

INTERNATIONAL MERGER POLICY COORDINATION IN COMPLEMENTARY GOODS MARKETS

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We analyze a simple model of merger policy coordination between two trading countries. We find that two countries producing complementary products are likely to face a prisoners' dilemma situation in implementing their merger policy. The policy-makers in the two countries tend to allow a merger proposed by their domestic firms, even though their welfare would be larger when they coordinate on not allowing merger in each country. This implies that two countries can benefit from coordination on merger policy. We extend the analysis to allow for import tariffs, more than two components, and independent goods, respectively. Lastly, it is shown that policy coordination can be achieved by granting each country a veto power to a merger in other countries.

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1. INTRODUCTION

In the current world where production processes are fragmented across countries, it is highly likely that domestic policies of a country influence the welfare of other trading partner countries. Our paper focuses on an issue related to domestic merger (or competition) policy coordination which may influence globally competing trading partner countries. According to Cabral (2003), US and EU antitrust authorities have reviewed many cases of recent mergers, even when the cases involved only their own domestic firms. What they are concerned about is any undesirable external effects from their counterpart's merger policies.

The most prominent example is the GE/Honeywell, where the European commission blocked the proposed merger between two American companies in June 2001, despite

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the earlier approval in the United States.¹ Similarly, in 1991 the European Commission prohibited the European-owned ATR from acquiring the Canadian-based de Havilland, even though the Canadian antitrust authority had already approved the same merger. Somewhat related to the current issue, Horn and Levinsohn (2001) also mention that there is a concern among countries in the world that when countries promote their national interests more than international ones they may weaken the effectiveness of international agreements on trade liberalization.

Such policy conflicts can give rise to important economic consequences to related parties. As William Kolasky, the former Deputy Assistant Attorney General for Antitrust Division, US Department of Justice, pointed out with respect to the GE/Honeywell case, when one country blocks a merger that other countries find procompetitive, the former decision denies consumers around the world the benefits the merger might have delivered.²

Our paper is concerned with merger policy coordination between two trading countries. We set up a simple model of domestic mergers in two countries producing complementary products. We model two countries to independently choose their own merger policy, and examine the welfare consequence of unilateral decisions regarding domestic mergers. Our analysis identifies whether and when there is need for international merger policy coordination. We also compare free trade system and tariff system in respect of merger policy coordination, and find that free trading tends to mitigate the policy conflicts between countries. This is because free trade enhances international competition. We extend our base model to allow for more than two components and independent products. Somewhat ironically, we find that granting mutual veto power, as in the above GE/Honeywell case, can play a crucial role for achieving merger policy coordination.

2. A SIMPLE MODEL WITH FREE TRADE

We first consider a simple two-component two-country model. There is a system market in which two complementary components, X and Y , must be used together on a 1-to-1 basis to form a final product (system). For example, X is a CPU, Y is a DRAM, and the final product is a PC. There are four firms in the world, two in country A and the other two in country B . Each country is “specialized” to produce a certain good, and without loss of generality we assume that the firms in country A produce good X and the

¹ Patterson and Shapiro (2001) argue that the GE/Honeywell disagreement occurred because there are fundamental differences between the US and the EU on whether mergers that lead to lower prices are procompetitive or anticompetitive. Also see Choi (2008) for a theoretical analysis on the competitive effect of the GE/Honeywell merger with bundling.

² See Choi (2008) and Bradford (2012) for related discussions.

firms in country B produce good Y . This type of production locations for the intermediate goods highlights our understanding of global production fragmentations. For simplicity, we assume that all firms produce at zero marginal cost and there is no fixed cost.

Assume consumers have unit demands for the system. The market demand for the system is given by

$$D(p_X + p_Y) = 1 - (p_X + p_Y), \quad (1)$$

where p_X and p_Y denote the price of components X and Y respectively. The total mass of consumers is normalized to 1, among which consumers in country A account for fraction x and consumers in country B account for fraction $1 - x$. The demand structure is symmetric for two countries. We assume that there are competitive importers in each country, and for now ignore transportation costs and any trade barriers such as tariffs.

