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## **Effects of globalizing a consumer-friendly firm into an asymmetric mixed duopoly**

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# Effects of globalizing a consumer-friendly firm into an asymmetric mixed duopoly

## 1 | INTRODUCTION

The world's economy is moving towards high levels of globalization. Some countries have created alliances with the aim of establishing a single market.<sup>1</sup> In this way, countries allow the movement of goods within the union as if it were a single country. For companies this represents greater business opportunities and access to a larger number of customers and suppliers. Meanwhile, consumers would be expected to benefit from more competitive prices.

Several authors have investigated the effects that globalization and free trade have on consumers, profits and welfare. For example, Markusen (1981), Cordella (1993) and Dong and Yuan (2010) showed that the welfare under free trade in a two-country model can fall. Kameda and Ui (2012) study a globalized single market and analyze the effects of symmetry on profits and consumer surplus when globalizing monopolies into a single oligopoly market. Amir et al. (2017), as well, compare a globalized single integrated market with autarky and identifies general conditions under which trade affects prices, outputs, export or import, consumer surplus, profits and welfare.

On the other hand, recent world-wide trend is that many companies have acquired social awareness.<sup>2</sup> As a subset of corporate social responsibility (CSR) addressed by Porter and Kramer (2006), there exist initiatives oriented to the consumers.<sup>3</sup> A consumer-friendly firm is a firm of which social responsibility is oriented to the consumer. In specific, consumer surplus-oriented CSR has modified the objectives of the firms that adopt it.<sup>4</sup> Thus, consumer-friendly firms do not only aim to maximize their own profits, but include consumer surplus in their decision-making process. In a scenario where there are firms committed to consumer-friendliness, does globalization have a positive economic effect on consumers, companies and welfare?

In the previous literature, earlier efforts have been made to answer whether globalization is good for all consumers and businesses and the welfare of the nations involved. It has been done, mostly, considering that the sole purpose of companies is to maximize their profits. However, it has become a common practice for private firms to implement CSR activities as a business strategy. Recently, Wang et al. (2012) and Chang et al. (2014) study "consumer-oriented" initiatives in international duopolies. Wang et al. (2012) analyzes how the welfare is affected by consumer-friendly

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<sup>1</sup>The European Union, established the single market since the 90s. According to the European Commission's website, the single market refers to "the EU as one territory without any internal borders or other regulatory obstacles to the free movement of goods and services". The Caribbean Community is another example of single market and the Cooperation Council for the Arab States of the Gulf was launched with plans for a fully integrated single market.

<sup>2</sup>According to the 19th Annual Global CEO Survey by PwC, 64% of CEOs claim that "corporate social responsibility (CSR) is core to their business rather than being a stand-alone program". They interviewed 1409 CEOs in 83 countries.

<sup>3</sup>CSR might be oriented to the environment, to the employees or to the consumers, for instance.

<sup>4</sup>For example, Nakamura (2014), Chang et al. (2014), Kopel (2015), Matsumura and Ogawa (2014, 2016), Lambertini and Tampieri (2015), Liu et al. (2015) and Flores and García (2016), to mention some, use consumer surplus as a proxy of the firm's CSR

initiative of two foreign exporting firms in a third country's market. Whereas Chang et al. (2014) examine the welfare effect when both home and foreign firms adopt a consumer-friendly posture in a domestic country.<sup>5</sup>

However, the global market addressed in the above works is different to the integrated single market.<sup>6</sup> Our work examines the integration of separated monopolies into a single duopoly market. Moreover, we contemplate the heterogeneous objectives of the firms, which conforms a *mixed duopoly*. Mixed oligopolies have been studied for some decades. Traditionally, private firms that only maximize their profits interact with public firm whose purpose is to maximize (weighted) welfare. Early studies include Cremer et al. (1991), De Fraja and Delbono (1989), Harris and Wiens (1980), Matsumura (1998), to mention some. Recent economic literature on mixed oligopolies addresses the interaction between private for-profit firms and non-profit organizations or private firms with corporate social responsibility.<sup>7</sup>

In this research line, we consider a mixed market that one of the firms adopts a consumer-friendly strategy by committing to consumers of the market in which operates. Then we analyze the effects of globalization on consumer surplus, profits, price, exports and welfare. We focus our study on the role of the technical advantage that a firm has over the other and the relative size of the markets.

