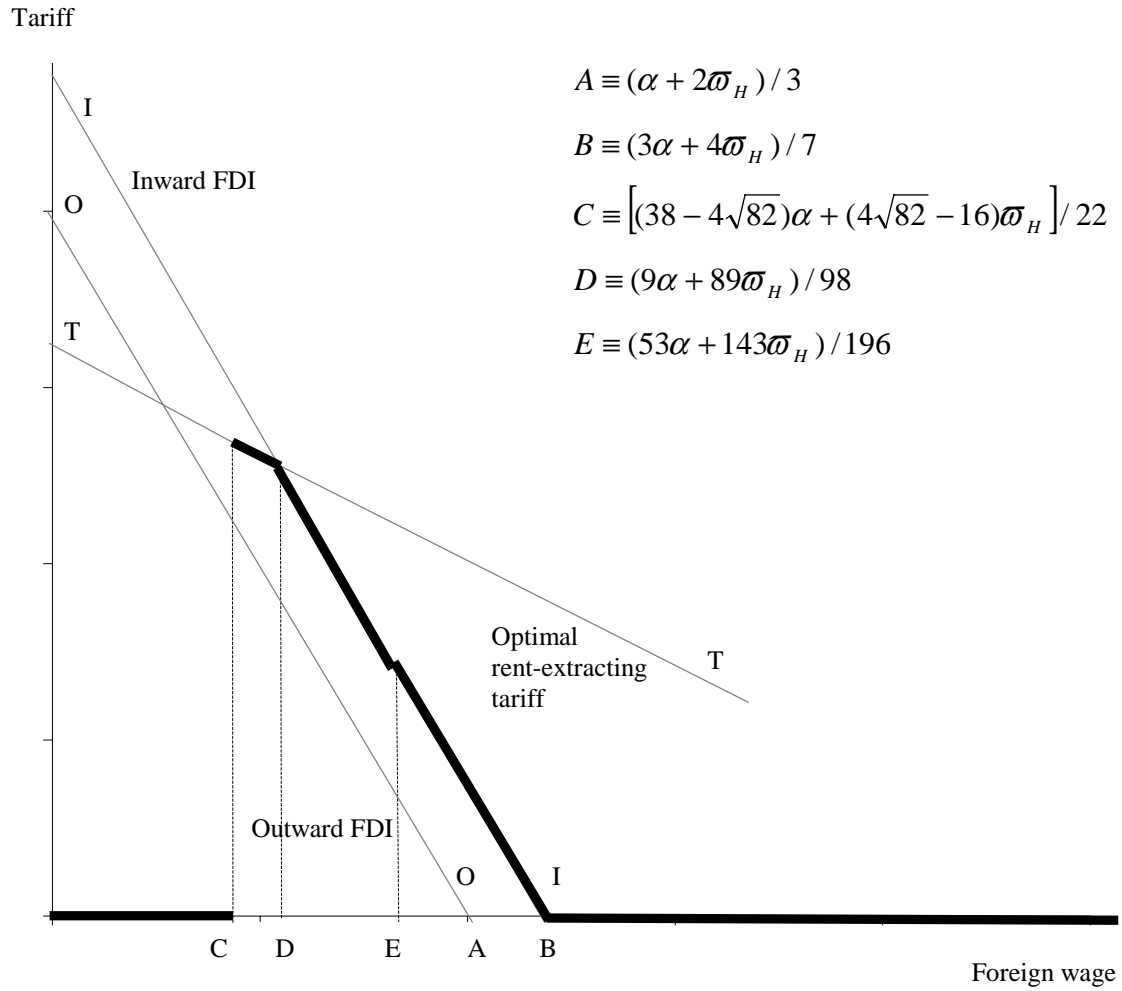


Figure Four



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Endnotes

¹ Renault by means of president Schweizer made several public statements about wage costs in Belgium being too high to justify further car assembly of Renault. A new plant was opened in Russia. Levis and Duparc Stockings admitted that Central Europe had become a more attractive location for them to carry out their activities. Boston Scientific moved to Ireland (Trends Review n°5, 1998)

² Although we do not explicitly model transport costs, they are implicitly present in the analysis since the foreign unit labour cost could include transport costs without affecting the analysis.

³ Our analysis could also apply to regions within Europe. For example France, with a rigid labour market, has accused the UK, with a much more flexible labour market, of social dumping in the French product market (Leahy and Montagna, 1999).

⁴ The fixed cost prevents firms from locating in both markets at the same time. Or to put it differently, the fixed cost ensures indivisibility of production. In addition the fixed cost explains the oligopolistic nature of the industry we consider.

⁵ Our model in fact has four outcomes rather than three. The No FDI equilibrium where there is one firm in each market involves two possibilities: either each firm is in its own market or each firm is in the other market. Given the great similarity between these equilibria we have focussed on the equilibrium where each firm is located in its own market namely where its shareholders are.

⁶ Unions are not the only mechanism that can drive this result. Other distortions in the labour market like efficiency wages which result in wages levels above the marginal product of labour would also lead to the result described in proposition 2.

⁷ This result is in part assumption specific. It depends on the linearity of the inverse demand curves and the fact that there is one domestic and one foreign firm. It can be shown that when demand is convex, the optimal tariff is positive while for concave demand, the optimal tariff is negative (equivalent to an import subsidy). The size of the optimal tariff also depends on the number of domestic versus the number of foreign firms that are located abroad. In a model with more than two firms, the size and sign of the optimal tariff depends on the relative number of foreign firms. However, despite the assumption specific nature of the zero tariff result here, it remains true that the optimal tariff will always be lowest for low foreign wage countries.