The Effects of FTA on Trade under Different Degree of Product Substitution and Imports Market Structure

Koo Woong Park[4]

Abstract

We study here the effects of FTA on demand, consumer surplus, dealer profit, and tariff revenue depending on the degree of substitution between two goods and import competition structure in a two country's static model. We consider monopolist dealer, and perfect competition in imports market. The base model is with a positive tariff and we compare the equilibrium with a zero tariff under FTA. The rankings in the consumer utility are such that it is i) the highest under perfect competition with FTA or without FTA, ii) second highest under monopoly with FTA, and iii) the lowest under monopoly without FTA.

Keywords : *FTA, Degree of Product Substitution, Imports Market Structure, Demand Elasticity, Utility Change*

JEL Classification numbers : *D4, F1, F4*

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[4] Corresponding author, Assistant Professor, Division of International Trade, University of Incheon, 12-1 Songdo-Dong, Yeonsu-Gu, Incheon, Korea, Tel: 032-835-8546, Fax: 032-835-0786, E-mail: ,August 18 2013.

1. Introduction

Various studies have analysed the effects of tariff reduction of FTAs. However, they usually focus on the strategic behaviours of governments setting tariff rates and producers determining sales volume and selling prices. In reality, majority of imported goods in most countries are supplied through importing dealers other than the original producers. There is scarcity of research directed on the importing market structure in studying the effects of FTAs. In this study I try to address the implications of different dealer structures in the imported goods market following a formation of an FTA.

Cheong (2001) undertakes a comprehensive study about the effects of Korea-Japan FTA employing new important measures. First of all, he analyses the impacts of alleviating non-tariff barriers (NTBs) as well as removing nominal tariffs. Second, the author introduces economies of scale and capital accumulation into a dynamic computational general equilibrium (CGE) model and thereby identifies the long-run effects alongside the short-run effects. Third, Cheong (2001) reflects 'Korean parameters' in the simulation in addition to the conventional global parameters (GTAP; Global Trade Analysis Project), emphasising the idiosyncratic parameter differences such as in price elasticity of import demand. As a result, Cheong (2001) could reach quite different outcome of the prospective Korea-Japan FTA from previous studies. First, tariff removal would lead to an increase up to 0.82~1.90% points in the long-run rather than decrease in Korean GDP. Second, non-tariff barrier reduction would result in the increase in GDP and furthermore the improvements in the Korean terms of trade and consequently of trade balance especially in the long-run. However, It is worrying that Korean industrial structure may suffer a transition towards more labour intensive or less technologically sophisticated industries following Korea-Japan FTA. Brown et al (2005) carry out computational analysis of the US FTAs with Central America, Australia and Morocco. They (p.1446) find that FTA under imperfect competition may raise gains from trade. Brown et al argue that trade liberalisation expands export sectors and leads all sectors to compete more closely. Therefore, countries benefit from increasing returns to scale, lower monopoly distortions, and greater product variety. Park et al (2006) analyse the effects of bilateral FTAs of the US with Korea, China and Japan on the trade structure in terms of exports and imports of Korea using CGE model. They define the international competitiveness of countries using RCA (revealed comparative advantage) index for six major industries. Cheong (2007) studies the importance of market access to maximize the gains from trade following an FTA. Assessing the quality of FTAs with tariff elimination for agricultural products and ROOs (rules of origin), he argues that a high level of market access is essential for high economic

gains from FTAs. In this regard, we may think of market imperfection in terms of competition such as a monopoly as a restriction to market access and thereby reducing the gains from trade even with an FTA. Ishikawa et al (2007) analyse the effect of ROOs (rules of origin) on prices, consumer surplus, and tariff revenue given an FTA. They identify two effects of ROOs; i) anti-circumvention effect that blocks the exporting firms from avoiding the higher tariff, and ii) price-discrimination effect that allows outside firms out of FTA to exercise a pricing-to-market behaviour. They show that the total consumer surplus within FTA can decrease with ROOs if country sizes and/or tariff differential are positive and substitutabilities between two goods are the same in both member countries (Ishikawa et al, p.195, Proposition 2).

Andreosso-O'Callaghan (2009) analyses economic structural complementarity between Korea and the European Union (EU) using three different definitions of RCA (revealed comparative advantage) at the 2-digit SITC level. He identifies very strong overall dissimilarity, i.e. complementarity, between the EU and Korean manufacturing structures, reflected in 49 cases out of 66 products. Kawabata et al (2010) investigate the effects of FTA on tariffs and welfare in vertical trade. There is one upstream country (A) that supplies an intermediate good to domestic final good producers and two downstream countries (B & C) that produce a final product and export to the upstream country. The upstream country also produces the same final good and sells it domestically.   The upstream country A now forms an FTA with a downstream country B. The other downstream country C is a non-member country. They show that FTA is beneficial to the non-member country if its tariff rate increases after the FTA. Simulations indicate that the welfare levels of the member countries may or may not rise depending on the numbers of intermediate good and final good producers and on whether the tariff rate of the upstream country falls in some range. Intermediate good firms and final good firms both engage in Cournot competition in the respective markets. Sohn & Lee (2010) study the relationship between trade and growth using three different trade models. In the factor proportions model employing dynamic Rybczynski effect, a country pursuing dynamic capital expansion path will achieve economic growth but a country with abundant natural resources would not. In the intra-industry trade model, countries with higher level of intra-industry trade tend to have higher economies of scale effect and thus higher productivity growth. In the endogenous growth model, FDI/Trade has a positive impact on growth on its own but not when combined with other structural variables such as macro stability. Dyck et al (2011) survey the quantitative effects of FTAs implemented by competitor countries on the US agricultural products. They argue that FTAs by ASEAN countries have little effect but FTAs implemented by Colombia with Mercosur would have proportionately greater impact on the US exports due to the increased margin of preference

enjoyed by FTA member countries other than the US.