To the best of our knowledge, the previous literature has not identified the conditions for the case where there exist a firm that is socially responsible being friendly to consumers. Although CSR is an important issue at present, little has been studied in the context of globalization or free trade. Our work provides certain conditions under which globalization increases or decreases consumer surplus, profits and welfare in a two-markets model. The story in this paper is as follows: Before globalization the non for-profit firm is friendly to consumers in its market of origin and after globalization is friendly to the consumers of the global market. The latter assumption is made considering that after globalization the firm operates in the global market,<sup>8</sup> but it is also compared with the case that after globalization the firm is friendly to the consumers of its original market. Finally, we also extend the analysis into a mixed oligopoly market where the consumer-friendly firm competes with a for-profit firm in its original market before globalization and the other for-profit firm in the counterpart market after globalization.

The followings are main findings of our study. Under the assumption that the non-profit firm is friendly to the global consumers, on the one hand, consumers in the market of the for-profit firm are always better off after globalization than before. The for-profit firm may benefit from globalization only if its local market is very small compared to its trading partner and has sufficient technical advantage or moderate disadvantage. If globalization benefits the for-profit firm, the market must export which implies that its output rises. A higher output guarantees a welfare gain in this market.

On the other hand, consumers in the original market of the consumer-friendly firm are not always better off after globalization. Thus, being friendly to the global consumers may hurt consumers in its original market or reduce its welfare after globalization. Differently from the results of Amir et al. (2017), if globalization hurts the consumers in this local market, it does not necessarily increases the consumer-friendly firm's profits unless it has sufficiently large technical advantage. This means that globalization may hurt simultaneously consumers and firms of this local market, in which case the welfare of this market decreases. It may also lead to a loss in global welfare after globalization under certain conditions. However, consumers in the original market of the consumer-friendly firm are always better off after globalization if the firm is only friendly to consumers in its original market before and after globalization. Finally, duopolistic competition between a consumer-friendly firm and a for-profit firm in the original market can increase not

<sup>5</sup> As a related work on the strategic trade and privatization policies in an international mixed oligopoly, see, for example, Bárcena-Ruiz and Garzón (2005), Dadpay and Heywood (2006), Lee et al. (2013) and Cato and Matsumura (2015).

<sup>6</sup> Kameda and Ui (2012) distinguish between two types of global markets: (a) the free trade market which allows the existence of  $n$  different markets with a separate supplier; and (b) a single integrated market in which all producers compete.

<sup>7</sup> See, for example, Königstein and Müller (2001), Kopel and Brand (2012), Goering (2007), Kopel et al. (2014), Flores and García (2016) and Cho and Lee (2017).

<sup>8</sup> As Porter and Kramer (2006) expressed, "any business that pursues its ends at the expense of the society in which it operates will find its success to be illusory and ultimately temporary".

only the local welfare in the original market but global welfare after globalization than under the monopoly case that only the consumer-friendly firm exists in the original market.

This paper is organized as follows. Section 2 constructs the basic model. First, we determine the optimal values of outputs, prices, profits and consumer surplus before globalization, for each market. Then, we examine the corresponding equilibrium values after globalization. Section 3 analyzes the effect of globalization on consumers, companies, and markets. It is done through the determination of conditions that indicate when those variables are increased or reduced. Section 4 compares the previous results with the case where after globalization the not-for-profit firm is friendly only to the local consumers in its original market. We also examine the welfare effect of globalization on the mixed duopoly in the original market with the consumer-friendly firm. The final section concludes the paper.

## 2 | MODEL SPECIFICATION AND ASSUMPTIONS

The model consists of two producers and two corresponding markets. A consumer-friendly firm and a for-profit firm produce one homogeneous commodity. We consider two cases: The first one is "separated monopolies" with two markets in which each producer serves only the demand of the corresponding market while the other is "mixed duopoly" where two markets are united into a single globalized market.