Let us consider a domestic merger in each country and examine the issue of merger policy coordination between the two countries. We assume that there are no cross-border mergers. Firms in each country, in the absence of merger, compete in price. If there is a merger in a country the merged firm sets its price as a monopoly supplier of the corresponding component. The policy-makers in the two countries independently decide on their merger policy, i.e., whether to allow merger or not, in order to maximize their own country's welfare. As usual in the literature, welfare is measured by a weighted sum of consumer surplus and firm profits. Country i 's ($i = A, B$) welfare is then defined as

$$W_i = CS_i + \alpha_i \Pi_i, \quad (2)$$

where $\alpha_i \geq 0$. Suppose two firms in each country applied for an approval of their merger. The following four cases can occur depending on the two countries' decisions on domestic mergers.

First, neither country allows the merger: Without any merger, price competition of two firms in each country will drive its component price down to zero (marginal cost), i.e.,

$$p_X = p_Y = 0, \quad (3)$$

and thus each country's welfare level can be easily calculated as

$$W_A = \frac{1}{2}x, \quad W_B = \frac{1}{2}(1 - x). \quad (4)$$

Second, only country A allows the merger: The two firms in country B still charge zero price for component Y due to price competition. But the merged firm in country A , as a monopoly provider of good X , can set the price of component X equal to the monopoly price for the system, i.e.,

$$p_X = \frac{1}{2}, \quad p_Y = 0, \quad (5)$$

and the equilibrium demand is $D\left(\frac{1}{2}\right) = \frac{1}{2}$. Each country's welfare is then given by

$$W_A = \frac{1}{8}x + \frac{1}{4}\alpha_A, \quad W_B = \frac{1}{8}(1-x). \quad (6)$$

Third, only country B allows the merger: By symmetry, we have

$$p_X = 0, \quad p_Y = \frac{1}{2}. \quad (7)$$

The merged firm in county B gets profit of $\frac{1}{4}$, and the firms in county A get zero profit. Each country's welfare is

$$W_A = \frac{1}{8}x, \quad W_B = \frac{1}{8}(1-x) + \frac{1}{4}\alpha_B. \quad (8)$$

Last, both countries allow the merger: Then, the two merged firms act as a regional monopolist for each component, and we have the classical Cournot complementary monopolies model. The equilibrium prices are

$$p_X = p_Y = \frac{1}{3}, \quad (9)$$

and the equilibrium demand is $D\left(\frac{2}{3}\right) = \frac{1}{3}$. Each merged firm gets profit of $\frac{1}{9}$. Each country's welfare is

$$W_A = \frac{1}{18}x + \frac{1}{9}\alpha_A, \quad W_B = \frac{1}{18}(1-x) + \frac{1}{9}\alpha_B. \quad (10)$$

The following table summarizes the total welfare of countries A and B in each of the above four cases.

Table 1. Total Welfare of Countries A and B

A \ B	Merger	No Merger
Merger	$\frac{1}{18}x + \frac{1}{9}\alpha_A, \frac{1}{18}(1-x) + \frac{1}{9}\alpha_B$	$\frac{1}{8}x + \frac{1}{4}\alpha_A, \frac{1}{8}(1-x)$
No Merger	$\frac{1}{8}x, \frac{1}{8}(1-x) + \frac{1}{4}\alpha_B$	$\frac{1}{2}x, \frac{1}{2}(1-x)$

Suppose that two countries are symmetric in population and also have the same weight on firm profits in the welfare measure (i.e., $x = x = \frac{1}{2}$, $\alpha_A = \alpha_B = \alpha$). In this simple case, allowing merger is a dominant strategy to both countries for $\alpha > \frac{3}{4}$. But both countries would be better off if neither allowed merger for $\alpha < 2$. So, if $\frac{3}{4} < \alpha < 2$ we have a situation of prisoners' dilemma, where the policy-makers in the two countries allow domestic mergers even though their welfare would be larger when they coordinate on not allowing merger in each country.³ This result shows that there exists a need for two countries to coordinate on merger policy when the weight on firm profits in the welfare measure is neither too small nor too large. Indeed, the weight α is likely to be quite large for countries whose economy relies heavily on a particular industry (e.g., South Korea on DRAM and LCD, Australia on iron ore, and so on).

