How the Movement of Natural Persons Agreement Could Fuel FTAs

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Abstract

We use an international oligopoly model to explore the effects of reductions in trade cost (non-tariff barrier) and travel cost on the domestic and foreign economies, when the choice of the foreign direct investment (FDI) production level is endogenous. In the case where the home firm produces in both countries, consumers invariably gain from the cost reductions, but the effects on producers are very complex. Using these findings, we discuss the importance of the movement of natural persons (MNP) agreement and its great potential in creating a free trade agreement (FTA) between the two countries.

Keywords: FDI, FTAs, Movement of natural persons, Trade liberalization
JEL classification: F12, F13, F15, F23

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1 Introduction

Since the Japan–Singapore Economic Partnership Agreement (JSEPA) became effective, the Government of Japan has concluded thirteen economic partnership agreements (EPAs) with twelve countries and one area. EPAs are not necessarily limited to trade and investment and cover a wider range of economic activities than free trade agreements (FTAs). From the handout released by the Ministry of Foreign Affairs of Japan, we recognized that most Japanese EPAs include agreements on movement of natural persons (MNP)[1].

Studies on MNP usually focus on the movement of persons such as nurses and certified care workers from Indonesia, the Philippines, and other countries to Japan, and the effect of such movement on the Japanese labor market. In this paper, however, we consider the movement of natural persons, such as short-term business travelers and intra-company transfers of employees, from Japan to other countries. These activities are part of some Japanese EPAs, for example, those with India, Indonesia, and the Philippines.

What is the difference between FTAs and EPAs? Ishikawa et al. (2010) consider post-production services and report an important finding, namely, trade liberalization may have a negative welfare effect, but this is eliminated by liberalizing foreign direct investment (FDI) in services at the same time. What is the difference between FTAs with and without MNP agreements? We examine the welfare impacts of a reduction in a non-trade barrier (trade liberalization) with and without MNP.

In addition, we explore the role of MNP agreements in the formation of FTAs. Specifically, we show the possibility of concluding FTAs supported by MNP agreements.

An agreement on the movement of natural persons reduces travel costs[2]. The effects of travel costs on international trade and FDI are important, as shown empirically by Neumayer (2011). Neumayer (2011) investigates the effect of visa restrictions on bilateral trade flows and FDI stocks by using a standard gravity model. It is found that bilateral trade decreases by up to 19% and FDI stock by up to 25% when unilateral visa restrictions are imposed.

Oldenski (2012) considers that the cost of transmitting information (communication) is underemphasized in the literature and shows that a firm's choice of location is influenced by the need to interact with customers and communicate complex information within the firm. Oldenski (2012) finds that activities requiring the former type of communication are more likely to be located near the market and those requiring the latter type of communication are more likely to

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[1]The exceptions are Japan's respective EPAs with Brunei, Malaysia, and Association of South East Asian Nations (ASEAN). Among the ASEAN members, Japan had visa exemption agreements with Brunei and Malaysia before these EPAs were formed. This might be the reason for the exceptions. The handout (in Japanese) can be downloaded as a PDF file at the following URL.

http://www.mofa.go.jp/mofaj/files/000037892.pdf

[2]An MNP agreement not only decreases real travel costs, but also reduces the opportunity costs of business travel for communication. For example, an application to the authorities for a visa costs money and time. A visa exemption for short-term business travelers eliminates their application fees and waiting times and makes them able to more quickly respond to unexpected events.

be located near the firm's headquarters. The difficulties of transmitting information are different for different tasks; therefore, firms that undertake FDI accomplish some tasks domestically and others abroad. We take this aspect into consideration in our analysis. MNP agreements that reduce travel costs also reduce the cost of communication.

The rest of the paper is organized as follows. We present the basic model in Section 2 and benchmark cases in Section 3. In Section 4, we construct an endogenous choice of FDI production level. We then examine the effects of trade-cost and travel-cost reductions on the FDI production level, firms' profits, consumer surplus, and welfare. In Section 5, we discuss a possible creation of an FTA supported by an MNP agreements. Section 6 concludes the paper.

2 Basic model

In this section, we introduce our basic model. There are two countries (home and foreign) and two firms (firm 1 and firm 2). Firm 1 (potential multinational enterprise or MNE) is in the home country and firm 2 (exporter) is in the foreign country. The firms produce a homogeneous good and compete only in the home country market. The inverse demand function is given by

$$P = A - BQ,$$

where Q and P are, respectively, the demand and consumer price.

When firm 1 produces the good without FDI, both firms produce the good domestically and their cost functions are very simple. The cost function of firm 1 is given by $C_1(q_1) = c_h q_1$, where c_h and q_1 are, respectively, the constant marginal cost (MC) and output of firm 1. The cost function of firm 2 is given by $C_2(q_2) = c_f q_2$, where c_f and q_2 are, respectively, the constant MC and output of firm 2.

When firm 1 undertakes FDI to produce the good, its cost function is given by

$$C_1(q_1) = \{(1-\alpha)c_h + \alpha(c_f + t)\} q_1 + \frac{1}{2}\alpha^2\tau + F, \tag{1}$$

where t, τ, and F are, respectively, the trade cost that forms a non-tariff barrier, the travel cost, and the fixed cost (FC) of FDI. The first term on the right hand side (RHS) of (1) is the production and trade cost. α captures the FDI production level ($0 < \alpha \leq 1$) and $(1-\alpha)c_h + \alpha(c_f + t)$ is the effective MC of firm 1. If $c_h > c_f + t$, firm 1 would be able to reduce its MC by raising the FDI production level. The second term is the (total) communication cost, composed of the FDI level and travel cost. This is the cost for FDI and managing foreign production. To manage production overseas, communication between the parent firm and subsidiaries is important. When the firm chooses a high FDI production level, the total communication cost is also high. As mentioned in Oldenski (2012), the cost of transmitting information is different for different tasks. The task that has the lowest communication cost (we call it "task 0" here) is easiest to shift abroad. Thus, total communication cost increases more than proportionally to the increase in α and it has a

quadratic form in our model[3]. An MNP agreement reduces the travel cost, τ, leading to a decline in the communication cost for any given α. When firm 1 produces more abroad, its effective MC decreases, but its communication cost increases. This is very similar to Jones and Kierzkowski's (2005) fragmentation model[4]. The third term is the FC of FDI and we assume $F = 0$ for the remainder of the paper[5].