### 2.1 | Assumptions

Denote the quantity produced by firm  $i$ ,  $i = 0, 1$  by  $q_i$  ( $q_i \geq 0$ ). Firm 0 is a consumer-friendly firm while firm 1 is a for-profit firm. In addition, we make the following assumptions about demand and cost functions.

*Before uniting the markets*

A1.1. The demand in market 0 is  $q_0 = a - p_0$ , where  $p_0$  is the price. In market 1 the demand is  $q_1 = \gamma(a - p_1)$ , where  $p_1$  is the price and  $\gamma > 0$  measures the relative size of market 1 to the market 0:  $0 < \gamma < 1$  indicates that market 1 is smaller than market 0; on the contrary,  $\gamma > 1$  indicates that market 1 is bigger than market 0;  $\gamma = 1$  indicates that market 1 is the same size as market 0.

A1.2. Firm  $i$ ,  $i = 0, 1$ , has a quadratic cost function:<sup>9</sup>

$$f_i(q_i) = \frac{1}{2}k_i q_i^2, \text{ where } k_i > 0$$

We use this functional form in order to determine the role of technical advantage in production on the effects of globalizing two separated markets. Let  $k_0 = 1$  and  $k_1 = k$ , where  $k$  defines the concept of technical advantage. According to Flores and García (2016), we can say that firm  $i$  has technical advantage over firm  $j$  if firm  $i$  can produce the same output with firm  $j$  at lower marginal cost and total cost. That is, if  $k < 1$  the for-profit firm has technical advantage over the consumer-friendly firm; if  $k > 1$  the opposite is true. If  $k = 1$  no firm has technical advantage over the other. Note that, even if the consumer-friendly firm has technical advantage ( $k > 1$ ), the for-profit firm can be technically more efficient than the consumer-friendly firm at the margin if  $q_0 > k q_1$ .

*After uniting the markets*

A2.1. The global demand is  $Q = (1 + \gamma)(a - p_w)$  where  $p_w$  is the global price.

<sup>9</sup> Following De Fraja and Delbono (1989), Wang and Wang (2009), Wang et al. (2012), Chang et al. (2014) and Flores and García (2016), we adopt usual assumption on the cost function in the analysis of mixed oligopolies. That is, we consider a competition with decreasing returns to scale (quadratic cost).

## 2.2 | Objective functions of the companies

### Before uniting the markets

Recall that before globalization a single company in each market is selling the commodity. The profit function of the firm  $i$  is:

$$\pi_i^B(q_i) = p_i q_i - \frac{1}{2} k_i q_i^2 \quad (1)$$

Firm 1, the for-profit firm, seeks profit maximization only. Firm 0, on the other hand is consumer-friendly. It takes both its own profits and consumer surplus into consideration. Following Wang et al. (2012) and Chang et al. (2014), we define the objective function that firm 0 maximizes:

$$U^B(q_0) = \pi_0^B(q_0) + CS_0(q_0) \quad (2)$$

where  $CS_0(q_0) = \frac{1}{2} q_0^2$  is the consumer surplus in market 0.<sup>10</sup>

The optimal outputs and prices for both firms and both markets are shown in appendix A. Note that the production in the single market  $i$  corresponds to the demand of such market, i.e.,  $\bar{q}_i = \bar{q}_i^{(c)}$ .

The respective optimal values  $\bar{\pi}_i^B$  and  $\bar{U}^B$  can be found by substituting  $\bar{q}_i$  and  $\bar{p}_i$ , ( $i \in \{0, 1\}$ ) in (1) and (2). The consumer surplus in market 0 would be  $\bar{CS}_0 = \frac{1}{2} \bar{q}_0^2$  and in market 1,  $\bar{CS}_1 = \frac{1}{2\gamma} \bar{q}_1^2$ . The social welfare in market  $i$  is  $\bar{W}_i = \bar{\pi}_i^B + \bar{CS}_i$ .

### After uniting the markets

After globalization, there is an integrated market where both companies compete in a classic mixed duopoly. The price at this stage is determined in the global market, so it obeys the inverse demand function in assumption A2.1.