Let us now examine how the result can be affected by asymmetries in population size and welfare weight on firm profits between two countries. In this more general case, the condition for the prisoner's dilemma situation to occur (i.e., the need of merger policy coordination) is given by

$$\frac{3}{2}x < \alpha_A < 4x, \quad (11)$$

³ For $\frac{5}{16} < \alpha < \frac{3}{4}$, we have two equilibria, both allowing merger and neither allowing merger. The no-merger equilibrium Pareto-dominates the merger-equilibrium. Note that, however, the risk-dominance criterion picks the merger-equilibrium for $\alpha > \frac{5}{16}$ and the no-merger equilibrium for $\alpha < \frac{5}{16}$. In this paper, we assume that the policy-makers in two countries choose the Pareto-dominant equilibrium.

for country A , and

$$\frac{3}{2}(1-x) < \alpha_B < 4(1-x), \quad (12)$$

for country B .

Suppose first that two countries differ in population but still have the same weight on firm profits in their welfare measure ($\alpha_A = \alpha_B = \alpha$). Not surprisingly, the need for merger policy coordination is larger when the population size is more symmetric. In fact, merger policy coordination is not mutually beneficial if the population size is sufficiently asymmetric ($x < \frac{3}{11}$ or $x > \frac{8}{11}$) since a country of small population has little to gain from merger policy coordination (i.e., it cares more about firm profits than consumer surplus).

Proposition 1. There exists a need for merger policy coordination provided $\frac{3}{11} < x < \frac{8}{11}$ for a given $\alpha = \alpha_A = \alpha_B$. The need for merger policy coordination is greater when two countries are more symmetric in the population size.

Note that the room for two countries to benefit from merger policy coordination gets larger when two countries differ in the weight on firm profits in the welfare measure ($\alpha_A \neq \alpha_B$). Recall that with symmetric α there is no need for merger policy coordination if $x < \frac{3}{11}$ or $x > \frac{8}{11}$. With asymmetric α , merger policy coordination can be Pareto-improving even if the population size is very asymmetric between two countries. For example, for $x = \frac{1}{4}$ (country A is much smaller than country B) the merger policy coordination is mutually beneficial if $\frac{3}{8} < \alpha_A < 1$ and $\frac{9}{8} < \alpha_B < 3$, i.e., the smaller country puts a sufficiently small weight on firms profit while the larger country puts a sufficiently large weight on firms profit. Similar remarks apply for the case where country B is sufficiently smaller than country A .⁴

⁴ Note that, however, for a similar population size the merger policy coordination can be desirable even if the smaller country's weight on firms profit is greater than the one of the larger country (e.g., $x = \frac{1}{2}$, $\alpha_A = \frac{3}{2}$ and $\alpha_B = 1$).

Proposition 2. With asymmetric α 's ($\alpha_A \neq \alpha_B$), merger policy coordination is mutually beneficial when the smaller (larger) country puts a small (large) weight on firms profit.

3. THE IMPACT OF TARIFFS ON MERGER POLICY

So far the two countries trade without import duties. Here, we introduce tariff barriers into our basic model and investigate the relationship between tariff policy and merger policy. Now suppose that there exist tariffs imposed on imported goods. For simplicity, we assume symmetric tariffs which are given exogenously by τ . Then the import price will be different from the export price, and is given by

$$p_X^B = p_X^A + \tau, \quad (13)$$

and

$$p_Y^A = p_Y^B + \tau, \quad (14)$$

where p_X^A and p_Y^B denote export prices for components X and Y , and p_X^B and p_Y^A denote import prices for components X and Y , respectively.

Then the domestic demands for system are given by

$$D^A(p_X^A + p_Y^A) = 1 - (p_X^A + p_Y^A), \quad (15)$$

and

$$D^B(p_X^B + p_Y^B) = 1 - (p_X^B + p_Y^B). \quad (16)$$

The welfare measure includes tariff revenues (TR_i):

$$W_i = CS_i + \alpha_i \Pi_i + TR_i. \quad (17)$$

As before, we consider the following four cases of merger policies of the two countries.

