

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

KOBE UNIVERSITY

ROKKO KOBE JAPAN

Discussion Paper Series

Outward Foreign Direct Investment in Unionized Oligopoly: Some Welfare Implications*

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October 7, 2005

Abstract

It is often argued, though mostly informally, that outward foreign direct investment (FDI) is a synonym for the export of employment and thus detrimental to the home economy. To see whether and under what conditions this intuition indeed holds true, we construct a model of unionized duopoly and examine welfare implications of outward FDI on the home country. It is found that the presence of domestic competition gives rise to effects which have critical bearings on social welfare. There are two main findings. First, due to strategic interactions between the unions, the welfare effect of FDI can be negative, even when we disregard the fixed cost of FDI. Second, this negative effect arises more at the expense of consumers, rather than the unions: in fact, quite contrary to the popular belief, FDI may actually benefit the unions because it serves to soften price competition between them. The analysis reveals that the welfare effect of outward FDI hinges critically on the nature of domestic competition, especially among input suppliers, and their bargaining power against their respective downstream producers.

JEL classification numbers: F21, J31, L13.

Key words: R&D investment, vertical relation, transport cost, welfare, wage bargaining

*We thank Laixun Zhao for helpful comments and suggestions. The authors gratefully acknowledge financial supports from Grant-in-Aid for Encouragement of Young Scientists from the Japanese Ministry of Education, Science and Culture. Needless to say, we are responsible for any remaining errors.

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1 Introduction

Should a government encourage, or even subsidize, globalization of domestic firms? If so, then to what extent? With the increasing degree of globalization, those questions become more and more critical for policy makers these days. Specifically at issue, regarding those questions, is the welfare effect of outward FDI on the home country: a policy intervention that encourages domestic firms to expand abroad can be justified only if outward FDI indeed proves to be welfare-improving. While the answer to this question is not necessarily straightforward, many government authorities in reality appear to be in favor of outward FDI and are often eager to encourage globalization of domestic firms in various ways. To name a few, the Swiss Organization for Investment Facilitation (SOFI) was set up in 1997 by the Swiss Secretariat for Economic Affairs to offer a wide scope of services to promote outward FDI. The Spanish Institute for Foreign Trade organizes fairs named *Expotecnia* in various countries in an attempt to boost outward FDI as well as exports. The Canadian Trade Commissioner Service and the Japan External Trade Organization (JETRO) provide information and various types of support, as one of their missions, to help Canadian and Japanese firms, respectively, to expand overseas. This tendency seems to suggest that there is an emerging global consensus, at least among policy makers, that outward FDI is generally beneficial for the home country and should therefore be encouraged.

To justify this policy stance, there is certainly a bright side of outward FDI because the firm that undertakes FDI can improve its efficiency through several channels. First, firms may invest abroad to save transport costs, including tariffs and other non-tariff trade barriers, which allows them to serve the foreign market more efficiently. Second, especially when firms invest in developing economies, FDI allows them to gain access to cheap raw material and labor force. Finally, outward FDI is also a means to acquire knowledge and to diversify country risk. Proponents of outward FDI would thus argue that FDI plays quite a similar role to R&D investment, which is normally welfare-improving in the long run, directed at the foreign market.

Despite those virtues, however, there may also be a cost associated with outward FDI when the production process involves some immobile factors such as labor. In such a case, the effect of outward FDI is no longer identical to that of R&D investment. It is often argued, though mostly informally, that FDI can be regarded as the export of employment and hence is detrimental to workers in the home country. Based on this argument, the overall welfare effect of FDI on the home country is ultimately determined by the tradeoff between firms' gains and workers' losses. FDI is not necessarily

welfare-improving if firms gain only at the expense of domestic workers.¹

While the welfare analysis of outward FDI offers critical policy implications, studies on the effect of outward FDI are relatively scarce, both theoretically and empirically.² The paper intends to fill this gap. In particular, the main purpose of this paper is to examine whether and under what circumstances the intuition mentioned above (that outward FDI may reduce social welfare) actually holds true. To this end, we construct a model of unionized duopoly where there are two downstream firms, firms A and B , and two unions (or, more generally, upstream suppliers). Each firm procures labor input from its own union which possesses some bargaining power. We then look at a situation where firm A first determines whether to set up a plant in the foreign market and then firm B determines whether to follow its rival: for expositional clarity, we say that the first FDI (the second FDI) is undertaken when firm A (firm B) sets up a foreign plant.

Within this framework, we examine welfare implications of outward FDI. We first show that when there is only one domestic firm in the market to begin with, outward FDI is *always* welfare-improving when the two markets, home and foreign, are comparable in size. Given this result, one might be tempted to conjecture that outward FDI is in general welfare-improving even in the presence of strong labor unions. As it turns out, however, this conclusion does not necessarily hold true with the addition of another rival firm. When there are more than one domestic firm-union pair, one firm's FDI decision affects not only its own union but also the other union as well. The main findings of the paper are summarized as follows:

1. FDI may reduce welfare in the presence of domestic competition. In particular, when the two markets are comparable in size, the second FDI is *always* welfare-reducing. Moreover, this holds true even when we disregard any fixed cost necessary to set up foreign plants, i.e., the effect of outward FDI can be purely negative.
2. The main reason why FDI reduces welfare is a reduction in consumer surplus. That is, FDI reduces welfare at the expense of consumers, rather than the unions. In fact, under certain conditions, the second FDI actually benefits the unions because it serves to soften price competition between them.

At the core of these results is the presence of domestic competition where the unions are competing

¹For instance, Skaksen and Sørensen (2001) show that unions are likely to lose on FDI if domestic and foreign activities are substitutable.