The profit function of firm  $i$  is:

$$\pi_i^A(q_i) = p_w q_i - \frac{1}{2} k_i q_i^2 \quad (3)$$

Firm 1 chooses its output to maximize profits. Firm 0 is still consumer-friendly; it wants to maximize its profits and consumer surplus. However, after uniting the markets, the firm 0 is friendly to the consumers of the entire market it serves. It means that the objective function of firm 0 considers the consumer surplus of the global market  $CS(Q) = \frac{1}{2(\gamma+1)} Q^2$  and its own profit, but not include the profit of firm 1.<sup>11</sup>

We define the objective function of firm 0 is as follows:

$$U^A(q_0) = \pi_0^A(q_0) + CS(Q) \quad (4)$$

The equilibrium outputs and price are shown in appendix A. Note that the quantity demanded by consumers in market 0 is  $\bar{q}_0^{(c)} = a - \bar{p}_w$  and by consumers in market 1 is  $\bar{q}_1^{(c)} = \gamma(a - \bar{p}_w)$ .

The equilibrium values  $\bar{\pi}_i^A$  and  $\bar{U}^A$  can be found by substituting  $\bar{q}_i$ , ( $i \in \{0, 1\}$ ) and  $\bar{p}_w$  in (3) and (4). The consumer surplus for market 0 and 1 would be  $\bar{CS}_0 = \frac{1}{2} (\bar{q}_0^{(c)})^2$  and  $\bar{CS}_1 = \frac{1}{2\gamma} (\bar{q}_1^{(c)})^2$ , respectively. The social welfare in market  $i$  is  $\bar{W}_i = \bar{\pi}_i^A + \bar{CS}_i$ .

<sup>10</sup>Thus, firm 0 maximizes total social welfare in market 0, which can be interpreted as a public monopoly in a single market configuration.

<sup>11</sup>In this sense, firm 0 is not a public firm in the entire market, which is different with the classical objective function of public firm in a mixed market.

### 3 | RESULTS

In order to find the effects of globalization in each market, we define the ratios of the equilibrium values after globalization to the separated optimal values before globalization.

$$\begin{aligned} R_i^p &= \frac{\tilde{p}_w}{\bar{p}_i}, & R_i^{q^{(c)}} &= \frac{\tilde{q}_i^{(c)}}{\bar{q}_i^{(c)}}, & R_i^q &= \frac{\tilde{q}_i}{\bar{q}_i} \\ R_i^\pi &= \frac{\tilde{\pi}_i^A}{\bar{\pi}_i^B}, & R_i^{cs} &= \frac{\tilde{CS}_i}{\bar{CS}_i}, & R_i^W &= \frac{\tilde{W}_i}{\bar{W}_i} \end{aligned} \quad (5)$$

Total production and total welfare ratios are, respectively,  $R^Q = \frac{\tilde{Q}}{\bar{q}_0 + \bar{q}_1}$  and  $R^W = \frac{\tilde{W}_0 + \tilde{W}_1}{\bar{W}_0 + \bar{W}_1}$ . All the ratios are shown in appendix B.

In the below, we determine conditions under which these ratios are greater or smaller than 1. When the ratio of a variable is less than 1, then there is degradation of that variable as a result of globalization. In addition, we find conditions under which a market must export or import the good.<sup>12</sup>

#### 3.1 | Effects on price and quantity demanded

**Proposition 3.1** *Globalization reduces the price paid in consumer-friendly firm's original market if and only if  $0 < k < \frac{2}{\gamma + \gamma^2}$ .*

The price perceived by market 0 drops down (its quantity demanded increases) after globalization if the new competing firm 1 has a larger technical advantage over the consumer-friendly firm. On the contrary, if the for-profit company has a larger technical disadvantage, this would push up the price in market 0 after globalization. The reason is that firm 0 does not maximize the entire welfare after globalization even though it maximizes its local welfare before globalization. Thus, competitiveness matters on the price in market 0, in which the relative technical advantage influences the price ratio.