First, neither country allows the merger: Price competition of the two firms in each country drives component prices down to zero, i.e.,

$$p_X^A = p_Y^B = 0. \quad (18)$$

However, the other component that is necessary to complete the system is now imported with the tariff τ . So, the import prices become

$$p_Y^A = p_X^B = \tau. \quad (19)$$

The equilibrium demand is $D(\tau) = 1 - \tau$, and each country's welfare is given by

$$W_A = \frac{1}{2}(1 - \tau)^2 x + \tau(1 - \tau)x, \quad (20)$$

$$W_B = \frac{1}{2}(1 - \tau)^2(1 - x) + \tau(1 - \tau)(1 - x). \quad (21)$$

Second, only country A allows the merger: The firms in country B charges zero price for component Y in their own country due to price competition. The merged firm in country A sets the price of component X equal to the monopoly price for the system. But, now there are tariffs on imports. So, in equilibrium we have

$$p_X^A = \frac{1 - \tau}{2}, \quad p_Y^B = 0, \quad (22)$$

and

$$p_Y^A = \tau, \quad p_X^B = \frac{1 + \tau}{2}. \quad (23)$$

Then the equilibrium demand is $D\left(\frac{1 + \tau}{2}\right) = \frac{1 - \tau}{2}$. The merged firm gets profit of $\left(\frac{1 - \tau}{2}\right)^2$ in country A and the firms in country B get zero profit. In this case, each country's welfare is

$$W_A = \frac{1}{2}\left(\frac{1 - \tau}{2}\right)^2 x + \alpha_A \left(\frac{1 - \tau}{2}\right)^2 + \tau\left(\frac{1 - \tau}{2}\right)x, \quad (24)$$

$$W_B = \frac{1}{2}\left(\frac{1 - \tau}{2}\right)^2(1 - x) + \tau\left(\frac{1 - \tau}{2}\right)(1 - x). \quad (25)$$

Third, only country B allows the merger: By symmetry, we have

$$p_X^A = 0, \quad p_Y^B = \frac{1-\tau}{2}, \quad (26)$$

and

$$p_Y^A = \frac{1+\tau}{2}, \quad p_X^B = \tau, \quad (27)$$

and the equilibrium demand is $D\left(\frac{1+\tau}{2}\right) = \frac{1-\tau}{2}$. The merged firm gets profits of $\left(\frac{1-\tau}{2}\right)^2$ in country B and the two firms in country A get zero profit. Each country's welfare is

$$W_A = \frac{1}{2}\left(\frac{1-\tau}{2}\right)^2 x + \tau\left(\frac{1-\tau}{2}\right)x, \quad (28)$$

$$W_B = \frac{1}{2}\left(\frac{1-\tau}{2}\right)^2 (1-x) + \alpha_B\left(\frac{1-\tau}{2}\right)^2 + \tau\left(\frac{1-\tau}{2}\right)(1-x). \quad (29)$$

Last, both countries allow the merger: The equilibrium prices are

$$p_X^A = p_Y^B = \frac{1-\tau}{3}, \quad (30)$$

and

$$p_X^B = p_Y^A = \frac{1+2\tau}{3}, \quad (31)$$

and the equilibrium demand is $D\left(\frac{2+\tau}{3}\right) = \frac{1-\tau}{3}$. Each merged firm gets profit of $\left(\frac{1-\tau}{3}\right)^2$. Each country's welfare is

$$W_A = \frac{1}{2}\left(\frac{1-\tau}{3}\right)^2 x + \alpha_A\left(\frac{1-\tau}{3}\right)^2 + \tau\left(\frac{1-\tau}{3}\right)x, \quad (32)$$

$$W_B = \frac{1}{2} \left(\frac{1-\tau}{3} \right)^2 (1-x) + \alpha_B \left(\frac{1-\tau}{3} \right)^2 + \tau \left(\frac{1-\tau}{3} \right) (1-x). \quad (33)$$

As before, two countries face the policy decision between allowing domestic merger or not. Without merger policy coordination, a prisoners' dilemma situation occurs if

$$\frac{1}{2} x \left(\frac{3+\tau}{1-\tau} \right) < \alpha_A < 2x \left(\frac{\tau+2}{1-\tau} \right), \quad (34)$$

for country A and

$$\frac{1}{2} (1-x) \left(\frac{3+\tau}{1-\tau} \right) < \alpha_B < 2(1-x) \left(\frac{\tau+2}{1-\tau} \right), \quad (35)$$

for country B .

Given a symmetric population size (i.e., $x = \frac{1}{2}$), the lower and upper bounds of the above conditions are increasing in τ , and the increasing rate is higher for the upper bound than the lower bound. The former says that as the tariff increases, the need for merger policy coordination requires two countries to give a higher weight on firms' profit. The latter implies that the room for mutually beneficial merger policy coordination gets larger as the tariff rate increases.