We study here the effects of FTA on trade depending on the degree of substitution between goods and import competition structure in a two country static model. We consider monopolist dealer and perfect competition in import market. The base model is with a positive tariff τ and we compare the equilibrium with a zero tariff under FTA.

The rest of the paper is composed as follows. Section 2 describes the model structure and the optimization of each players. Section 3 identifies the equilibrium for the monopoly and perfectly competitive cases in the dealer structure. Section 4 analyses the effects of FTA on prices, demand, tariff revenue, and dealer profits. Section 5 runs simulation using specific parameter values to compare welfare between monopoly and perfect competition. Section 6 concludes.

2. Model

Country A and country B initiate an FTA (Free Trade Agreement) and set tariff rates equal to zero. Country A produces good X and country B produces good Y. Good X and good Y are substitutes and the degree of substitution will be defined later in terms of consumers' utility function. Country A's import of good Y from country B is carried out by dealers of country A. The distribution structure by the dealers will be one of key factors that will be discussed in detail later. We will consider monopoly and perfect competition in dealership structure. Country A government levies specific tariff τ^B on imports into the country and country B government levies specific tariff likewise. Good X and good Y are produced competitively within each country.

2.1. Trade structure
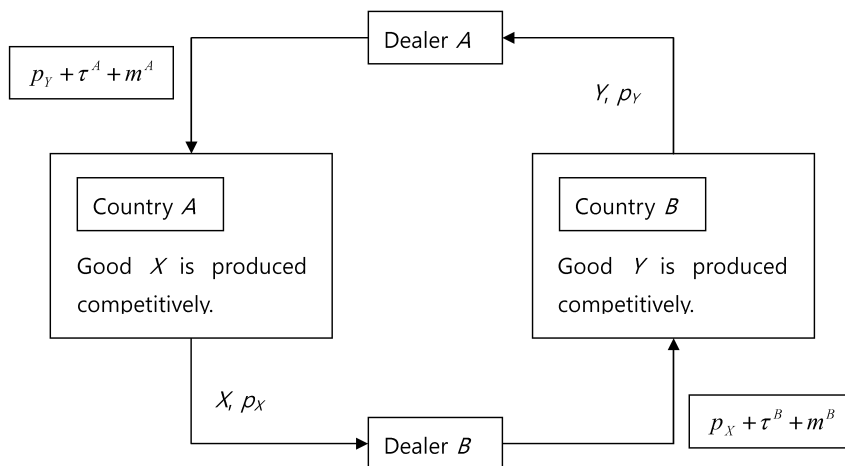
The base trade structure is illustrated in Figure 1.

Figure 1.

Trade structure

In Figure 1, p_Y is good Y price in country B and m^A is country A dealer's margin over import price of good Y. Country A government gets tariff τ^A per unit of good Y imported. The same arguments apply to country B. Hence, country A consumers have to pay $P_Y + \tau^A + m^A$ per unit of good Y they consume, and country B consumers $P_X + \tau^B + m^B$ per unit of good X.

2.2 Sequence of the game

The sequence of the game is as follows. First, governments of country A and country B set tariff rates independently. Second, observing the tariff rates, dealers set their sales margins to maximize their own profit. Third, producers set their production level competitively and consumers choose their consumptions of good X and good Y to maximize their own utility. We solve this problem with backward induction. With perfect foresight without uncertainty, we will get subgame perfect Nash equilibrium. Figure 2 shows the sequence of the game.
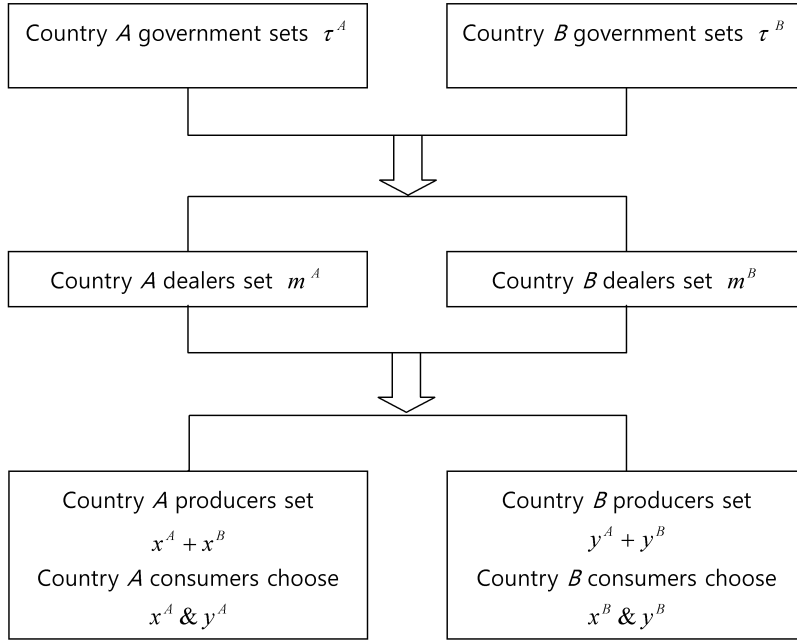
Figure 2.
Sequence of the game

2.3 Consumers' utility maximization

Consumers maximize their own utility by consuming good X and good Y at the market prices. Country A has a continuum of identical consumers normalized to size 1 and country B has the same population structure of consumers. We define a CES (constant elasticity of substitution) utility function to represent different degree of substitution as follows.