Also, the relative size of the market influences the price ratio and the magnitude of output substitution. As a sufficient condition, for example, when market 0 is larger or at least has the same size as market 1 ( $0 < \gamma \leq 1$ ), the presence of a for-profit firm with the technical advantage ( $0 < k < 1$ ) after globalization will push down the price and raise the quantity demanded by market 0. Nevertheless, if the for-profit firm has no technical advantage but its disadvantage is small enough ( $1 \leq k < \frac{2}{\gamma + \gamma^2}$ ), the consumers in market 0 would still perceive a fall in the price and would raise its quantity demanded.

In contrast, if the market 0 is the smallest one ( $\gamma > 1$ ), the presence of a firm with the technical disadvantage ( $k > 1$ ) would push up the price in market 0 (its quantity demanded decreases). However, if the for-profit firm has the technical advantage, the rise in the price and the fall in quantity demanded would occur if this advantage is relatively moderate ( $\frac{2}{\gamma + \gamma^2} < k < 1$ ).

**Proposition 3.2** *Globalization reduces the price paid in for-profit firm's original market regardless of the relative size of the trading partner and which firm has technical advantage.*

On the other hand, the price perceived by market 1 drops down after globalization irrespective of technical advantage of the new competing firm 0. The reason is that this market is more competitive and consumer-friendly firm 0

<sup>12</sup>All the proofs of Propositions are provided in appendix B

considers consumer surplus in market 1 after globalization, which always increases total quantity demanded in market 1. Thus, consumers in market 1 will perceive a decrease in the price after globalization.

### 3.2 | Effects on output production

**Proposition 3.3** *Consumer-friendly firm's output and total production rise after globalization, regardless of the relative size of the trading partner and which firm has technical advantage.*

According to Amir et al. (2017), a typical result of free trade is that it stimulates production when all the firms are profit maximizers since an increase in firm's output has a less negative impact on the price. Thus, given the same price, the companies would produce more after globalization. Proposition 3.3 states that it remains true in the context where one of the firms is consumer-friendly. In our model, the consumer-friendly firm always produces more, regardless of the cost of each firm. The reason is that this firm weighs the consumer surplus of both markets where it serves, which increases its production to compensate and even surpass the possible reduction of the for-profit company's output (if such a reduction exists). In such a way that the total production of the global market is higher after globalization than before. This result is contrast with Dong and Yuan (2010) and Amir et al. (2017), who show that a high-cost country might end up producing less owing to an excessive output expansion by a low-cost country.

**Proposition 3.4** *For-profit firm's output rises after globalization if and only if  $0 < k < \frac{2}{\gamma + \gamma^2}$ .*

This proposition states that whether the production of the for-profit firm increases or not after globalization depends on the value of  $k$  and  $\gamma$ . Note that this condition is exactly same with that in Proposition 3.1. Particularly, if the market 0 is larger or has the same size as market 1 ( $0 < \gamma \leq 1$ ), and the for-profit firm has the technical advantage or if its disadvantage is relatively moderate, then its production increases after globalization. On the other hand, if the market 0 is smaller and the for-profit firm has technical disadvantage or relatively moderate advantage, then its production decreases with globalization.

### 3.3 | Effects on consumer surplus

**Proposition 3.5** *Globalization benefits consumers of consumer-friendly firm's original market if and only if  $0 < k < \frac{2}{\gamma + \gamma^2}$ .*

**Proposition 3.6** *Consumers in market 1 are better off after globalization, regardless of the relative size of the trading partner and which firm has technical advantage.*

Consumer surplus ratio in each market is the square of the quantity demanded ratio<sup>13</sup>:  $R_i^{cs} = \left(R_i^{q(c)}\right)^2$ . Hence, the consumer surplus of market  $i$  will be larger after globalization than before if and only if the quantity demanded by consumers in market  $i$  increases. The conditions for the quantity demanded by market 0 to increase or decrease were established in Proposition 3.1, those are the same conditions of Proposition 3.5 for the consumer surplus of market 0 to increase or decrease. In Proposition 3.2 we also stated that the price in market 1 falls and the quantity demanded by consumers increases regardless of the size of the market or the cost of the firm, therefore consumer surplus of this will increase.