As before, the need for merger policy coordination is smaller for two countries with more asymmetric population sizes. However, if we allow different α 's for two countries the room for merger policy coordination becomes larger when a positive tariffs exist. (As before, we can easily verify the range of α_A and α_B when $x = \frac{1}{4}$.)

Proposition 3. i) The presence of tariffs changes the condition for merger policy coordination to require both countries to assign a higher weight on firm profits. ii) There is more need for merger policy coordination with the presence of tariffs. iii) The room for merger policy coordination becomes larger for countries with asymmetric weights on firm profits in the welfare measure.

4. EXTENSION TO N COMPONENTS

In this section, we extend the basic model to the case of a system consisted of n components. There are n countries, each of which specializes on producing one of the n components. For simplicity, we assume that all countries are symmetric in population size as well as weight on firms profit in the welfare measure. It will be useful to solve

for the equilibrium component price in the k -firm symmetric Cournot complementary goods model. Each firm's problem is to solve the following program:

$$\max_{p_i} \left(1 - \sum_{j=1}^k p_j \right) p_i. \quad (36)$$

The first-order condition is

$$-p_i + 1 - \sum_{j=1}^k p_j = 0. \quad (37)$$

By symmetry (i.e., $p_i = p$, $i = 1, 2, \dots, k$), the equilibrium price for each component is given by $p = \frac{1}{1+k}$. Then, the equilibrium system price and demand are $\sum_{j=1}^k p_j = kp = \frac{k}{1+k}$ and $D\left(\frac{k}{1+k}\right) = \frac{1}{1+k}$ respectively, and the equilibrium profit of each merged firm is $\left(\frac{1}{1+k}\right)^2$.

Each country faces the strategic decision of whether to allow domestic merger or not. Let us first calculate the welfare of country i when $j-1$ other countries allow merger, where $j = 1, 2, \dots, n$. If country i allows merger, we have a situation of Cournot complementary goods pricing with j firms since competition in $n-j$ countries drives the price of the corresponding component down to zero. Then, country i 's welfare is given by

$$W_i^M = \frac{1}{2n} \left(\frac{1}{1+j} \right)^2 + \left(\frac{1}{1+j} \right)^2 \alpha. \quad (38)$$

Similarly, if country i does not allow merger, we have a situation of Cournot complementary goods pricing with $j-1$ firms, and country i 's welfare is given by

$$W_i^{NM} = \frac{1}{2n} \left(\frac{1}{j} \right)^2. \quad (39)$$

The condition for allowing merger to be a dominant strategy for country i is

$$\alpha > \frac{1}{2n} \left[\left(\frac{1+j}{j} \right)^2 - 1 \right] = \frac{1}{2n} \left(\frac{1+2j}{j^2} \right) \text{ for all } j = 1, 2, \dots, n. \quad (40)$$

The RHS of the above inequality is decreasing in j . Then, a necessary and sufficient condition for all of the above conditions to hold is that

$$\alpha > \frac{3}{2n}. \quad (41)$$

All countries would be mutually better off by coordinating on not allowing merger altogether if

$$\frac{1}{2n} > \frac{1}{2n} \left(\frac{1}{1+n} \right)^2 + \left(\frac{1}{1+n} \right)^2 \alpha \Rightarrow \alpha < \frac{n+2}{2}. \quad (42)$$

Then, we have a situation of prisoners' dilemma when conditions (41) and (42) hold together, i.e.,

$$\frac{3}{2n} < \alpha < \frac{n+2}{2}. \quad (43)$$

Note that the LHS of (43) is decreasing in n and the RHS is increasing in n . So, the room for international merger policy coordination is bigger with a larger number of countries.

Proposition 4. The need for merger policy coordination increases as the number of countries (components) increases.