²The literature on the welfare effect of FDI has mainly focused on the effect of inward FDI, i.e., the effect of FDI on the host country. See Lipsey (2004) for an extensive survey on this issue.

against one another through downstream market competition. The strategic interaction between them gives rise to effects that are hardly straightforward and have critical bearings on social welfare. The reason why the second FDI reduces social welfare and is especially detrimental to consumers is as follows. When a firm sets up a foreign plant, its union is consequently forced to concentrate on the home market that it can serve more effectively, and thus responds to this by raising its wage. The magnitude of this effect, however, depends heavily on the structure of FDI. When only one of the two firms undertakes FDI, there arises a differential between them in the cost of supplying to the foreign market. Because of this, the union of the less productive firm, the one that does not undertake FDI, must lower its wage to stay competitive in the foreign market, and intense price rivalry between the unions arises as a result: the presence of the rival firm thus functions as an anchor to keep the wages low in the domestic market. This is welfare-improving since lower wages lead to more output, which particularly benefits consumers. The effect of this price rivalry is totally wiped out, however, when the second (and the last, in this case) FDI is undertaken. The wages suddenly go up and the increase in the wages results in less output, which entails welfare losses. The result indicates that the welfare effect of outward FDI hinges critically on the nature of domestic competition, especially among upstream suppliers: when the price rivalry among upstream suppliers is intense, the amount of outward FDI can easily be excessive, even in the long-run where the effect of fixed costs can be fairly negligible.

While the first result confirms a popular view that outward FDI may reduce social welfare under certain conditions, it is important to note that this is not necessarily at the expense of the unions, as one might anticipate. The more dominant factor in this is rather a reduction in consumer surplus, resulting from higher wages. The effect of FDI, especially the second one, on the unions is less clear. The first FDI puts downward pressure on the wages in order to compete in the foreign market, and the price competition between the unions can be excessively intense from their viewpoint. The second FDI may be beneficial for them, quite contrary to the popular belief, because it releases them from this downward pressure. In other words, as the option of exporting is no longer available, the second FDI serves to substantially soften price competition between the unions and consequently benefits them.

The present analysis is related to a line of research which deals with FDI in the presence of labor unions (Bughin and Vannini, 1995; Zhao, 1995, 2001; Leahy and Montagna, 2000; Skaksen and Sørensen, 2001; Naylor and Santoni, 2003; Lommerud et al., 2003; Ishida and Matsushima, 2004).³ Among them, the paper is closest in spirit to Lommerud et al. (2003), on which our model framework

³There is also a growing body of literature on international unionized oligopoly. Examples along this line include Brander and Spencer (1988), Naylor (1998, 1999), Straume (2002, 2003), Lommerud et al. (2004), and Skaksen (2004), just to name a few.

is based. The difference is that there is only one domestic firm in their model and hence do not consider domestic competition, which is the driving force of our model. This difference amounts to different welfare and policy implications. Although they also point out that the amount of FDI can be excessive, it is mostly due to the presence of the fixed cost: that is, there arises a case in their model where the welfare gain from FDI is exceeded by the fixed cost of investment. In contrast, we argue that the pure welfare effect of FDI is often negative, meaning that FDI reduces welfare even when the fixed cost of investment approaches zero, in the presence of domestic competition.

The paper proceeds as follows. The next section outlines the basic model. Section 3 analyzes as a benchmark a case with only one domestic firm and shows that outward FDI is normally welfare-improving. Section 4 extends the analysis to a case with two domestic firms and illustrate how market outcomes driven by upstream competition are affected by the amount of FDI. Finally, section 5 offers some concluding remarks.

2 The model

2.1 Basic environment

The basic structure of our model closely follows Lommerud *et al.* (2003), except for the number of domestic firms.⁴ Although it appears to be an innocuous extension, it proves to give rise to strategic interactions absent in the case with only one domestic firm, as stated in the introduction. There are two markets, home and foreign, and two firms, denoted by A and B . Initially, A and B are located in the home market. Labor is unionized in the home market, whereas it is not in the foreign market. Each firm procures its labor input from its firm-specific union: we refer to the union of firm i as union i in the subsequent analysis. Needless to say, the unions can interchangeably be regarded as the upstream input suppliers.

2.2 Production and market competition

Each firm uses labor as the sole input and produces output in a constant-returns-to-scale technology. Let x_i denote i 's sale in the home market and y_i denote i 's sale in the foreign market ($i \in \{A, B\}$). We assume that the two countries are symmetric and the demand function for each country is given by

$$p = 1 - (x_A + x_B), \tag{1}$$

$$q = 1 - (y_A + y_B). \tag{2}$$

⁴In Lommerud *et al.* (2003), there is only one firm that initially is located in the home market. The other firm is located in the foreign market and is non-unionized.

p is the price level that prevails in the home market, while q is the price level in the foreign market. The firms engage in Cournot competition in each market. Following the convention, we adopt the segmented market hypothesis where the firms choose separate quantities for the two markets. If a firm in one market exports to the other, it must incur a transport cost per unit, denoted by $t > 0$. The transport cost is meant to capture various trade barriers, most notably tariffs. Throughout the analysis, we restrict our attention to a case where the transport cost is sufficiently small:

$$t \leq \bar{t} \equiv 2 - \sqrt{2}. \quad (3)$$

Under this restriction, each firm chooses a nonnegative quantity to export.

Within this framework we consider a situation where firms A and B in the home market may potentially undertake FDI by shifting part of their productive capacities abroad. More precisely, A and B can establish a new production facility in the foreign market, which allows them to supply to that market without incurring any transport cost. The plant set up in the foreign market is used solely to supply to that market.⁵ There are generically three distinct cases, depending on how many firms undertake FDI. Let $j \in \{0, 1, 2\}$ denote the number of firms that undertake FDI, which we also refer to as the degree of FDI for expositional simplicity.