$$U^A = \left[a_1 \left(x^A \right)^\alpha + a_2 \left(y^A \right)^\alpha \right]^{\frac{1}{\alpha}} \tag{1}$$

$$U^B = \left[b_1 \left(x^B \right)^B + b_2 \left(y^B \right)^B \right]^{\frac{1}{\beta}} \tag{2}$$

where u^j is country $j = A \, or \, B$ consumer's utility, x^j is country $j = A \, or \, B$ consumer's good X consumption, y^j is country $j = A \, or \, B$ consumer's good Y consumption, a_1, a_2, b_1, b_2 are positive constants, and α and β are constants. Degree of substitution between two goods X and Y is defined as in Table 1, depending on the values

α and β. If $\alpha = 1$, two goods X and Y are perfect substitutes for country A consumers.[1])
We call $\theta = 1/(1 - \alpha)$ the elasticity of substitution between good X and good Y. The
parameter θ is an increasing function of α and θ becomes large as $\alpha \to 1$ and goods X &
Y become close substitutes.[2])

Table 1.

Degree of substitution between good X & good Y

α & β	Shape of the utility function	Degree of substitution	Technology
1	linear	perfect substitutes	linear
0	convex to the origin	imperfect substitutes	Cobb-Douglas
$-\infty$	kinked with right angle	perfect complements	Leontief

Each consumer of country $j = A \, or \, B$ is assumed to have a fixed income of M^j plus
government's transfer of tariff revenue TR^j to be explained in subsection 2.6.

Hence, consumers solve the following optimization problem.

$$L^A = \left[a_1 (x^A)^\alpha + a_2 (y^A)^\alpha \right]^{\frac{1}{\alpha}} + \lambda^A \left\{ M^A + TR^A - p_X x^A - P_Y^d y^A \right\} \tag{3}$$

$$L^B = \left[b_1 (x^B)^\beta + b_2 (y^B)^\beta \right]^{\frac{1}{\beta}} + \lambda^B \left\{ M^B + TR^B - p_x^d x^B - p_Y y^B \right\} \tag{4}$$

where L^j is country $j = A \, or \, B$ Lagrangean and λ^j is country $j = A \, or \, B$ Lagrange
multiplier and p_Y^d & p_X^d are domestic prices of imported goods in country A & country B,
respectively. Differentiating (3) & (4) with respect to x^j & y^j for $j = A \, or \, B$ with
$TR^A = \tau^A y^A$ & $TR^B = \tau^B x^B$, we get the following conditions.

For country A;

$$\frac{\partial L^A}{\partial x^A} = a_1 (x^A)^{\alpha - 1} \left[a_1 (x^A)^a \right]^{\frac{1 - \alpha}{\alpha}} - \lambda^A p_x = 0$$

$$\frac{\partial L^A}{\partial y^A} = a_2 (x^A)^{\alpha - 1} \left[a_1 (x^A)^\alpha + a_2 (y^A)^\alpha \right]^{\frac{1 - \alpha}{\alpha}} + \lambda^A \left(\tau^A - p_Y^d \right) = 0$$

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[1]) Varian (1992, p.19).

[2]) Blanchard and Fischer (1989, pp.376-377) mention that θ has to be larger than 1 (α has to be positive) to
guarantee an equilibrium

For country B;

$$\frac{\partial L^B}{\partial x^B} = b_1\left(x^B\right)^{\beta-1}\left[b_1\left(x^B\right)^\beta + b_2\left(y^B\right)^\beta\right]^{\frac{1-\beta}{\beta}} + \lambda^B\left(\tau^B - p_x^d\right) = 0$$

$$\frac{\partial L^B}{\partial y^B} = b_2\left(y^B\right)^{\beta-1}\left[b_1\left(x^B\right)^\beta + b_2\left(y^B\right)^\beta\right]^{\frac{1-\beta}{\beta}} - \lambda^B p_Y = 0$$

Rearranging these, we get

$$\frac{a_1}{a_2}\left(\frac{x^A}{y^A}\right)^{\alpha-1} = \frac{p_x}{p_Y^d - \tau^A} \tag{5}$$

$$\frac{b_1}{b_2}\left(\frac{x^B}{y^B}\right)^{\beta-1} = \frac{p_x^d - \tau^B}{p_Y} \tag{6}$$

We also have the following budget constraints for the consumers.

$$p_x x^A + p_Y^d y^A = M^A + TR^A = M^A + \tau^A y^A \tag{7}$$

$$p_x^d x^B + p_Y y^B = M^B + TR^B = M^B + \tau^B x^B \tag{8}$$

2.4 Producers' profit maximization

Good X and good Y are produced competitively in each country. Producers maximize their own profit with the following production cost function.

$$C^A(x) = F^A + c^A x \tag{9}$$

$$C^B(y) = F^B + c^B y \tag{10}$$

where $C^j(i)$ is total cost of producing good $i = x$ or y for country $j = A\,or\,B$, F^j is fixed cost for country $j = A\,or\,B$, c^j is constant marginal cost for country $j = A\,or\,B$, and x and y are amounts of goods X and Y produced respectively.

$$\pi^A = p_X\left(x^A + x^B\right) - F^A - c^A\left(x^A + x^B\right)$$

$$\pi^B = p_Y\left(y^A + y^B\right) - F^B - c^B\left(y^A + y^B\right)$$

Differentiating these objective functions, we get the marginal cost pricing conditions.

$$p_X = c^A \tag{11}$$

$$p_Y = c^B. \tag{12}$$

2.5 Dealer's profit maximization; monopoly

Dealers maximize their own profit by importing goods from the other country and sell them to their home country consumers with a margin.

$$D^A = p_y^d y^A - (p_y + \tau^A)y^A$$
$$D^B = p_x^d x^B - (p_x + \tau^B)x^B$$

where D^j is country $j = A\, or\, B$ dealer's profit when they import y^A (or x^B) at the price p_Y (or, p_X) paying tariff τ^A (or, τ^B) and sell them at the price p_Y^d (or, p_X^d).