5. INDEPENDENT PRODUCTS

Now we compare the above outcome with the case of independent products. There are n independent markets in the world. As before, in each country there are two firms specializing on producing one particular product. In order for a fair comparison, we assume that the worldwide demand for each good is given by

$$D(p) = 1 - np. \quad (44)$$

Again, each country decides whether to allow domestic merger or not. If country i allows merger, market i is monopolized. The merged firm in that country gets profit of

$\frac{1}{4n}$ with the monopoly price $\frac{1}{2n}$. Each country's consumer surplus is $\frac{1}{8n^2}$ in this monopolized market. In a market where there is no merger, competition drives price down to zero, and each country gets consumer surplus of $\frac{1}{2n^2}$. Then, the welfare of country i when $j-1$ other countries allow merger, where $j=1,2,\dots,n$, can be calculated as follows:

$$W_i^M = \frac{1}{8n^2}j + \frac{1}{2n^2}(n-j) + \frac{1}{4n}\alpha, \quad (45)$$

if allowing merger,

$$W_i^{NM} = \frac{1}{8n^2}(j-1) + \frac{1}{2n^2}(n-j+1), \quad (46)$$

if not allowing merger.

The condition for allowing merger to be a dominant strategy for country i is

$$\alpha > \frac{3}{2n}, \text{ for all } j=1,2,\dots,n. \quad (47)$$

The countries would be mutually better off by coordinating on not allowing merger altogether if

$$\frac{1}{2n} > \frac{1}{8n} + \frac{1}{4n}\alpha \Rightarrow \alpha < \frac{3}{2}. \quad (48)$$

Then, we have a situation of prisoners' dilemma when both conditions (47) and (48) hold, i.e.,

$$\frac{3}{2n} < \alpha < \frac{3}{2}. \quad (49)$$

Note that the RHS is constant while the LHS is decreasing in n , implying that the need for merger policy coordination increases as n increases. However, the set of α satisfying condition (49) is nested by the set of α satisfying condition (43), which leads to the following result.

Proposition 5. The room for merger policy coordination is larger in markets for complementary goods relative to markets for independent goods.

This difference is mainly due to the double-marginalization problem in markets for complementary goods, which is exacerbated as n increases. The loss in consumer surplus due to merger is much larger in markets for complementary goods compared with markets for independent goods (of equal sizes).

6. POLICY MEASURE

6.1. Veto as a Coordination Device

Then a natural question arising is how coordination on merger policy between countries can be achieved. Here we consider a simple veto game. If a merger is proposed by firms in a country, each country's merger authority decides whether to approve the merger. A merger takes place only if it is approved by both merger authorities.

Consider the previous two-component two-country model with symmetric α . In this veto game, the strategy space of the merger authority in each country is now consisted of the following four options:

- i) Approve the mergers proposed in both countries.
- ii) Approve the merger proposed in their own country and veto the merger proposed in the other country.
- iii) Disapprove the merger proposed in their own country and approve the merger proposed in the other country.
- iv) Disapprove the mergers proposed in both countries.

Clearly, each country always has the incentive to veto the merger proposed in the other country, regardless of the decision on the merger proposed in their own country. The other country's merger reduces both consumer surplus and firms profit in their country. So, the first strategy is dominated by the second strategy, and the third strategy is dominated by the fourth strategy. After iterative eliminations of two dominated strategies, each country is indifferent between the remaining second and fourth strategies. So, we have four Nash equilibria $\{(2,2), (2,4), (4,2), (4,4)\}$ all of which give the same efficient payoffs $(\frac{1}{2}x, \frac{1}{2}(1-x))$. For example, the payoff matrix for $x = \frac{1}{2}$ is as follows.

The same result equally applies to markets for independent goods. For example, the payoff matrix for $x = \frac{1}{2}$ for the independent product markets described in the previous section is as follows.

Table 2. Payoffs of Countries *A* and *B* ($x = \frac{1}{2}$)

A \ B	1	2	3	4
1	$\frac{1}{36} + \frac{\alpha}{9}, \frac{1}{36} + \frac{\alpha}{9}$	$\frac{1}{16}, \frac{1}{16} + \frac{\alpha}{4}$	$\frac{1}{16} + \frac{\alpha}{4}, \frac{1}{16}$	$\frac{1}{4}, \frac{1}{4}$
2	$\frac{1}{16} + \frac{\alpha}{4}, \frac{1}{16}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{16} + \frac{\alpha}{4}, \frac{1}{16}$	$\frac{1}{4}, \frac{1}{4}$
3	$\frac{1}{16}, \frac{1}{16} + \frac{\alpha}{4}$	$\frac{1}{16}, \frac{1}{16} + \frac{\alpha}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$
4	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$