In our model, the social welfare of the home country and that of the foreign country are, respectively,

$$W_h = CS_h + \Pi_1,$$
$$W_f = \Pi_2,$$

where CS_h is the consumer surplus in the home country and Π_i is the profit of firm i $(i = 1, 2)$. The tariff revenue is not added to the home country's welfare, because we consider non-tariff barriers in the form of a trade cost.

The model involves two stage of decision. In stage 1, firm 1 chooses its FDI production level, α. In stage 2, the firms compete in quantities with Cournot conjectures. The game is solved by backward induction.

We now make the following assumptions:

$$c_h - c_f - t > 0 \Leftrightarrow c_h > c_f + t, \tag{Assumption 1}$$
$$9B\tau - 8\left(c_h - c_f - t\right)^2 > 0 \Leftrightarrow \tau > 8\left(c_h - c_f - t\right)^2 / 9B, \tag{Assumption 2}$$
$$A - 2c_h + c_f + t > 0. \tag{Assumption 3}$$

Assumption 1 reflects a cost advantage of the foreign country. Assumption 2 ensures a non-negative FDI production level $(\alpha \geq 0)$. We obtain an interior solution for Cournot competition by Assumption 3.

3 Benchmarks

In this section, we briefly review the case of no FDI production $(\alpha = 0)$, that is, the simple international duopoly model, and the full FDI production case $(\alpha = 1)$ as benchmarks.

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[3]The shape of the (total) communication cost in our model is justified by an alternative explanation. We suppose that interactions with consumers are very important for the production of the good and that task 0 is the most primal task and task 1 is the closest to the final good. In this case, the larger α, the higher the communication cost for the task.

[4]For example, see Jones and Kierzkowski (2005). Figure 1 of the paper shows how reductions in the service-link costs promote greater degrees of fragmentation for any given output level.

[5]We could consider the second term as part of the FDI cost. In this case, FDI cost is not a constant and depends on the extent to which the firm produces abroad.

3.1 No FDI production

The profits of firms are given by

$$\Pi_1 = Pq_1 - c_h q_1, \ \Pi_2 = Pq_2 - (c_f + t) \, q_2.$$

We obtain the equilibrium outputs as follows:

$$q_1 = \frac{1}{3B} \left(A - 2c_h + c_f + t\right), \ q_2 = \frac{1}{3B} \left(A + c_h - 2c_f - 2t\right),$$
$$Q = \frac{1}{3B} \left(2A - c_h - c_f - t\right).$$

The equilibrium profits and consumer surplus are, respectively,

$$\Pi_1 = B \left(q_1\right)^2, \ \Pi_2 = B \left(q_2\right)^2,$$
$$CS_h = \frac{B}{2} Q^2.$$

Thus, the social welfare of the home and foreign countries, respectively, is as follows:

$$W_h = \frac{B}{2} Q^2 + B \left(q_1\right)^2,$$
$$W_f = B \left(q_2\right)^2.$$

We now examine the effects of trade liberalization (a reduction in the non-tariff barrier). The effects of trade liberalization on outputs are

$$-\frac{dq_1}{dt} = -\frac{1}{3B} < 0, -\frac{dq_2}{dt} = \frac{2}{3B} > 0, -\frac{dQ}{dt} = \frac{1}{3B} > 0.$$

Because the trade liberalization reduces firm 2's effective MC, $c_f + t$, only, firm 2 increases its output and firm 1 decreases its output. The effects of trade liberalization on the consumer surplus, profits, and welfare are, respectively,

$$-\frac{dCS_h}{dt} = BQ \left(-\frac{dQ}{dt}\right) = \frac{1}{9B} \left(2A - c_h - c_f - t\right) > 0,$$
$$-\frac{d\Pi_1}{dt} = 2Bq_1 \left(-\frac{dq_1}{dt}\right) = -\frac{2}{9B} \left(A - 2c_h + c_f + t\right) < 0,$$
$$-\frac{dW_h}{dt} = BQ \left(-\frac{dQ}{dt}\right) + 2Bq_1 \left(-\frac{dq_1}{dt}\right) = \frac{1}{3B} \left(c_h - c_f - t\right) > 0,$$
$$-\frac{d\Pi_2}{dt} = -\frac{dW_f}{dt} = 2Bq_2 \left(-\frac{dq_2}{dt}\right) = \frac{4}{9B} \left(A + c_h - 2c_f - 2t\right) > 0.$$

Both countries are better off as a whole when there is no FDI production ($\alpha = 0$). With trade liberalization, consumers in the home country are better off, whereas the producer is worse off. Thus, the producer in the home country opposes agreements on non-tariff trade-cost reduction. In this case, the governments have no other instrument to resolve this conflict of interests.