Maximizing the above profit functions for the dealers and rearranging, we get

$$p_y^d \left\{ 1 + \left(\frac{dp_y^d}{dy^A}\right) \Big/ \left(\frac{p_y^d}{y^A}\right) \right\} = p_y^d \left\{ 1 + \frac{1}{\xi_{y^A}} \right\} = p_y + \tau^A \tag{13}$$

$$p_x^d \left\{ 1 + \left(\frac{db_x^d}{dx^B}\right) \Big/ \left(\frac{p_x^d}{x^B}\right) \right\} = p_x^d \left\{ 1 + \frac{1}{\xi_{x^B}} \right\} = p_x + \tau^B \tag{14}$$

where $\xi_{y^A} \equiv \left(\frac{dy^A}{y^A}\right) \Big/ \left(\frac{db_y^d}{p_y^d}\right)$ and $\xi_{x^B} \equiv \left(\frac{dx^B}{x^B}\right) \Big/ \left(\frac{db_x^d}{p_x^d}\right)$ are price elasticity of demand for imported good in country A and country B, respectively. We can rearrange equations (13) & (14) in terms of the mark-up of dealer's sales price over import price as below.

$$\Phi^A \equiv \frac{p_y^d - p_y - \tau^A}{p_y + \tau^A} = \frac{-1}{1 + \xi_{y^A}} \tag{15}$$

$$\Phi^B \equiv \frac{p_x^d - p_x - \tau^B}{p_x + \tau^B} = \frac{-1}{1 + \xi_{x^B}} \tag{16}$$

Hence, the mark-up is decreasing in the absolute value of the elasticity, assuming that the conditions $\xi_{y^A} < -1$ and $\xi_{x^B} < -1$ hold for positive sales price.[3]

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[3] We know that at the optimal level of output the elasticity of demand must be greater than 1 in absolute value for the marginal revenue to be positive. Refer to Varian (1992, p.235).

2.6 Governments' optimization

Governments of country A and country B maximize their own tariff revenue as below.

$$TR^A = \tau^A y^A$$
$$TR^B = \tau^B x^B$$

where TR^j is tariff revenue of country $j = A\,or\,B$. Each government transfers all the tariff revenue to the home consumers. The amounts of imports depend on the tariff rates and so the governments' optimization problem is given as follows.

$$y^A\left\{1 + \left(\frac{dy^A}{y^A}\right)\bigg/\left(\frac{d\tau^A}{\tau^A}\right)\right\} = y^A(1 + \xi_A) = 0 \tag{17}$$

$$x^B\left\{1 + \left(\frac{dx^B}{x^B}\right)\bigg/\left(\frac{d\tau^B}{\tau^B}\right)\right\} = x^B(1 + \xi_B) = 0 \tag{18}$$

where ξ_{τ^j} is import demand elasticity with respect to tariff rate in country $j = A\,or\,B$. Hence, we get the following conditions for the elasticity, $\xi_{\tau^A} = -1$ and $\xi_{\tau^B} = -1$. These imply that each government has to set its tariff rate such that the import demand elasticity equals -1 at the optimum tariff rates.

3. Equilibrium

3.1 Monopoly equilibrium

We can solve (5)~(8), (11)~(14), (17) & (18) together to find the equilibrium conditions.[4]

$$x_M^A = \frac{M^A}{c^A + \left(\dfrac{a_1}{a_2}\right)^{\frac{1}{\alpha-1}}(c^A)^{\frac{1}{1-\alpha}}\left(\dfrac{c^B\xi_{y^A} - \tau^A}{1 + \xi_{y^A}}\right)^{\frac{-\alpha}{1-\alpha}}} \tag{19}$$

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[4] The subscript M denotes monopoly case in dealership. Details are available from the author on request.

$$y_M^A = \cfrac{M^A}{\left(\cfrac{a_1}{a_2}\right)^{\frac{1}{1-\alpha}} (c^A)^{\frac{-\alpha}{1-\alpha}} \left(\cfrac{c^B \xi_{y^A} - \tau^A}{1+\xi_{y^A}}\right)^{\frac{1}{1-\alpha}} + \left(\cfrac{c^B \xi_{y^A} + \tau^A}{1+\xi_{y^A}}\right)} \tag{20}$$

$$x_M^B = \cfrac{M^B}{\left(\cfrac{c^A \xi_{x^B} - \tau^B}{1+\xi_{x^B}}\right) + \left(\cfrac{b_1}{b_2}\right)^{\frac{1}{\beta-1}} (c^B)^{\frac{-\beta}{1-\beta}} \left(\cfrac{c^A \xi_{x^B} - \tau^B}{1+\xi_{x^B}}\right)^{\frac{1}{1-\beta}}} \tag{21}$$

$$y_M^B = \cfrac{M^B}{\left(\cfrac{b_1}{b_2}\right)^{\frac{1}{1-\beta}} (c^B)^{\frac{1}{1-\beta}} \left(\cfrac{c^A \xi_{x^B} - \tau^B}{1+\xi_{x^B}}\right)^{\frac{-\beta}{1-\beta}} + c^B} \tag{22}$$