2.3 Unions

The difference in unionization across the two markets implies different costs of production. In this paper we focus on a situation where the two unions are disintegrated and each union independently supplies labor to its firm. The competitive wage in the two countries is set equal to $\bar{w} = 0$.⁶ Taking this as their reservation wage, the unions in the home market independently set wages to maximize the following utility function:

$$u_i = w_i z_i, \quad i = A, B. \quad (4)$$

z_i is i 's production in country H where $z_i = x_i$ ($z_i = x_i + y_i$) if its downstream firm undertakes FDI (no FDI).

2.4 National welfare

The main purpose of the paper is to examine welfare effects of outward FDI. To this end, we adopt the national welfare as the measuring stick. Let $NW^j(t)$ denote the national welfare as a function of

⁵Lommerud *et al.* (2003) refer to this strategy as ‘partial FDI’ to distinguish it from ‘full FDI’ where a firm shift all of their productive capacities. We also rule out the option of importing from its foreign plant. These assumptions can be considered as a type of capacity constraint.

⁶This is strictly to simplify the analysis since the competitive wage plays no role in a qualitative sense.

t when the degree of FDI is given by j . The national welfare is defined as the sum of the firms' profit $\pi_i^j(t)$, the unions' utility $u_i^j(t)$ and the consumer surplus in the home market $CS^j(t)$:

$$NW^j(t) \equiv \Pi^j(t) + U^j(t) + CS^j(t),$$

where $\Pi^j(t) \equiv \pi_A^j(t) + \pi_B^j(t)$ and $U^j(t) \equiv u_A^j(t) + u_B^j(t)$.

2.5 Timing

The timing of the model is summarized as follows:

1. the domestic firms sequentially choose whether to undertake FDI;
2. the unions set wages to maximize their utilities;
3. the firms simultaneously choose quantities for each country to maximize their profits.

3 Benchmark: one domestic firm

3.1 Equilibrium wages and quantities

Before we proceed further, we first consider as a benchmark a case with only one domestic firm. The analysis is instrumental in illustrating the role of domestic competition in unionized international oligopoly. In this monopoly case, we abbreviate the subscript i for notational simplicity.

(no FDI): In the absence of FDI, the monopolist maximizes

$$\max_{x,y} (1 - x - w)x + (1 - y - t - w)y,$$

subject to the constraint that all the quantities are nonnegative (this evidently applies for all subsequent problems). The first-order condition then leads to

$$x, y = \frac{1 - w}{2}, \frac{1 - t - w}{2}. \quad (5)$$

Taking this into account, the union sets its wage to maximize the union utility. Depending on the transport cost, there arise two distinct cases. The firm chooses a positive quantity to export if the wage set by the union is sufficiently low relative to the transport cost, i.e., $1 - t \geq w$. In this case, the union maximizes

$$\max_z w(x + y) = \frac{w(2 - t - 2w)}{2}, \quad s.t. \quad 1 - t \geq w.$$

If the wage is sufficiently high, i.e., $1 - t < w$, the union maximizes

$$\max_w wx = \frac{w(1-w)}{2}, \quad s.t. \quad 1 - t < w.$$

It is then straightforward to obtain

$$w = \frac{2-t}{4}, \tag{6}$$

and

$$x, y = \frac{2+t}{8}, \frac{2-3t}{8}. \tag{7}$$

(FDI): If the monopolist undertakes FDI, it maximizes

$$\max_{x,y} (1-x-w)x + (1-y)y.$$

The first-order condition leads to

$$x, y = \frac{1-w}{2}, \frac{1}{2}. \tag{8}$$

The union loses the foreign market when its firm establishes a plant in the foreign market. The union's problem is thus defined as

$$wx = \frac{w(1-w)}{2}.$$

The union never sets the wage above the transport cost because it loses all the employment by doing so. Given this, we can show that

$$w = \frac{1}{2}. \tag{9}$$

and

$$x, y = \frac{1}{4}, \frac{1}{2}. \tag{10}$$

3.2 Welfare effects of FDI with one domestic firm

Figure 1 depicts the national welfare NW^j as a function of t . In the present context, FDI gives rise to two welfare effects. First, there is a pure productive gain as FDI allows the firm to gain access to cheaper labor as well as to save the transport cost. This productivity effect in general raises the firm's profit and thus improves welfare. Second, there is also an indirect distributional effect of FDI since with the firm going abroad, its union now faces a smaller market to serve. This wage effect is potentially welfare-reducing since it can raise the equilibrium wage set by the union. When the two markets, home and foreign, are comparable in size, however, the former effect always dominates the

latter so that FDI is always welfare-improving.⁷ To summarize, we state the following result, which can immediately be seen from figure 1.

Proposition 1 *When (i) there is only one domestic firm and (ii) the two markets are symmetric in size, outward FDI is always welfare-improving.*

[figure 1 about here]

4 Main Results

4.1 Equilibrium wages and quantities

We now extend the analysis by introducing another domestic firm (firm B) and examine the effect of domestic competition on the home market. Suppose that a new firm (firm B) along with its union (union B) enters into the market for some exogenous reasons. Firm B is assumed to be identical to firm A in every aspect. The addition of a competing domestic rival results in strategic interactions absent in the benchmark case.

When there are two domestic firms that may undertake FDI, there are generically three possible pairs of FDI decisions: (i) none of the firms undertakes FDI (no FDI, no FDI); (ii) only one of the firms undertakes (FDI, no FDI); (iii) both of the firms undertake FDI (FDI, FDI). We now examine each case in turn.