3.2 Full FDI production

The profits of firms are given by

$$\Pi_1 = Pq_1 - (c_f + t)\,q_1 - \frac{1}{2}\tau, \ \ \Pi_2 = Pq_2 - (c_f + t)\,q_2.$$

We obtain the equilibrium outputs as follows:

$$q_1 = \frac{1}{3B}\,(A - c_f - t)\,, \ \ q_2 = \frac{1}{3B}\,(A - c_f - t)\,,$$
$$Q = \frac{2}{3B}\,(A - c_f - t)\,.$$

The equilibrium profits and consumer surplus are, respectively,

$$\Pi_1 = B\,(q_1)^2 - \frac{1}{2}\tau, \ \ \Pi_2 = B\,(q_2)^2\,,$$
$$CS_h = \frac{B}{2}Q^2.$$

Unlike in the previous subsection, firm 1 should bear the communication cost because of its FDI production. Thus, the social welfare of the home and foreign countries, respectively, is as follows:

$$W_h = \frac{B}{2}Q^2 + B\,(q_1)^2 - \frac{1}{2}\tau = \frac{1}{3B}\,(A - c_f - t)^2 - \frac{1}{2}\tau,$$
$$W_f = B\,(q_2)^2\,.$$

We now examine the effects of trade liberalization (a reduction in the non-tariff trade cost). The effects of trade liberalization on outputs are

$$-\frac{dq_1}{dt} = \frac{1}{3B} > 0, -\frac{dq_2}{dt} = \frac{1}{3B} > 0, -\frac{dQ}{dt} = \frac{2}{3B} > 0.$$

Because the trade liberalization decreases effective MCs of the two firms equally, both firms increase their outputs. The effects of trade liberalization on the consumer surplus, profits, and welfare are, respectively,

$$-\frac{dCS_h}{dt} = BQ\left(-\frac{dQ}{dt}\right) = \frac{4}{9B}\,(A - c_f - t) > 0,$$
$$-\frac{d\Pi_1}{dt} = 2Bq_1\left(-\frac{dq_1}{dt}\right) = \frac{2}{9B}\,(A - c_f - t) > 0,$$
$$-\frac{dW_h}{dt} = BQ\left(-\frac{dQ}{dt}\right) + 2Bq_1\left(-\frac{dq_1}{dt}\right) = \frac{2}{3B}\,(A - c_f - t) > 0,$$
$$-\frac{d\Pi_2}{dt} = -\frac{dW_f}{dt} = 2Bq_2\left(-\frac{dq_2}{dt}\right) = \frac{2}{9B}\,(A - c_f - t) > 0.$$

In the case of full FDI production ($\alpha = 1$), both countries are better off as a whole. Furthermore, both consumers and producer in the home country are better off with a reduction in non-tariff trade barriers. Thus, there is no opposition to trade liberalization.

Next, we examine the effects of an MNP agreement (a reduction in travel cost). A reduction in τ does not affect firm 1's effective MC but the communication cost, and the equilibrium outputs

of the firms do not change. Thus, the reduction in τ affects the profit of firm 1 only[6]. The effects of the MNP agreement on the consumer surplus, profits, and welfare are given by

$$-\frac{dCS_h}{d\tau} = 0, \; -\frac{d\Pi_1}{d\tau} = \frac{1}{2} > 0, \; -\frac{dW_h}{d\tau} = \frac{1}{2} > 0,$$
$$-\frac{d\Pi_2}{d\tau} = -\frac{dW_f}{d\tau} = 0.$$

In this case, the governments have the MNP agreement as a policy instrument, but they do not understand its importance for trade liberalization, because the latter has no opponents in this world.

4 Endogenous FDI production level

In the previous section, we investigated two exogenous FDI cases ($\alpha = 0$ and $\alpha = 1$). In this section, we examine the case where the choice of FDI production level is endogenous. In this case, firm 1 chooses its FDI level in the first stage, and firms 1 and 2 set their outputs level in the second stage. We solve this game by backward induction.

4.1 Second stage

Given α, the profits of the two firms are given by, respectively,

$$\Pi_1 = Pq_1 - \{(1-\alpha)\,c_h + \alpha\,(c_f + t)\}\,q_1 - \frac{1}{2}\alpha^2\tau,$$
$$\Pi_2 = Pq_2 - (c_f + t)\,q_2.$$

We obtain the equilibrium outputs as follows:

$$q_1 = \frac{1}{3B}\left\{A - 2\,(1-\alpha)\,c_h + (1-2\alpha)\,(c_f + t)\right\},$$
$$q_2 = \frac{1}{3B}\left\{A + (1-\alpha)\,c_h - (2-\alpha)\,(c_f + t)\right\},$$
$$Q = \frac{1}{3B}\left\{2A - (1-\alpha)\,c_h - (1+\alpha)\,(c_f + t)\right\}.$$

Given α, the equilibrium profits and consumer surplus are, respectively,

$$\Pi_1 = B\,(q_1)^2 - \frac{1}{2}\alpha^2\tau, \tag{2}$$
$$\Pi_2 = B\,(q_2)^2, \tag{3}$$
$$CS_h = \frac{B}{2}Q^2.$$

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[6]In the case of endogenous choice of FDI production level, the MNP agreement affects α. Thus, the MNP agreement changes firm 1's effective MC.