3.1.1 Imperfect substitutes case; $0 < \alpha < 1$, $0 < \beta < 1$

In this case, we have $1/(1-\alpha) > 0, 1/(1-\beta) > 0, -\alpha/(1-\alpha) < 0$ and $\beta/(1-\beta) < 0$. Then, we can see in (19)~(22) that x_M^j is decreasing in c^A and increasing in c^B while y_M^j is increasing in c^A and decreasing in c^B for $j = A \& B$, provided that $\xi_{y^A} < \tau^A / c^B$ and $\xi_{x^B} < \tau^B / c^A$ which will be easily satisfied given the condition that the elasticity is less than -1. The effect of increasing tariff τ^A is to raise X_M^A and to lower y_M^A. Symmetrically, an increase in tariff τ^B lowers X_M^B and raises y_M^B. That is, tariffs drive the demand away from imported good and towards domestic good. We can see in (19) & (20) that the term $(c^B \xi_{y^A} - \tau^A)/(1+\xi_{y^A})$ is positive and decreasing as the elasticity ξ_{y^A} is increasing in its absolute value. Hence, we can conclude that X_M^A is falling and y_M^A is rising as the demand for imported good Y becomes more price elastic, i.e. the more negative ξ_{y^A}, in country A. Similarly, in (21) & (22) the term $(c^A \xi_{x^B} - \tau^B)/(1+\xi_{x^B})$ is again positive and decreasing as ξ_{x^B} is increasing in its absolute value. Consequently, X_M^B is rising and y_M^B is falling as the demand for imported good X becomes more price elastic in country B.

3.1.2 Complements case; $\alpha < 0$, $\beta < 0$

In this case, we have $1/(1-\alpha) > 0, 1/(1-\beta) > 0, -\alpha/(1-\alpha) < 0$ and $\beta/(1-\beta) < 0$. Then, in (19)~(22) both x_M^j & y_M^j are decreasing either in c^A or c^B for $j = A \& B$. The effect of tariff τ^A is to lower both X_M^A and y_M^A. Similarly, an increase in

tariff τ^B lowers both X_M^B and y_M^B. The effect of the elasticity is such that both X_M^A and y_M^A are rising as the demand for imported good Y becomes more price elastic, i.e. the more negative ξ_{y^A}, in country A. Similarly in country B, both X_M^B and y_M^B are rising as the demand for imported good X becomes more price elastic in country B, i.e. the more negative ξ_{x^B}.

We can summarize the results for the monopoly case as in Table 2. If the effect of increasing a parameter value is to raise the demand, then we mark +. If the effect is to lower the demand, we mark -. If the effect is absent, then we mark 0.

Table 2
Monopoly equilibrium demand for good X & good Y

X & Y	Parameter	X_M^A	y_M^A	X_M^B	y_M^B
Substitutes $0 < \alpha < 1$ $0 < \beta < 1$	c^A	-	+	-	+
	c^B	+	-	+	-
	τ^A	+	-	0	0
	τ^B	0	0	-	+
	ξ_{y^A} a)	-	+	0	0
	ξ_{x^B} a)	0	0	+	-
Complements $\alpha < 0$ $\beta < 0$	c^A	-	-	-	-
	c^B	-	-	-	-
	τ^A	-	-	0	0
	τ^B	0	0	-	-
	ξ_{y^A} a)	+	+	0	0
	ξ_{x^B} a)	0	0	+	+

a) For the elasticity, we show the effects on the demand when ξ_{y^A} or ξ_{x^B} is becoming more negative, i.e. more price elastic.

3.2 Perfect competition

Now, we find the equilibrium for perfectly competitive dealer case. Maximizing dealer's profit, we get the followings instead of (13) & (14).

$$\frac{d}{dy^A}(D^A) = p_y^d - p_y - \tau^A = 0$$

$$\frac{d}{dx^B}(D^B) = p_x^d - p_x - \tau^B = 0$$

Hence, under perfect competition in dealers market, we get the marginal cost pricing of imported goods.

$$p_y^d = p_y + \tau^A \tag{13a}$$
$$p_x^d = p_x + \tau^B \tag{14a}$$

Using (5), (6), (7), (8), (11), (12), (13a) & (14a), we can solve[5)]

$$x_c^A = \frac{M^A}{c^A + c^B\left(\dfrac{a_1}{a_2}\right)^{\frac{1}{\alpha-1}}\left(\dfrac{c^A}{c^B}\right)^{\frac{1}{1-\alpha}}} \tag{23}$$

$$y_c^A = \frac{M^A}{c^A\left(\dfrac{a_1}{a_2}\right)^{\frac{1}{1-\alpha}}\left(\dfrac{c^A}{c^B}\right)^{\frac{1}{\alpha-1}} + c^B} \tag{24}$$

$$x_c^B = \frac{M^B}{c^A + c^B\left(\dfrac{b_1}{b_2}\right)^{\frac{1}{\beta-1}}\left(\dfrac{c^A}{c^B}\right)^{\frac{1}{1-\beta}}} \tag{25}$$

$$y_c^B = \frac{M^B}{c^A\left(\dfrac{b_1}{b_2}\right)^{\frac{1}{1-\beta}}\left(\dfrac{c^A}{c^B}\right)^{\frac{1}{\beta-1}} + c^B} \tag{26}$$

Comparing the results (23)∼(26) with those of the monopoly case in (19)∼(22), we have three distinct features here in the perfect competition. First, the goods demand in the perfect competition in dealers market does not depend on import tariff τ^A or τ^B. Second, goods consumption under perfect competition neither depends on the price elasticity of imported goods demand, ξ_{y^A} or ξ_{x^B}. Third, demand for good X, X_C^j, is always decreasing in c^A but increasing if X & Y are substitutes and decreasing if complements in c^B while demand for good Y, Y_C^j, is always decreasing in c^B but increasing if X & Y are

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[5)] The subscript C denotes perfect competition in dealers market. Details are available from the author on request

substitutes and decreasing if complements in c^A for $j = A \& B$.