(no FDI, no FDI): With both of the firms remaining in country H , each firm maximizes

$$\max_{x_i, y_i} (1 - (x_i + x_{-i}) - w_i)x_i + (1 - (y_i + y_{-i}) - w_i - t)y_i,$$

where $i \neq -i$ throughout the analysis. Solving the first-order conditions, the optimal quantities are obtained as

$$x_i, y_i = \frac{1 - 2w_i + w_{-i}}{3}, \frac{1 - t - 2w_i + w_{-i}}{3}. \quad (11)$$

Each union thus maximizes

$$\max_{w_i} w_i(x_i + y_i) = \frac{w_i(2 - t - 4w_i + 2w_{-i})}{3}, \quad s.t. \quad 1 - t - 2w_i + w_{-i} \geq 0.$$

It is conceptually straightforward to solve this problem (see Appendix A for detail). The equilibrium wages and quantities are given by

$$w_i = \frac{2 - t}{6}, \quad (12)$$

⁷The productivity gain is evidently not significant when the foreign market is relatively small. As a result, there may arise an exceptional situation where the wage effect prevails. See Appendix B for this.

$$x_i, y_i = \frac{4+t}{18}, \frac{4-5t}{18}. \quad (13)$$

(FDI, no FDI): This is an intriguing case which apparently never occurs with one domestic firm. In this situation each union faces different demand schedules for labor: as a consequence, two different wages prevail in equilibrium. Without loss of generality, suppose that firm A sets up a plant in the foreign market.

Suppose that firm B chooses a nonnegative quantity to export (because the wage set by its union is sufficiently low relative to the transport cost). Each firm's problem is then defined as

$$\begin{aligned} \max_{x_A, y_A} & (1 - (x_A + x_B) - w_A)x_A + (1 - (y_A + y_B))y_A \\ \max_{x_B, y_B} & (1 - (x_A + x_B) - w_B)x_B + (1 - (y_A + y_B) - w_B - t)y_B. \end{aligned}$$

Solving the first-order conditions, the optimal quantities are obtained as

$$x_A, y_A = \frac{1 + w_B - 2w_A}{3}, \frac{1 + t + w_B}{3} \quad (14)$$

$$x_B, y_B = \frac{1 - 2w_B + w_A}{3}, \frac{1 - 2t - 2w_B}{3}. \quad (15)$$

Since firm A has two plants, the unions are now asymmetric. Each union maximizes

$$\max_{w_A} w_A x_A = \frac{w_A(1 + w_B - 2w_A)}{3}, \quad (16)$$

$$\max_{w_B} w_B(x_B + y_B) = \frac{w_B(2 - 2t + w_A - 4w_B)}{3}. \quad (17)$$

It also follows from (15) that if $(1 - 2t - 2w_B)/3 \leq 0$, firm B chooses not to export. The optimal quantities in this case are given by

$$x_A, y_A = \frac{1 + w_B - 2w_A}{3}, \frac{1}{2} \quad (18)$$

$$x_B, y_B = \frac{1 - 2w_B + w_A}{3}, 0 \quad (19)$$

and each union now maximizes

$$\max_{w_i} w_i x_i = \frac{w_i(1 + w_{-i} - 2w_i)}{3}.$$

Define

$$t^* \equiv \frac{54 - 31\sqrt{2}}{48} \approx 0.212.$$

With some algebra (see Appendix A), the equilibrium wages are given by

$$w_A = \begin{cases} (10 - 2t)/31 & \text{if } t \in [0, t^*) \\ 1/3 & \text{if } t \in [t^*, \bar{t}], \end{cases} \quad (20)$$

$$w_B = \begin{cases} (9 - 8t)/31 & \text{if } t \in [0, t^*) \\ 1/3 & \text{if } t \in [t^*, \bar{t}]. \end{cases} \quad (21)$$

It follows from these that the equilibrium quantities are

$$x_A, y_A = \begin{cases} (20 - 4t)/93, (40 + 23t)/93 & \text{if } t \in [0, t^*) \\ 2/9, 1/2 & \text{if } t \in [t^*, \bar{t}], \end{cases} \quad (22)$$

$$x_B, y_B = \begin{cases} (23 + 14t)/93, (13 - 46t)/93 & \text{if } t \in [0, t^*) \\ 2/9, 0 & \text{if } t \in [t^*, \bar{t}]. \end{cases} \quad (23)$$

(FDI, FDI): Finally, suppose that firm B follows firm A and sets up a plant in the foreign market.

When each of the firms has two plants, each firm maximizes

$$\max_{x_i, y_i} (1 - (x_i + x_{-i}) - w_i)x_i + (1 - (y_i + y_{-i}))y_i.$$

The first-order condition implies that the optimal wages must satisfy

$$w_i = \frac{1 + w_{-i}}{4}. \quad (24)$$

Solving the first-order conditions, we obtain

$$x_i, y_i = \frac{1 - 2w_i + w_{-i}}{3}, \frac{1}{3}. \quad (25)$$

In this case, the wage set by a union has no effect on the foreign market. With no strategic consideration, each union simply maximizes

$$\max_{w_i} w_i x_i = \frac{w_i(1 - 2w_i + w_{-i})}{3}.$$

It is straightforward to obtain

$$w_i = \frac{1}{3}, \quad (26)$$

$$x_i, y_i = \frac{2}{9}, \frac{1}{3}. \quad (27)$$

4.2 Welfare effects of FDI with two domestic firms

When there is only one domestic firm, FDI is *always* welfare-improving, provided that the two markets are comparable in size. This leads us to the following question: is more FDI in general beneficial for the home economy? As it turns out, the answer to this question is mostly negative even when we disregard the fixed cost of FDI. We in particular show that, in a two-firm setting, the second FDI is in general welfare-reducing even in the long run: that is, the amount of FDI can be excessive.

As in the case with only one domestic firm, outward FDI gives rise to two distinct effects of particular interest. First, FDI improves the firm's efficiency as it allows the firm to gain access to cheaper labor as well as to save the transport cost. Both of them apparently contribute to a reduction in the cost of production and thus play a similar role to cost-reducing R&D investment directed at the foreign market. We refer to this as the productivity effect of FDI. This effect is generally welfare-improving when its fixed cost is negligible.