Table 3. Payoffs of Countries *A* and *B* for the Independent Product Markets ($x = \frac{1}{2}$)

A \ B	1	2	3	4
1	$\frac{1}{16} + \frac{\alpha}{8}, \frac{1}{16} + \frac{\alpha}{8}$	$\frac{5}{32}, \frac{5}{36} + \frac{\alpha}{8}$	$\frac{5}{32} + \frac{\alpha}{8}, \frac{5}{32}$	$\frac{1}{4}, \frac{1}{4}$
2	$\frac{5}{32} + \frac{\alpha}{8}, \frac{5}{32}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{5}{32} + \frac{\alpha}{8}, \frac{5}{32}$	$\frac{1}{4}, \frac{1}{4}$
3	$\frac{5}{32}, \frac{5}{32} + \frac{\alpha}{8}$	$\frac{5}{32}, \frac{5}{32} + \frac{\alpha}{8}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$
4	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{4}, \frac{1}{4}$

Proposition 6. Granting each country a veto power to a merger proposed by firms in the other country is an effective device to overcome the prisoners' dilemma and achieve the merger policy coordination.

This contrasts with the result obtained in Cabral (2003). In the present model, veto is used as a coordination device to overcome the situation of prisoners' dilemma (merger being approved in both countries), whereas in Cabral (2003) veto prevents efficient mergers from occurring and it is reputation that achieves coordination.

6.2. Consensus on Welfare Standard

Another solution to the coordination problem is to reach a consensus on antitrust welfare standard among related countries. To be more specific, if all countries involved in a merger put sufficiently large weight on consumer surplus in their welfare measure (i.e., small α) there would be no coordination problem in merger policy across

countries. For example, if each country's competition authority were concerned about consumer surplus only (ignoring firm profits) they would block all mergers inducing price increases.

Both in the European Union and the United States, merger control is guided by a consumer surplus standard, although they allow for an efficiency defense under specified conditions.⁵ On the other hand, in other jurisdictions such as Canada, Australia, and New Zealand, competition authorities seem to lean towards a total welfare standard. Note that there are numerous arguments advocating total welfare standard such as Carlton (2007), Blair and Sokol (2013) and Kaplow (2011). Our result provides another case supporting consumer surplus as welfare standard in merger control in an international context.

7. CONCLUDING REMARKS

The world production system has been complicated by multinational enterprises which globally outsource intermediate goods. With the opportunity of sourcing inputs in the world market, the prices of imported inputs matter for the final producers' profitability. The input prices are affected by not only trade liberalization but also competition policy of related countries. In particular, we examine merger policy that influences domestic input prices through which a trading partner's national welfare may be affected. The main purpose of this paper is to theoretically investigate a recent debate on international merger policy coordination arising from complementary good markets.

The main results are summarized as follows. First, when two countries independently and unilaterally decide whether to allow domestic mergers, their dominant strategies are often to allow the merger and those decisions lead to a situation of prisoners' dilemma. This calls for policy coordination regarding merger policy between related countries. Second, the prisoners' dilemma problem is exacerbated when tariffs are imposed on imports. Third, the need for merger policy coordination increases as the number of components (i.e., countries) increases. Fourth, the room for the policy coordination is larger for complementary goods compared with independent goods. Fifth, the presence of mutual veto power between countries can enhance policy coordination. Finally, our result provides another support for consumer surplus as welfare standard in merger control. We hope these can shed some light on promoting merger policy coordination in global markets.

Although we tried to generalize our arguments in several ways, we admit that there are some caveats in the current setting. First, we rely on a linear example of demand

⁵ See European Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentration between undertakings (2004) and the Horizontal Merger Guidelines of the U.S. Department of Justice and the Federal Trade Commission (2010).

function for the sake of analytical simplicity. Although we believe that our main results still hold under a fairly generalized system of demand structure, we have not been able to confirm it in the present paper due to potential complexity of the problem. We hope that one may pursue this direction for a further research. Second, we considered only horizontal merger within a country. However, in reality multinational firms may acquire their foreign suppliers in order to reduce transactions costs in their relations. That is, cross-border mergers between different component producers can occur in the global market, which has been ruled out in our analysis. This is only because our paper is motivated by domestic mergers that have an external effect to trading partners in other countries.

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