4.2　First stage

We differentiate Π_1 with respect to α and obtain

$$\frac{d\Pi_1}{d\alpha} = 2Bq_1\left(\frac{dq_1}{d\alpha}\right) - \alpha\tau$$

$$= \frac{4}{9B}\left\{A - 2(1-\alpha)c_h + (1-2\alpha)(c_f + t)\right\}(c_h - c_f - t) - \alpha\tau,$$

$$\frac{d}{d\alpha}\left(\frac{d\Pi_1}{d\alpha}\right) = \frac{8}{9B}(c_h - c_f - t)^2 - \tau.$$

If $\tau = 0$, $\frac{d\Pi_1}{d\alpha} > 0$ and $\frac{d}{d\alpha}\left(\frac{d\Pi_1}{d\alpha}\right) > 0$. Thus, firm 1 chooses full FDI production ($\alpha = 1$). However, we omit this case, because the second-order condition holds from Assumption 2. Using the first-order condition, we obtain the optimal FDI production level as follows:

$$\alpha = \frac{4(c_h - c_f - t)(A - 2c_h + c_f + t)}{9B\tau - 8(c_h - c_f - t)^2} > 0.$$

From Assumptions 1, 2, and 3, we always obtain positive α. The condition for $\alpha < 1$ is

$$\tau > 4(c_h - c_f - t)(A - c_f - t)/9B.$$

Because $4(c_h - c_f - t)(A - c_f - t)/9B > 8(c_h - c_f - t)^2/9B$, Assumption 2 may not guarantee $\alpha < 1$. Thus, for the remainder of the paper, we assume

$$9B\tau - 4(c_h - c_f - t)(A - c_f - t) > 0 \Leftrightarrow \tau > 4(c_h - c_f - t)(A - c_f - t)/9B. \quad \text{(Assumption 4)}$$

Thus, we have $0 < \alpha < 1$ for the FDI production level[7].

We obtain the equilibrium outputs as follows:

$$q_1 = \frac{3\tau(A - 2c_h + c_f + t)}{9B\tau - 8(c_h - c_f - t)^2},$$

$$q_2 = \frac{3B\tau(A + c_h - 2c_f - 2t) - 4(c_h - c_f - t)^2(A - c_f - t)}{B\left\{9B\tau - 8(c_h - c_f - t)^2\right\}},$$

$$Q = \frac{3B\tau(2A - c_h - c_f - t) - 4(c_h - c_f - t)^2(A - c_f - t)}{B\left\{9B\tau - 8(c_h - c_f - t)^2\right\}}.$$

From Assumption 4, we can find $q_2 > 0$ and $Q > 0$.

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[7]When $\tau \leq 4(c_h - c_f - t)(A - c_f - t)/9B$, firm 1 chooses the full FDI production level ($\alpha = 1$). This case is discussed in the previous section.

The equilibrium profits, consumer surplus, and social welfare are, respectively,

$$\Pi_1 = \frac{\tau \left(A - 2c_h + c_f + t\right)^2}{9B\tau - 8\left(c_h - c_f - t\right)^2},$$

$$CS_h = \frac{\left\{3B\tau\left(2A - c_h - c_f - t\right) - 4\left(c_h - c_f - t\right)^2\left(A - c_f - t\right)\right\}^2}{2B\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2},$$

$$W_h = CS_h + \Pi_1,$$

$$\Pi_2 = W_f = \frac{\left\{3B\tau\left(A + c_h - 2t - 2c_f\right) - 4\left(c_h - c_f - t\right)^2\left(A - c_f - t\right)\right\}^2}{B\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2}.$$

4.3 Trade liberalization

In this subsection, we examine the effects of trade liberalization (a reduction in the non-tariff barrier) in the case of endogenous choice of FDI production. The effect of trade liberalization on the FDI production level is given by

$$-\frac{d\alpha}{dt} = \frac{4\Delta}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2} > 0, \tag{4}$$

where $\Delta \equiv 9B\tau\left(A - 3c_h + 2c_f + 2t\right) + 8\left(c_h - c_f - t\right)^2\left(A - c_h\right)$. Using Assumption 2, we can show that $\Delta > 16\left(c_h - c_f - t\right)^2\left(A - 2c_h + c_f + t\right) > 0$. Thus, (4) is positive. Therefore, when the trade cost decreases, firm 1 produces more in the foreign country. Then, the effective MC, $(1 - \alpha)c_h + \alpha\left(c_f + t\right)$, decreases as follows:

$$-\frac{d}{dt}\left(\left(1 - \alpha\right)c_h + \alpha\left(c_f + t\right)\right) = -\alpha - \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right) < 0. \tag{5}$$

The first term on the RHS of (5) is the direct effect of trade liberalization and the second term is due to an increase in the FDI production level. However, as the FDI production level increases, the communication cost increases as follows:

$$-\frac{d}{dt}\left(\frac{1}{2}\alpha^2\tau\right) = \alpha\tau\left(-\frac{d\alpha}{dt}\right) > 0.$$

The effective MC of firm 2, $c_f + t$, also decreases when trade liberalization occurs. The reduction in the effective MC of firm 2 is always one.

The effects of trade liberalization on the outputs of firm i ($i = 1, 2$) and the total output are,

respectively,

$$-\frac{dq_1}{dt} = -\frac{1}{3B}\left\{(1-2\alpha) - 2\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right)\right\}$$

$$= \frac{-3\tau\left\{9B\tau - 8\left(c_h - c_f - t\right)\left(2A - 3c_h + c_f + t\right)\right\}}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2}, \tag{6}$$

$$-\frac{dq_2}{dt} = \frac{1}{3B}\left\{(2-\alpha) - \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right)\right\}$$

$$= \frac{2Z}{B\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2}, \tag{7}$$

$$-\frac{dQ}{dt} = \frac{1}{3B}\left\{(1+\alpha) + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right)\right\} > 0,$$

where $Z \equiv 3B\tau\left\{9B\tau - 2\left(c_h - c_f - t\right)\left(2A + 3c_h - 5c_f - 5t\right)\right\} + 16\left(c_h - c_f - t\right)^4$. Unlike in the exogenous cases, the effects on firm outputs are ambiguous. From (6), we have

$$-\frac{dq_1}{dt} \gtreqless 0 \Leftrightarrow \alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right) \gtreqless \frac{1}{2}.$$