When the production process involves immobile factors such as labor, FDI also has an impact on the factor prices because the union's wage-setting behavior hinges critically on the productivity of its downstream firm. When FDI is undertaken, the union is consequently forced to concentrate on the home market. Since the firm can serve the home market more effectively by the margin of the transport cost, there arises an incentive for the union to raise its wage to take advantage of this. The consequences of this incentive are not simply a matter of distributional concern since the wage levels subsequently determine the output level. We refer to this as the wage effect of FDI. The wage effect may or may not be welfare-improving, depending crucially on the structure of FDI. When only firm *A* undertakes FDI, there arises a productivity gap between the two firms in terms of supplying to the foreign market. In order to fill this gap and to compete in the foreign market, union *B* has a strong incentive to lower its wage, which also places downward pressure on the wage set by union *A*. The presence of the rival firm, which remains entirely in the home market, thus acts as an anchor to keep the wages low and improves welfare under certain conditions. Note that this incentive is totally wiped out when firm *B* follows its rival and undertakes FDI. The wages tend to go up rather excessively as a consequence. See figure 2 for the relationship between the equilibrium wages and the amount of FDI.

[figures 2 about here]

The domestic economy consists of three components: the firms, the unions and domestic consumers. In order to identify who gains and who loses, we examine each component in turn.

Total profit: It can be shown that the firm that undertakes FDI can always increase its profit. This does not necessarily mean, however, that FDI always increases the firms' total profit because a firm may gain at the expense of its rival firm.

To see this, figure 3 depicts the total profit as a function of t . First, it can be seen from the figure that the first FDI unambiguously increases the total profit. The productivity effect is evidently a crucial contributing factor in this. Moreover, when the transport cost is sufficiently small, the wage

effect also works positively for the firms as it invites intense competition between the unions. While the wage effect leads to higher wages as the transport cost increases, the productivity effect generally prevails and the overall effect of the first FDI on the total profit is in general positive.

While the first FDI in general increases the total profit, the effect of the second FDI is more ambiguous. In particular, when $t \in [t^*, \tilde{t}]$, the second FDI actually decreases the total profit. This is because, in this range, the transport cost is so large that firm B (or more precisely union B) chooses not to export to the foreign market: as a result, firm A can monopolize the foreign market. The total profit naturally declines as the foreign market becomes duopolistic. In any event, though, the figure indicates that the effect of the second FDI on the total profit seems to be fairly negligible, compared to that of the first FDI. This implies that the firms' gains associated with FDI are almost fully exploited by the first FDI.

[figure 3 about here]

Total union utility: With the relocation of productive capacities, the unions inevitably lose employment to foreign workers. Intuition thus suggests that the unambiguous loser of FDI is the unions. This intuition is in general true for the first FDI, but the magnitude of the loss is again fairly negligible for the second FDI. In fact, the unions are actually made better off by the second FDI when t is in an intermediate range. The driving force behind this result is the presence of domestic competition. When only firm A undertakes FDI and $t \in [0, t^*]$, union B is placed in a difficult situation since it needs to lower its wage to compete in the foreign market. Note that this downward pressure works adversely for union A as well since it must also lower its wage in response to union B 's wage-setting behavior (see figure 2). The second FDI may be beneficial for the unions as a whole because they no longer have this competitive pressure on their wages. This implies that the fact that the firm can export and potentially capture the foreign market may sometimes work adversely for the unions because it leads to excessive price competition between them.⁸ As a result, there may arise a situation where FDI benefits the unions because it serves to soften price competition between them by depriving them of the option of exporting altogether. The next proposition summarizes this result.

Proposition 2 *When (i) there are two domestic firms and (ii) the two markets are symmetric in size, there exists some $\tilde{t} \in (0, t^*)$ such that the unions benefit from the second FDI for $t \in [\tilde{t}, t^*]$.*

⁸Apparently, the unions can avoid this problem if the union, whose firm does not undertake FDI, can somehow credibly commit itself to setting higher wages and thus staying out of the foreign market.

While the incentive to lower the wage to compete in the foreign market becomes stronger as t increases, it eventually reaches a point where it no longer pays off for union B to continue to do so. The union then gives up the foreign market and instead raises its wage to compensate for the loss of the market: that is, the union behaves as if its firm undertakes FDI. This also releases union A from the downward pressure on its wage. When $t \in [t^*, \bar{t}]$, therefore, the second FDI has no effect on how union B behaves because its firm does not export in the first place. As a result, nothing changes as far as the unions are concerned when the second FDI is undertaken.

[figure 4 about here]

Domestic consumers: The consumer surplus is ultimately determined by the wages set by the unions. Higher wages are detrimental to consumers since they result in higher prices and less output. As can be seen from figure 5, the unions' gains are roughly consumers' losses and vice versa. In this sense, the consumer surplus can be seen as a flip side of the unions' utility.

In general, the consumer surplus is minimized when both of the firms undertake FDI because the wage effect pushes the wages upward. The first FDI is beneficial for consumers when $t \in [0, t^*]$ because the upstream competition between the unions over the foreign market drives down the wages. The second FDI is, on the other hand, always detrimental to consumers because it releases the unions from this downward pressure on the wages. This indicates that while FDI as a device to soften price competition benefits the unions, it works adversely for consumers because of less output resulting from higher wages. The loss incurred by consumers due to the second FDI constitutes a substantial part of the overall welfare loss, as we will see next.