We summarize the results for the perfect competition in Table 3. The sign convention is the same as in Table 2.

Table 3.

Competitive equilibrium demand for good X & good Y

$X \& Y$	Parameter	X_C^A	y_C^A	X_C^B	y_C^B
Substitutes $0 < \alpha < 1$ $0 < \beta < 1$	c^A	-	+	-	+
	c^B	+	-	+	-
	τ^A	0	0	0	0
	τ^B	0	0	0	0
	ξ_{y^A} a)	0	0	0	0
	ξ_{x^B} a)	0	0	0	0
Complements $\alpha < 0$ $\beta < 0$	c^A	-	-	-	-
	c^B	-	-	-	-
	τ^A	0	0	0	0
	τ^B	0	0	0	0
	ξ_{y^A} a)	0	0	0	0
	ξ_{x^B} a)	0	0	0	0

a) For the elasticity, we show the effects on the demand when ξ_{y^A} or ξ_{x^B} is becoming more negative, i.e. more price elastic.

4. Effects of FTA on Demand and Dealer Profit

4.1 Monopoly equilibrium under FTA

Under FTA, country A and country B governments set tariff rates $\tau^A = \tau^B = 0$. Consumers' utility maximization of subsection 2.3 and producers' profit maximization of 2.4 remain the same as before except equations (7) & (8) now with $\tau^A Y^A = \tau^B X^B = 0$. Dealer's profit maximization proceeds similarly as before with $\tau^A = \tau^B = 0$ and we get the

following results instead.

$$p_y^d\left(1 + \frac{1}{\xi_{y^A}}\right) = p_y \tag{13F}$$

$$p_x^d\left(1 + \frac{1}{\xi_{x^B}}\right) = p_x \tag{14F}$$

Governments of country A & country B simply set $\tau^A = \tau^B = 0$ under FTA. Following the same procedure as in subsection 3.1, we get the following results.[6]

$$x_M^{AF} = \frac{M^A}{c^A + \left(\frac{a_1}{a_2}\right)^{\frac{1}{\alpha-1}}(c^A)^{\frac{1}{1-\alpha}}\left(\frac{c^B\xi_{y^A}}{1+\xi_{y^A}}\right)^{\frac{-\alpha}{1-\alpha}}} \tag{19F}$$

$$y_M^{AF} = \frac{M^A}{\left(\frac{a_1}{a_2}\right)^{\frac{1}{1-\alpha}}(c^A)^{\frac{-\alpha}{1-\alpha}}\left(\frac{c^B\xi_{y^A}}{1+\xi_{y^A}}\right)^{\frac{1}{1-\alpha}} + \left(\frac{c^B\xi_{y^A}}{1+\xi_{y^A}}\right)} \tag{20F}$$

$$x_M^{BF} = \frac{M^B}{\left(\frac{c^A\xi_{x^B}}{1+\xi_{x^B}}\right) + \left(\frac{b_1}{b_2}\right)^{\frac{1}{\beta-1}}(c^B)^{\frac{-\beta}{1-\beta}}\left(\frac{c^A\xi_{x^B}}{1+\xi_{x^B}}\right)^{\frac{1}{1-\beta}}} \tag{21F}$$

$$y_M^{BF} = \frac{M^B}{\left(\frac{b_1}{b_2}\right)^{\frac{1}{1-\beta}}(c^B)^{\frac{1}{1-\beta}}\left(\frac{c^A\xi_{x^B}}{1+\xi_{x^B}}\right)^{\frac{-\beta}{1-\beta}} + c^B} \tag{22F}$$

Therefore, we can say that under the FTA consumers' choice of goods consumption is affected as in Table 4 below. The effects of c^A, c^B, ξ_{y^A} and ξ_{x^B} remain qualitatively the same as before in Table 2 without FTA. Table 4 shows the effect as the tariff rates become zero from positive values, $\tau^A \rightarrow 0$ and $\tau^B \rightarrow 0$.

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[6] Superscript ^{F} denotes FTA equilibrium. Details are available from the author on request.

Table 4.
Monopoly equilibrium demand under FTA

X & Y	Parameter	x_M^{AF}	y_M^{AF}	x_M^{BF}	y_M^{BF}
Substitutes $0 < \alpha < 1$ $0 < \beta < 1$	c^A	-	+	-	+
	c^B	+	-	+	-
	$\tau^A \to 0$	-	+	0	0
	$\tau^B \to 0$	0	0	+	-
	ξ_{y^A} a)	-	+	0	0
	ξ_{x^B} a)	0	0	+	-
Complements $\alpha < 0$ $\beta < 0$	c^A	-	-	-	-
	c^B	-	-	-	-
	$\tau^A \to 0$	+	+	0	0
	$\tau^B \to 0$	0	0	+	+
	ξ_{y^A} a)	+	+	0	0
	ξ_{x^B} a)	0	0	+	+

a) For the elasticity, we show the effects on the demand when ξ_{y^A} or ξ_{x^B} is becoming more negative, i.e. more price elastic.