Because $\alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right)$ is the reduction in the effective MC of firm 1 and 1 is the reduction in that of firm 2, the above condition means that firm 1 increases its output when its effective MC reduction is greater than half of its rival's effective MC reduction. In the same manner, from (7), we have

$$-\frac{dq_2}{dt} \gtreqless 0 \Leftrightarrow 1 \gtreqless \frac{1}{2}\left\{\alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right)\right\}.$$

This means that firm 2 increases its output when its effective MC reduction is greater than half of its rival's effective MC reduction. Thus, the effects of trade liberalization on the respective outputs are summarized as follows:

$$-\frac{dq_1}{dt} < 0, -\frac{dq_2}{dt} > 0 \text{ if } \alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right) < \frac{1}{2},$$

$$-\frac{dq_1}{dt} \geq 0, -\frac{dq_2}{dt} > 0 \text{ if } \frac{1}{2} \leq \alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right) < 2,$$

$$-\frac{dq_1}{dt} > 0, -\frac{dq_2}{dt} \leq 0 \text{ if } 2 \leq \alpha + \left(c_h - c_f - t\right)\left(-\frac{d\alpha}{dt}\right).$$

The effects of trade liberalization on the consumer surplus and profits are, respectively,

$$-\frac{dCS_h}{dt} = \frac{2}{18B} \left\{ 2A - (1-\alpha)c_h - (1+\alpha)(c_f+t) \right\} \left\{ (1+\alpha) + (c_h - c_f - t) \left(-\frac{d\alpha}{dt} \right) \right\} > 0,$$

$$-\frac{d\Pi_1}{dt} = -\left[\frac{2}{9B} \left\{ A - 2(1-\alpha)c_h + (1-2\alpha)(c_f+t) \right\} \left\{ (1-2\alpha) - 2(c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \right\} + \alpha\tau \left(-\frac{d\alpha}{dt} \right) \right]$$

$$= -\frac{2\tau(A - 2c_h + c_f + t)\left\{ 9B\tau - 8(c_h - c_f - t)(A - c_h) \right\}}{\left\{ 9B\tau - 8(c_h - c_f - t)^2 \right\}^2}, \qquad (8)$$

$$-\frac{d\Pi_2}{dt} = \frac{2}{9B} \left\{ A + (1-\alpha)c_h - (2-\alpha)(c_f+t) \right\} \left\{ (2-\alpha) - (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \right\}$$

$$= \frac{4 \left\{ 3B\tau(A + c_h - 2c_f - 2t) - 4(c_h - c_f - t)^2(A - c_f - t) \right\} Z}{B \left\{ 9B\tau - 8(c_h - c_f - t)^2 \right\}^3}. \qquad (9)$$

Unlike in the exogenous cases, the effects on profits are ambiguous. From (3), we can show that firm 2's profit increases (decreases) when its output increases (decreases) owing to trade liberalization. For firm 1, however, we can only show that its profit decreases when its output decreases from (2). Even if the output of firm 1 increases, trade liberalization may have a negative effect on its profit, because of the increase in communication cost.

From (6) and (8), we have the following lemma.

Lemma 1 $\alpha + (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) < \frac{1}{2} \Leftrightarrow -\frac{dq_1}{dt} < 0 \text{ and } -\frac{d\Pi_1}{dt} < 0.$ $\frac{1}{2} \le \alpha + (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \Leftrightarrow -\frac{dq_1}{dt} \ge 0.$

$\frac{1}{2} > \alpha + (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right)$ comes from $(1 - 2\alpha) - 2(c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) > 0$. This means that when the reduction in the effective MC of firm 2 (equal to 1) is more than twice as large as that of firm 1, the output and profit of firm 1 decrease. Otherwise, the output of firm 1 increases. However, even with an increase in output, the effect on firm 1's profit is ambiguous, because of the increase in communication cost. Of course, if firm 1's profit increases, then its output also increases.

Similarly, from (7) and (9), we have the following lemma.

Lemma 2 $\alpha + (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \lesseqgtr 2 \Leftrightarrow -\frac{dq_2}{dt} \gtreqless 0, -\frac{d\Pi_2}{dt} \gtreqless 0.$

$\alpha + (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \lesseqgtr 2$ comes from $(2 - \alpha) - (c_h - c_f - t)\left(-\frac{d\alpha}{dt} \right) \gtreqless 0$. This means that when the reduction in the effective MC of firm 2 (equal to 1) is less than half of that of firm 1, the output and profit of firm 2 decrease; otherwise, they increase. From lemma 1 and lemma 2, we potentially have five combinations of the effects of trade liberalization on outputs and profits.