Proposition 3 *When (i) there are two domestic firms and (ii) the two markets are symmetric in size, the consumer surplus is minimized when both of the firms undertake FDI.*

[figure 5 about here]

National welfare: There are several forces at work as illustrated, depending on t . Figure 6 consistently reveals, however, that there exists a non-monotonic relationship between national welfare and the amount of FDI: the first FDI is always welfare-improving while the second FDI is always welfare-reducing. The driving force behind this is again the presence of upstream competition. In particular, the first FDI leads to intense rivalry between the unions and consequently results in welfare gains, although the competition may be excessively intense from the unions' viewpoint. Note also that, when

t is sufficiently small, the national welfare is minimized when both of the firms undertake FDI, i.e., (FDI, FDI) is worse, in terms of the national welfare, than not only (FDI, no FDI) but also (no FDI, no FDI). This draws clear contrast to the case with one domestic firm where outward FDI is always welfare-improving, provided that the markets are symmetric in size. When there are two domestic firms, the increase in the firms' total profit, the most important part of welfare gains, are not sufficient to totally compensate for the losses because the foreign market is now duopolistic and hence more competitive. The following statement summarizes the main result of the paper.

Proposition 4 *When (i) there are two domestic firms and (ii) the two markets are symmetric in size, the national welfare is maximized for any $t \in [0, \bar{t}]$ when only one of the firms undertakes FDI. Alternatively, the second FDI is always welfare-reducing.*

[figure 6 about here]

5 Conclusion

The paper constructs a model of unionized duopoly and examines the long-run welfare effect of outward FDI on the home country. It is found that the presence of upstream competition gives rise to welfare effects that lead to a non-monotonic relationship between national welfare and the amount of FDI. With the strategic interaction between the unions, the amount of FDI can be excessive even when FDI is totally free of cost. The present analysis identifies a possible mechanism through which outward FDI actually reduces welfare in the home economy, as often argued informally, and thus raises a policy implication: whether outward FDI should be encouraged depends on the nature of domestic competition, especially among upstream input suppliers.

Since our analysis is confined in a relatively simple framework, there are several potential avenues to extend the present analysis. For instance, the analysis in our model is confined to a case with disintegrated unions. A natural extension is thus to consider a case where the upstream unions are integrated and act as one utility-maximizing unit. Such an extension is potentially crucial since it provides a framework to examine the impact of upstream merger when FDI is a concern. In future, it is of some interest to extend the present analysis to various settings to gain further insight on the home-country welfare effect of outward FDI.

[2005.10.7 729]

Appendix A

(no FDI, no FDI): In this situation, each firm may choose not to export, depending on the wage set by its union. If both of the firms choose to export, we obtain

$$w_i = \frac{2 + 2w_{-i} - t}{8}, \quad (\text{A.1})$$

which leads to

$$w_i = \frac{2 - t}{6}, \quad (\text{A.2})$$

$$x_i, y_i = \frac{4 + t}{18}, \frac{4 - 5t}{18}. \quad (\text{A.3})$$

It follows from this that each union's utility is

$$u_i = \frac{(2 - t)^2}{27}. \quad (\text{A.4})$$

We now show that this pair of wages indeed constitutes an equilibrium. To see this, it suffices to show that each union has no incentive to deviate from this wage level taking the other union's wage as given. If a union unilaterally deviates and prevents its firm from exporting, the objective function becomes

$$\max_{w_i} w_i x_i = \frac{w_i(1 - 2w_i + w_{-i})}{3}, \quad \text{s.t. } 1 - t - 2w_i + w_{-i} < 0.$$

If $t < 8/13$, the constraint is binding and we have

$$w_i = \frac{1 - t + w_{-i}}{2} = \frac{8 - 7t}{12}. \quad (\text{A.5})$$

$$x_i, y_i = \frac{t}{3}, 0. \quad (\text{A.6})$$

The union's utility when it deviates is then

$$u_i = \frac{(8 - 7t)t}{36}. \quad (\text{A.7})$$

There is no incentive to unilaterally deviate from the equilibrium if (A.4) is larger than (A.7), i.e.,

$$\frac{(2 - t)^2}{27} \geq \frac{(8 - 7t)t}{36}. \quad (\text{A.8})$$

It is straightforward to verify that this holds for any t .

(FDI, no FDI): In this situation, firm B may choose not to export, depending on the wage set by union B . Suppose first that the wage set by union B is low enough for firm B to export. The first-order conditions then imply that

$$x_A, y_A = \frac{1 - 2w_A + w_B}{3}, \frac{1 + w_B}{3}, \quad (\text{A.9})$$

$$x_B, y_B = \frac{1 + w_A - 2w_B}{3}, \frac{1 - 2w_B - 2t}{3}. \quad (\text{A.10})$$

The maximization problem for each union becomes

$$\max_{w_A} w_A x_A = \frac{w_A(1 - 2w_A + w_B)}{3}, \quad (\text{A.11})$$

$$\max_{w_B} w_B(x_B + y_B) = \frac{w_B(2 + w_A - 4w_B - 2t)}{3}, \quad \text{s.t.} \quad \frac{1 - 2w_B - 2t}{3} \geq 0. \quad (\text{A.12})$$