As we can see in the highlighted parts of Table 4, under FTA the demand for home good falls and the demand for foreign good rises compared to those without FTA when two goods are substitutes. Hence, we need to further analyse the details whether the consumer utility actually rises or falls following an FTA. The relevant analysis will be carried out using simulation in section 5. In contrast, when two goods are complements, it is straightforward that consumption of both goods increases following an FTA and so does the consumer welfare.

4.2 Perfect competition under FTA

Now, we consider the equilibrium change under FTA for perfectly competitive dealer case. Following the same procedure as in subsection 3.2, we get exactly the same results as in (23)~(26). Consequently, the implications are the same as in Table 3. This implies that if all the consumers and suppliers behave perfectly competitively and the governments

transfer all the tariff revenue to their own consumers, then there is no difference whether the governments levy positive tariff or zero tariff. That is the effect of tariff becoming completely nullified.

4.2.1 Dealer's profit

Dealers' profit maximization under FTA with $\tau^A = \tau^B = 0$ leads to the following equilibrium dealer mark-ups.

$$\Phi^{AF} \equiv \frac{p_Y^d - p_Y}{p_Y} = \frac{-1}{1 + \xi_{y^A}} \tag{15F}$$

$$\Phi^{BF} \equiv \frac{p_X^d - p_X}{p_X} = \frac{-1}{1 + \xi_{x^B}} \tag{16F}$$

Illustrating the situation under FTA in contrast to without FTA in the quantity-price space, we may spot the equilibrium as point E for without FTA and point F for with FTA in Figure 3, assuming the equilibrium price is lower under FTA. We can see here that the elasticity of demand is greater at point F under FTA than at point E in absolute terms. Hence, the dealer mark-up will be smaller under FTA than without FTA.

4.2.2 Tariff revenue

Obviously, government's tariff revenue under FTA falls to zero from nonnegative amount from the case without an FTA in each country.
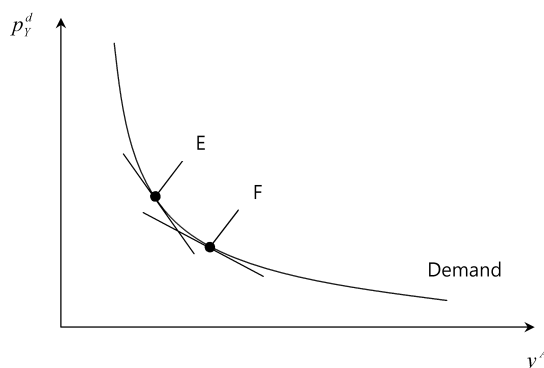

Figure 3.
Equilibrium demand with and without FTA

5. Welfare Comparison between Monopoly and Perfect Competition with or without FTA: Simulation

5.1 Parameter values

At the end of subsection 4.1, we questioned whether the consumer utility actually rises or falls following an FTA in the monopolist dealer case. We check here the actual changes in demand using specific parameter values in a simulation. First, we define the parameter values and ranges as in Table 5 taking account of both effectiveness (precision) and efficiency (computing time).[7] The parameter values are set with the following assumptions. First, good X and good Y enter the utility functions (1) & (2) symmetrically. Second, parameters α & β cover both substitutes and complements cases. Third, country B (e.g. USA) is much larger than country A (e.g. Korea) with the upper limit of M^B being ten times that of M^A. Fourth, marginal production costs are similar between country A and country B. Fifth, tariff rates are similar between the two countries and the upper limit is 20%. Sixth, the price elasticity of demand for imported good is between -2 and -1.1 in both countries taking into account the condition for optimal level of output.[8]

Table 5.

Ranges & values of parameters

Parameters	Range/Value	Increments	Data Points
a_1	1	NA	1
a_2	1	NA	1
b_1	1	NA	1
b_2	1	NA	1
α	[-1.0,0.9]	0.1	20
β	[-1.0,0.9]	0.1	20
M^A	[10,100]	10	10
M^B	[10,1000]	10	100

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[7] I use Maple 15 for the simulation. Details are available from the author on request.

[8] Refer to footnote 4.

Parameters	Range/Value	Increments	Data Points
c^A	[1,10]	1	10
c^B	[1,10]	1	10
τ^A	[0,0.2]	0.02	11
τ^B	[0,0.2]	0.02	11
ξ_{y^A}	[-2.0,-1.1]	0.1	10
ξ_{x^B}	[-2.0,-1.1]	0.1	10

5.2 Simulation

We run simulations to find equilibrium goods demand, (19)~(22), (23)~(26), (19F)~(22F), and resulting consumer utilities (1) & (2) using parameter values of Table 5. To begin with, we can think of 4 different trade structures depending on the import market structure and the presence of FTA as in Figure 4.
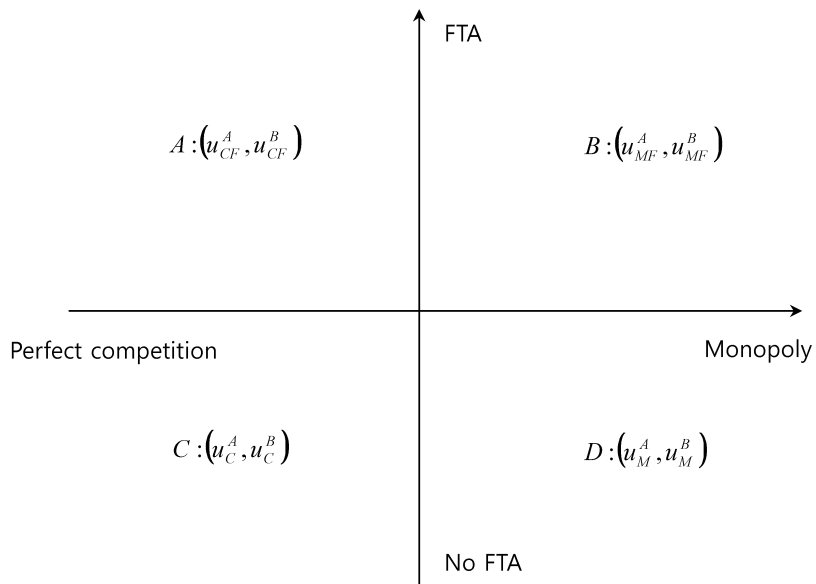
$$A : \left(u_{CF}^A , u_{CF}^B \right) \qquad\qquad B : \left(u_{MF}^A , u_{MF}^B \right)$$