The five potential cases are shown in Tables 1 and 2 with parameters where each case occurs. Case 1 has the highest τ and Case 4 the lowest. Case 1 has similar results to those of no FDI production ($\alpha = 0$), whereas Case 3 has similar results to those of full FDI production ($\alpha = 1$). In Case 2, the reduction in trade cost increases firm 1's output, but is not large enough to increase its profit. The question then is, why would firm 1 increase its FDI level, α, even when the reduction

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	$-\frac{dq_1}{dt}$	$-\frac{d\Pi_1}{dt}$	$-\frac{dq_2}{dt}$	$-\frac{d\Pi_2}{dt}$	α	parameters
Case 1	-	-	+	+	0.21311	$A = 10$, $B = 2$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 3.5$
Case 2	+	-	+	+	0.48507	$A = 10$, $B = 2$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1.6$
Case 3	+	+	+	+	0.8125	$A = 10$, $B = 2$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1$
Case 4	+	+	-	-	0.91549	$A = 10$, $B = 2$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 0.9$

Table 1: Effects on outputs and profits of firms (part 1)

	$-\frac{dq_1}{dt}$	$-\frac{d\Pi_1}{dt}$	$-\frac{dq_2}{dt}$	$-\frac{d\Pi_2}{dt}$	α	parameters
Case 1	-	-	+	+	0.21622	$A = 3.6$, $B = 0.25$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1.3$
Case 2	+	-	+	+	0.28571	$A = 3.6$, $B = 0.25$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1.2$
Case 5	+	-	-	-	0.42105	$A = 3.6$, $B = 0.25$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1.1$
Case 4	+	+	-	-	0.8	$A = 3.6$, $B = 0.25$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 1$

Table 2: Effects on outputs and profits of firms (part 2)

in effective MC does not compensate for the increase in communication cost? Case 2 gives us a hint in this respect. In this case, because $\alpha < \frac{1}{2}$, firm 1 decreases its output and profit without changing the FDI level, for the reduction in effective MC is equal to α and is less than half of that of firm 2. Firm 1 could reduce the decline in its profit by shifting more tasks abroad. In Case 4, trade liberalization decreases the MC of firm 2, but its profit also decreases. The firm in the importing country (home country) gains from the reduction in the non-tariff trade cost and that in the exporting country (foreign country) loses from the reduction. Surprisingly, in Case 5, both firms lose from trade liberalization. The effects of trade liberalization on the firms are summarized in the following proposition.

Proposition 1 *At high values of τ, where the FDI production level is low, firm 1 (multinational firm) loses and firm 2 gains from trade liberalization. At low values of τ, where the FDI production level is high, firm 1 gains and firm 2 loses from trade liberalization. At medium values of τ, both firms gain from trade liberalization or both firms, surprisingly, lose from the cost reduction.*

The cross effect of t and τ is shown as follows:

$$\frac{d}{d\tau}\left(\frac{d\alpha}{dt}\right) = \frac{144B\left(c_h - c_f - t\right)\left(A + t + c_f - 2c_h\right)\Delta}{\left\{9B\tau - 8\left(t + c_f - c_h\right)^2\right\}^4} > 0.$$

Using (5), we have

$$\frac{d}{d\tau}\left(\frac{d}{dt}\left((1 - \alpha)c_h + \alpha\left(c_f + t\right)\right)\right) = \frac{d\alpha}{d\tau} - \left(c_h - c_f - t\right)\frac{d}{d\tau}\left(\frac{d\alpha}{dt}\right) < 0.$$

This means that when τ is low, the reduction in the effective MC of firm 1 is large. In cases in Table 1, these reductions are 0.42381 in Case 1, 1.0052 in Case 2, 1.7656 in Case 3, and 2.0184

in Case 4. The reduction in firm 1's MC could be larger than that of firm 2 (the reduction in firm 2's MC is always 1) at a low τ. Thus, firm 1's profit is likely to increase and that of firm 2 is likely to decrease at low values of τ[8].

The effects of trade liberalization on welfare are given by

$$
\begin{aligned}
-\frac{dW_h}{dt} &= -\frac{\partial W_h}{\partial t} + \frac{\partial W_h}{\partial \alpha}\left(-\frac{d\alpha}{dt}\right) \\
&= \frac{2\alpha\left(A - 2c_h + c_f + t\right) + \left(1 + 3\alpha^2\right)\left(c_h - c_f - t\right)}{3B} \\
&\quad - \left[\frac{3B\alpha\tau - \left(c_h - c_f - t\right)\left\{2A - 3\left(1 - \alpha\right)c_h + \left(1 - 3\alpha\right)\left(c_f + t\right)\right\}}{3B}\right]\left(-\frac{d\alpha}{dt}\right) \\
&= \frac{\left(c_h - c_f - t\right)\left[B\tau\left\{9B\tau\left(27B\tau + 4\Lambda\right) - 16\left(c_h - c_f - t\right)^2\Xi\right\} - 128\left(c_h - c_f - t\right)^5\left(A - c_f - t\right)\right]}{B\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^3},
\end{aligned}
$$

$$
-\frac{dW_f}{dt} = -\frac{d\Pi_2}{dt},
$$

where $\Lambda \equiv 15Ac_f - 31Ac_h - 28tc_f + 13tc_h - 14c_f^2 + 9c_h^2 + 13c_fc_h + 15At + 8A^2 - 14t^2$ and $\Xi \equiv 35Ac_f - 63Ac_h - 54tc_f + 19tc_h - 27c_f^2 + 22c_h^2 + 19c_fc_h + 35At + 14A^2 - 27t^2$. The effect of trade liberalization on the welfare of the home country is very complex. However, the effect is positive, $-\frac{dW_h}{dt} > 0$ for all parameters in Tables 1 and 2. We do not obtain any case where the home country is worse off as a whole.

4.4 Agreement on movement of natural persons

The effects of an MNP agreement, that is, a reduction in travel cost, τ, on the FDI production level is given by

$$
-\frac{d\alpha}{d\tau} = \frac{36B\left(c_h - c_f - t\right)\left(A - 2c_h + c_f + t\right)}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2} > 0.
$$

This means that firm 1 increases its FDI production level when the movement of natural persons becomes smooth. Then, the effective MC of firm 1, $(1 - \alpha)c_h + \alpha(c_f + t)$, decreases as follows:

$$
-\frac{d}{d\tau}\left((1 - \alpha)c_h + \alpha(c_f + t)\right) = -(c_h - c_f - t)\left(-\frac{d\alpha}{d\tau}\right) < 0.
$$

---

[8]Ishikawa and Komoria (2009) use a Cournot model with two domestic firms and a foreign firm to explore the effects of trade costs and foreign wage rates on the domestic economy with reverse imports. Their important finding is that when the marginal cost is decomposed into the wage rate and labor coefficient, the effects of foreign wages could be counterintuitive. In this paper, considering an endogenous FDI production level, we find the effects of cost reduction could be counterintuitive, even in the case of trade cost.