If $t < 13/46$, the constraint is not binding, the optimal wages must satisfy

$$w_A = \frac{1 + w_B}{4}, \quad (\text{A.13})$$

$$w_B = \frac{2 + w_A - 2t}{8}. \quad (\text{A.14})$$

We can then show that

$$w_A = \frac{10 - 2t}{31}, \quad (\text{A.15})$$

$$w_B = \frac{9 - 8t}{31}, \quad (\text{A.16})$$

$$x_A, y_A = \frac{20 - 4t}{31}, \frac{40 - 23t}{31}, \quad (\text{A.17})$$

$$x_B, y_B = \frac{23 + 14t}{93}, \frac{13 - 46t}{93}. \quad (\text{A.18})$$

It follows from these that union B 's utility is

$$u_B = \frac{4(9 - 8t)^2}{2883}. \quad (\text{A.19})$$

Now suppose that union B raises the wage to the level that makes firm B unable to export. Solving the first-order conditions, we have

$$x_A, y_A = \frac{1 - 2w_A + w_B}{3}, \frac{1}{2}, \quad (\text{A.20})$$

$$x_B, y_B = \frac{1 + w_A - 2w_B}{3}, 0. \quad (\text{A.21})$$

The maximization problem for each union now becomes

$$\max_{w_A} w_A x_A = \frac{w_A(1 - 2w_A + w_B)}{3}, \quad (\text{A.22})$$

$$\max_{w_B} w_B x_B = \frac{w_B(1 + w_A - 2w_B)}{3}, \quad \text{s.t.} \quad \frac{1 - 2w_B - 2t}{3} < 0. \quad (\text{A.23})$$

If $t > 1/6$, the constraint is not binding and the optimal wages and quantities are given by

$$w_A = w_B = \frac{1}{3}, \quad (\text{A.24})$$

$$x_A, y_A = \frac{2}{9}, \frac{1}{2}, \quad (\text{A.25})$$

$$x_B, y_B = \frac{2}{9}, 0. \quad (\text{A.26})$$

It follows from these that union B 's utility is

$$u_B = \frac{2}{27}. \quad (\text{A.27})$$

Union B then chooses the latter strategy, which prevents firm B from exporting, if (A.27) exceeds (A.19), i.e.,

$$\frac{2}{27} - \frac{4(9-8t)^2}{2883} > 0, \Rightarrow t > \frac{54-31\sqrt{2}}{48} \sim 0.212. \quad (\text{A.28})$$

Appendix B

In this appendix, we consider a case where the two markets are asymmetric in size and derive conditions under which FDI reduces welfare. To this end, we redefine the demand function of the foreign market as follows:

$$q = a - y. \quad (\text{A.29})$$

The intercept a measures the (relative) size of the foreign market.

Even with this modification, the nature of the problem is virtually unchanged. In the case of no FDI, we obtain

$$w = \begin{cases} (1+a-t)/4 & \text{if } \tilde{t}(a) \geq t \\ 1/2 & \text{if } t > \tilde{t}(a), \end{cases} \quad (\text{A.30})$$

and

$$x, y = \begin{cases} (3-a+t)/8, (3a-3t-1)/8 & \text{if } \tilde{t}(a) \geq t \\ 1/4, 0 & \text{if } t > \tilde{t}(a). \end{cases} \quad (\text{A.31})$$

where $\tilde{t}(a) \equiv 1 - \sqrt{2} + a$. Similarly, in the case of FDI, we obtain

$$w = \frac{1}{2}, \quad (\text{A.32})$$

and

$$x, y = \frac{1}{4}, \frac{a}{2}. \quad (\text{A.33})$$

To show that FDI is always welfare-improving, we need to consider two cases: (i) $\tilde{t}(a) \geq t$ and (ii) $t > \tilde{t}(a)$. For each case, the welfare effect of FDI is computed as

$$NW^1 - NW^0 = \begin{cases} (-9 + 14a + 3a^2 - 2(7 - 29a)t - 29t^2)/128 & \text{if } \tilde{t}(a) \geq t \\ a^2/4 & \text{if } t > \tilde{t}(a). \end{cases} \quad (\text{A.34})$$

It is immediate to see that the welfare effect is positive when $t > \tilde{t}(a)$. This implies that FDI is welfare-reducing if and only if (a, t) satisfies the following conditions:

$$\frac{-9 + 14a + 3a^2 - 2(7 - 29a)t - 29t^2}{128} < 0, \quad (\text{A.35})$$

$$1 - \sqrt{2} + a \geq t. \quad (\text{A.36})$$

The shaded region in figure 7 depicts the range for which FDI reduces welfare.

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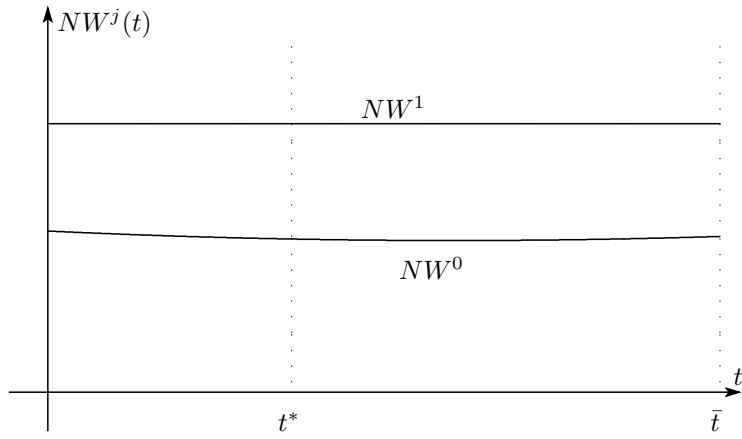