Perfect competition   Monopoly

$$C : \left(u_C^A , u_C^B \right) \qquad\qquad D : \left(u_M^A , u_M^B \right)$$

FTA

No FTA

Figure 4.
Consumer utility comparison under different trade structures

We compare consumer utilities between A & C, C & D, B & D, and B & C and decide the rankings among the 4 cases.[9] First of all, we know from subsection 4.2 that the equilibrium goods demands depend only on exogenous parameter values and are exactly the same between perfect competition with FTA, A, and perfect competition without FTA, C. Consequently, equilibrium consumer utilities are also the same between A and C, i.e. $u_C^A = u_{CF}^A$ & $u_C^B = u_{CF}^B$. This result does not require a simulation. Second, we get from a simulation the result that perfect competition without FTA, C, has higher utilities than monopoly without FTA, D, i.e. $u_C^A > u_M^A$ & $u_C^B > u_M^B$ for all the parameter values. Third, comparing monopoly with FTA, B, with monopoly without FTA, D, we get the result $u_{MF}^A > u_M^A$ & $u_{MF}^B > u_M^B$ again for all the parameter values. Fourth, comparing perfect competition without FTA, C, with monopoly with FTA, B, we find that utilities are higher in C than in B, i.e. $u_C^A > u_{MF}^A$ & $u_C^B > u_{MF}^B$ for all the parameter values.

5.3 Welfare comparison

Summarizing the simulation results of the previous section, we can rank the consumer utilities as below.

$$A : \left(u_{CF}^A, u_{CF}^B\right) \approx C : \left(u_C^A, u_C^B\right) > B : \left(u_{MF}^A, u_{MF}^B\right) > D : \left(u_M^A, u_M^B\right) \qquad (27)$$

In the above ranking, $\approx$ denotes pairwise equality in utility and $>$ shows pairwise superiority in utility. Hence, we can conclude that the consumer utilities are the highest under perfect competition whether FTA is present or not, second highest under monopoly with FTA, and the lowest under monopoly without FTA. This outcome is new to the present literature. When we study the effect of FTA, we usually focus only on the effect of tariff reduction on trade and consumer surplus. However, this novel finding implies that the import market structure can be more important than merely lowering tariff barrier to achieve a higher consumer utility. If all the import dealers and goods producers behave perfectly competitively and the governments transfer all the tariff revenue to their home consumers, then we can achieve the highest possible utility level even without an FTA. Nevertheless, if the import market suffers imperfect competition such as monopoly, then an FTA can enhance consumer utilities. This improvement in consumer utilities due to FTA is greater under monopoly than under perfect competition. We summarize these results as two propositions and a corollary.

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[9] Details are available from the author on request.

Proposition 1. If all the consumers, import dealers and goods producers behave perfectly competitively and the governments transfer all the tariff revenue to their home consumers, then we can achieve the highest possible utility level even without an FTA ($A \approx C > B > D$).

Proposition 2. If there exists imperfect competition such as monopoly in the imported goods market, then even an FTA cannot raise consumer utilities above those under perfect competition in the imported goods market without an FTA ($C > B$).

Corollary 1. Given the existence of imperfect competition such as monopoly in the imported goods market, FTA can raise consumer utilities ($B > D$).

6. Conclusion

In the monopolist dealer case without an FTA when two goods are substitutes, demand for each good is decreasing in its own marginal production cost and increasing in the other good's marginal production cost. The effect of tariff is to raise demand for domestic good and to lower demand for foreign good. Demand for domestic good is falling and demand for foreign good is rising as the demand for imported good becomes more price elastic. When two goods are complements, demand for both goods are decreasing in both marginal production costs c^A and c^B. The effect of rising tariff is to lower demand for both goods within the corresponding country. The effect of the elasticity is such that demand for both goods are rising as the demand for imported good becomes more price elastic.

In the perfect competition without an FTA, we have several distinct features. First, the goods demand does not depend on import tariff. Second, goods consumption does not depend on the price elasticity of imported goods demand. Third, demand for any good whether domestic or foreign is always decreasing in its own marginal production cost. Fourth, demand for any good is increasing if goods X & Y are substitutes and decreasing if complements in the other good's marginal production cost.

Under FTA with a monopolist dealer, demand for home good falls and demand for foreign good rises compared to the case without an FTA when two goods are substitutes. Running simulations using relevant parameter values, we could find that the consumer utility rises with an FTA compared to without an FTA. In contrast, when two goods are complements, it is straightforward that consumption of both goods increases and so does the consumer welfare. Given perfectly competitive dealers, we get exactly the same results

for with an FTA as for without an FTA.

Simulations confirm that consumer utilities are the highest under perfect competition whether FTA is present or not, the second highest under monopoly with an FTA, and the lowest under monopoly without FTA. To put it differently, when imports goods market suffers imperfect competition such as monopoly here, then FTA can raise consumer utilities.

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