The communication cost changes as follows:

$$-\frac{d}{d\tau}\left(\frac{1}{2}\alpha^2\tau\right) = -\frac{1}{2}\alpha^2 + \alpha\tau\left(-\frac{d\alpha}{dt}\right)$$

$$= \frac{8\left(c_h - c_f - t\right)^2\left(A - 2c_h + c_f + t\right)^2\left\{9B\tau + 8\left(c_h - c_f - t\right)^2\right\}}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^3} > 0.$$

Thus, even when τ decreases, the communication cost increases because of a rise in α.

The effects of the MNP agreement on outputs are, respectively,

$$-\frac{dq_1}{d\tau} = \frac{2}{3B}\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{d\tau}\right) > 0,$$

$$-\frac{dq_2}{d\tau} = -\frac{1}{3B}\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{d\tau}\right) < 0,$$

$$-\frac{dQ}{d\tau} = \frac{1}{3B}\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{d\tau}\right) > 0.$$

The effects of the MNP agreement on the consumer surplus and profits are, respectively,

$$-\frac{dCS}{d\tau} = \frac{2}{18B}\left\{2A - \left(1-\alpha\right)c_h - \left(1+\alpha\right)\left(c_f + t\right)\right\}\left\{\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{d\tau}\right)\right\} > 0,$$

$$-\frac{d\Pi_1}{d\tau} = \left[\frac{4}{9B}\left\{A - 2\left(1-\alpha\right)c_h + \left(1-2\alpha\right)\left(c_f + t\right)\right\}\left(c_h - c_f - t\right) - \alpha\tau\right]\left(-\frac{d\alpha}{d\tau}\right) + \frac{1}{2}\alpha^2$$

$$= \frac{8\left(c_h - c_f - t\right)^2\left(A - 2c_h + c_f + t\right)^2}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^2} > 0,$$

$$-\frac{d\Pi_2}{d\tau} = -\frac{2}{9B}\left\{A - \left(2-\alpha\right)\left(c_f + t\right) + \left(1-\alpha\right)c_h\right\}\left(c_h - c_f - t\right)\left(-\frac{d\alpha}{d\tau}\right) < 0.$$

Thus, we find that the consumers and producer of the home country gain and the producer of the foreign country loses from an MNP agreement.

The effects of the MNP agreement on welfare in the home and foreign countries are, respectively,

$$-\frac{dW_h}{d\tau} = -\frac{\partial W_h}{\partial\tau} + \frac{\partial W_h}{\partial\alpha}\left(-\frac{d\alpha}{d\tau}\right)$$

$$= \frac{1}{2}\alpha^2 - \left[\frac{3B\alpha\tau - \left(c_h - c_f - t\right)\left\{\left(2A - 3\left(1-\alpha\right)c_h + \left(1-3\alpha\right)\left(c_f + t\right)\right)\right\}}{3B}\right]\left(-\frac{d\alpha}{d\tau}\right)$$

$$= \frac{4\left(c_h - c_f - t\right)^2\left(A - 2c_h + c_f + t\right)\Phi}{\left\{9B\tau - 8\left(c_h - c_f - t\right)^2\right\}^3} > 0,$$

$$-\frac{dW_f}{d\tau} = -\frac{d\Pi_2}{d\tau} < 0,$$

where $\Phi \equiv 9B\tau\left(4A - 5c_h + c_f + t\right) - 4\left(c_h - c_f - t\right)^2\left(7A - 8c_h + c_f + t\right)$. Using Assumption 2, we obtain $\Phi > 4\left(c_h - c_f - t\right)^2\left(A - 2c_h + c_f + t\right) > 0$. Thus, a reduction in the travel cost owing to an MNP agreement increases the consumer surplus, profit, and welfare in the home country.

Unlike in the full FDI production case ($\alpha = 1$) shown in Section 3, firm 2's profit decreases because of the reduction in firm 1's effective MC, which is caused by more tasks being shifted abroad.

5   Finalizing an FTA fueled by an MNP agreements

In this section, we examine the formation of a free trade area and trade liberalization that lead to a reduction in the non-tariff barrier[9]. We specifically discuss the possible creation of an FTA supported by an MNP agreement.

In Cases 4 and 5, which are important and counterintuitive from the viewpoint of trade cost reduction, trade liberalization is not preferable for the foreign government, because firm 2 loses from the liberalization. Thus, we omit these cases. We also drop Case 3, because all parties concerned gain from a reduction in t and there is no opposition to liberalization. This situation is similar to that of full FDI production described in Section 3. Thus, we focus on Cases 1 and 2. In these cases, trade liberalization is attractive to the home and foreign governments. However, firm 1 in the home country opposes trade liberalization. Income transfers within the home country could resolve this conflict, but in this paper, we focus on MNP agreements as an alternative measure.