Figure 1: National welfare with one domestic firm

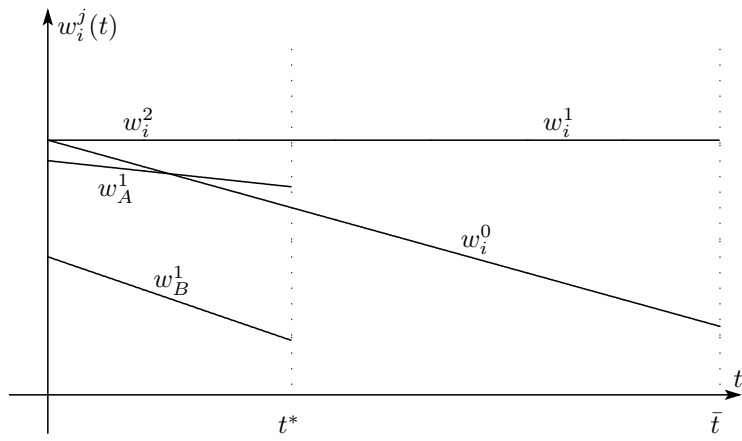


Figure 2: Equilibrium wages

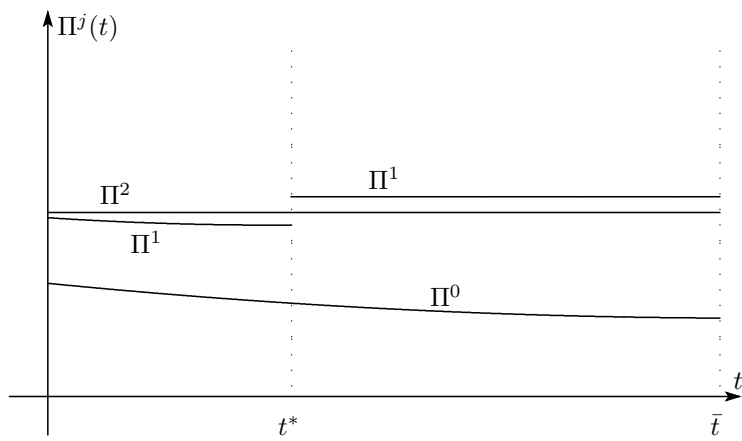


Figure 3: Total profit $\Pi^j \equiv \pi_A^j + \pi_B^j$

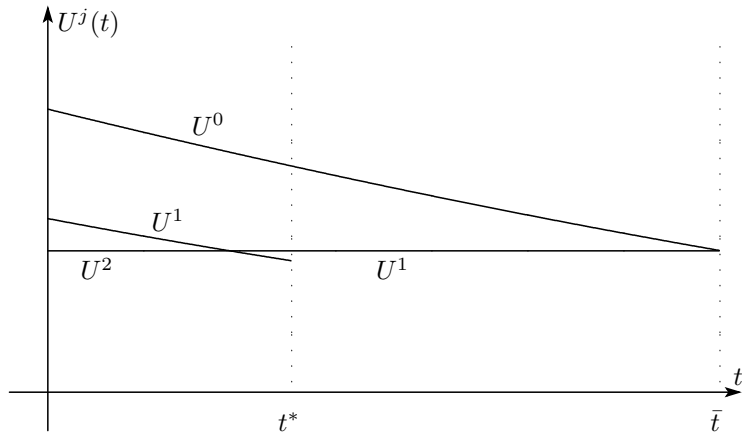


Figure 4: Total union utility $U^j \equiv u_A^j + u_B^j$

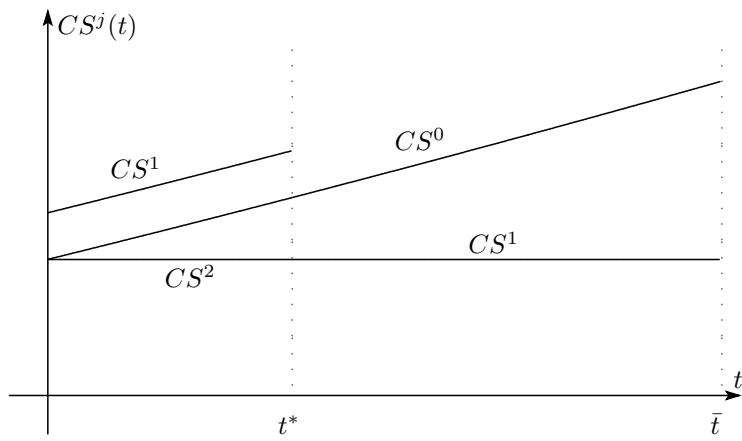


Figure 5: Consumer surplus

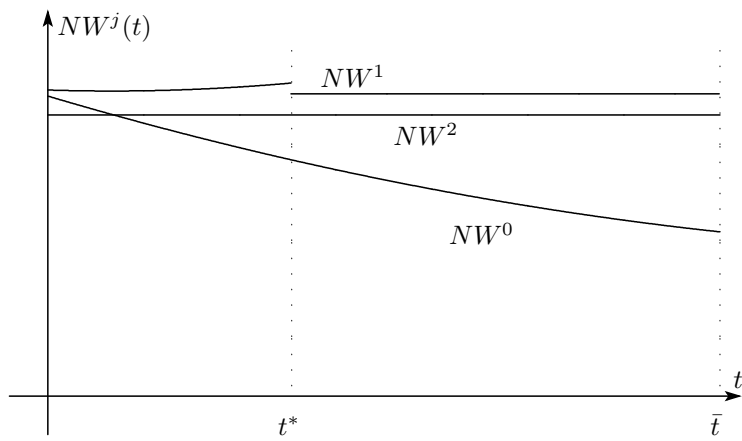


Figure 6: National welfare with two domestic firms

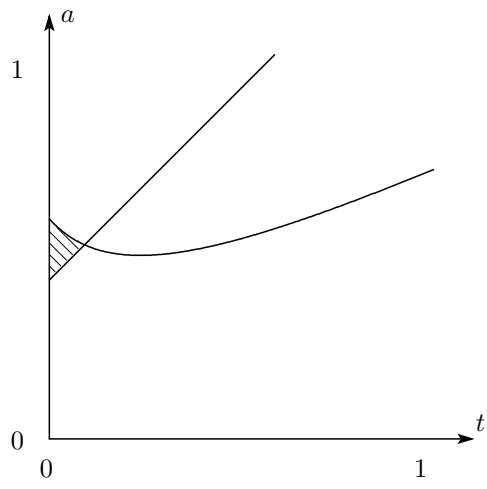


Figure 7