In Cases 1 and 2, the home and foreign countries are better off by a reduction in t. Thus, both governments would like to conclude an FTA to reduce the non-tariff trade cost. However, in the home country, the producer (firm 1) opposes FTA formation. This situation is similar to that of the no FDI production case ($\alpha = 0$) described in Section 3. The difference between the two cases is that the governments now have another issue on the agenda, that is, the movement of natural persons. By combining the two agreements, the home and foreign governments may conclude an FTA unopposed, because all parties concerned are better off relative to the initial level. Using Case 1 ($A = 10$, $B = 2$, $c_h = 3$, $c_f = 1.5$, $t = 1$, $\tau = 3.5$) in Table 1, we show a possible creation of an FTA fueled by an MNP agreement.

First, in the simulation, we assume that t and τ are reduced by the same percentage. In Table 3, a 40% reduction in t from Case 1 increases the welfare of both countries, but firm 1 opposes trade liberalization that implements this reduction. A 40% reduction in τ from Case 1 increases the consumer surplus, profit, and social welfare in the home country. However, the foreign government opposes an MNP agreement to implement this reduction, because it results in firm 2 being worse off. When the 40% reduction in t and 40% reduction in τ occur at the same time, it results in gains for all parties. This is an example of the possible creation of an FTA supported by an MNP agreement. The MNP agreement is important for trade liberalization, because it supports the creation of the FTA; in the absence of this agreement, the FTA may not be possible owing to domestic opponents. In the case of 10%, 20%, and 30% reductions, firm 1

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[9]In the literature, trade liberalization is usually considered as a tariff shift from a given level, $\overline{T}$, to zero. In this paper, however, we consider trade liberalization as reductions in the non-tariff barrier.

	q_1	Π_1	q_2	Π_2, W_f	W_h	α
initial point	1.1189	2.4242	1.3156	3.4615	8.3506	0.21311
40% reduction in t	1.1332	2.3042	1.4084	3.9671	8.764	0.38854
40% reduction in τ	1.1439	2.4784	1.3031	3.3960	8.4658	0.36313
40% reductions in t and τ	1.227	2.4949	1.3615	3.7073	9.1953	0.70115

Table 3: Trade liberalization and movement of natural persons (part 1)

	q_1	Π_1	q_2	Π_2, W_f	W_h	α
initial point	1.1189	2.4242	1.3156	3.4615	8.3506	0.21311
10% reduction in t	1.1178	2.3846	1.3411	3.5972	8.4307	0.25549
30% reduction in τ	1.1348	2.4587	1.3076	3.4196	8.424	0.30879
mixed use	1.1412	2.4345	1.3294	3.5346	8.5384	0.37263

Table 4: Trade liberalization and movement of natural persons (part 2)

disagrees with FTA formation, even if the governments use an MNP agreement.

Next, in the simulation, we suppose different percentage reductions in t and τ. Given a 10% reduction in t, a 10% or 20% reduction in τ would not completely compensate firm 1's loss. In Table 4, the effects of a 10% reduction in t and 30% reduction in τ from Case 1 are shown. These results are similar to the case in which both are reduced by the same percentage.

Proposition 2 *In the endogenous FDI production case, there is a possibility of trade liberalization supported by an agreement on movement of natural persons.*

The possibility of FTA creation supported by MNP agreement, as mentioned above, implies the important role of the MNP agreements in trade liberalization and FTA formation.

When t and τ are low enough to result in the full FDI production case ($\alpha = 0$), a further reduction in t increases the social welfare of both countries, whereas a further reduction in τ increases the social welfare of the home country. When t and τ are high enough to have $\alpha < 1$, the welfare effects of using trade liberalization and an MNP agreement together are more complex. Whereas both countries are better off by using trade liberalization and an MNP agreement together, as shown in Tables 3 and 4, these welfare effects should be investigated more carefully in future research.

6 Concluding remarks

We examined the endogenous choice of FDI production level by using an international oligopoly model. We explored the effects of trade liberalization (a reduction in the non-tariff barrier) and an MNP agreement (a reduction in travel cost) on the home and foreign economies. While consumers

always gain from cost reductions in the endogenous choice model, unlike in the exogenous choice model, the effects of trade liberalization on the profits of firms are complex.

Based on the findings, we discussed the formation of an FTA and trade liberalization, which lead to a reduction in non-tariff barriers. With the help of some simulations, we found that it was possible to conclude an FTA, supported by an MNP agreement. This result reveals the importance of MNP agreements.

In Section 4, we showed five cases of the effect of trade liberalization on the outputs and profits of home and foreign firms with parameters where each case occurs. We should retry this in a more elegant manner in future research. In Section 5, we could have further investigated the magnitude of travel cost reduction that the countries would have to impose for a given level of trade liberalization.We have discussed the possibility of concluding an FTA supported by an MNP agreement; analyses of the FTA-formation game between the home and foreign governments are left for future research.

References

[1] Ishikawa, Jota, Yoshimasa Komoriya (2009) "Trade Costs, Wage Rates, Technologies, and Reverse Imports," *Canadian Journal of Economics*, Vol. 42, pp. 615-638.

[2] Ishikawa, Jota, Hodaka Morita, and Hiroshi Mukunoki (2010) "FDI in Post-Production Services and Product Market Competition," *Journal of International Economics*, Vol. 82, pp. 73-84.

[3] Jones, Ronald W. and Henryk Kierzkowski (2005) "International Fragmentation and the New Economic Geography," *North American Journal of Economics and Finance*, Vol. 16, pp. 1-10.

[4] Neumayer, Eric (2011) "On the Detrimental Impact of Visa Restrictions on Bilateral Trade and Foreign Direct Investment," *Applied Geography*, Vol. 31, pp. 901-907.

[5] Oldenski, Lindsay (2012) "Export Versus FDI and the Communication of Complex Information," *Journal of International Economics*, Vol. 87, pp. 312-322.