<sup>13</sup>  $R_i^{q(c)} = \frac{a - \bar{p}_i w}{a - \bar{p}_i}$ , therefore,  $R_i^{q(c)} > 1$  if and only if  $R_i^p < 1$  (law of diminishing demand).

We can provide economic explanations. Before and after globalization, firm 0 has an incentive of high production because of its consumer-friendliness. In equilibrium (after globalization) the higher the total production, the higher the consumption of each market. In market 0, consumption was already high before globalization due to the friendliness of the company 0. Thus, whether the consumer surplus of market 0 rises or falls in this market depends on cost parameter and the relative size of the market. On the other hand, the only firm that serves market 1 before globalization, has no interest in the consumer, while after globalization there is a rival firm that has an interest in the consumers of the global market, which induces market 1's consumption to be boosted in this market, resulting in consumer surplus of this market larger than before.

### 3.4 | Effects on profits

**Proposition 3.7** *Globalization benefits the consumer-friendly firm if and only if  $k > \frac{2(2+\gamma)^2}{\gamma(1+\gamma)(4+3\gamma)}$*

It implies that the profits of the consumer-friendly firm 0 drops down if it has a larger technical disadvantage over the for-profit firm. This is because consumer-friendly firm 0 should produce larger outputs in order to increase total consumer surplus in entire market. On the contrary, if the consumer-friendly company has a larger technical advantage, then it is better off after globalization. Thus, globalization may reduce or increase the profit of firm 0. It is sharply contrast with Amir et al. (2017), who found in a model with only for-profit firms that the firms and consumers of a country cannot be both worse off with globalization. Unlike them, we show that the profits of the consumer-friendly company and the consumers of its original market can be worse off with globalization simultaneously.

The relative size of the markets will also influence the profits ratio. As a sufficient condition, if market 0 is larger or not much smaller than its trading partner ( $0 < \gamma \leq \gamma^* \approx 1.21956$ ) and the consumer-friendly firm has a technical disadvantage ( $0 < k < 1$ ), its profit will fall after globalization. Thus, in order to make more profits after globalization, the consumer-friendly firm needs to have relatively high technical advantage. If market 0 is even smaller ( $\gamma > \gamma^*$ ), it is enough that the consumer-friendly company has the technical advantage to benefit from globalization. It can also achieve benefit from trade being at a disadvantage if it is relatively moderate.

**Proposition 3.8** *Globalization benefits the for-profit firm if and only if  $0 < \gamma < \frac{1}{2}(-1 + \sqrt{5})$  and  $0 < k < \frac{2(1-\gamma-\gamma^2)}{3\gamma+5\gamma^2+2\gamma^3}$*

It implies that the for-profit firm may benefit from globalization only if market 1 is very small compared to its trading partner and has sufficient technical advantage or relatively moderate disadvantage. This is because the consumer-friendly firm 0 cares about all consumers in the global market, which pushes up consumption in both individual markets. As a result, as shown in Proposition 3.2, globalization reduces the price in market 1. Therefore, globalization turns out to be good for firm 1's profits only when it has sufficient technical advantage and market 1 is very small.

### 3.5 | Export/Import

Since this is a two-market model, one of the individual markets must export and the other import in a global market. To find out if a market exports under globalization we have to compare the output of each market with its consumption. That is, a market  $i$  exports if it has excess quantity supplied:  $\tilde{q}_i - \tilde{q}_i^{(c)} > 0$  where

$$\tilde{q}_0 - \tilde{q}_0^{(c)} = - \left( \tilde{q}_1 - \tilde{q}_1^{(c)} \right) = - \frac{a(1 - \gamma(1 + k(1 + \gamma)))}{(2 + \gamma)(2 + k(1 + \gamma))} \quad (6)$$



**Proposition 3.9** *The consumer-friendly firm's original market exports to the for-profit firm's original market either (i) if  $0 < \gamma \leq 1$  and  $k > \frac{1-\gamma}{\gamma+\gamma^2}$  or (ii) if  $\gamma > 1$ .*

It states that market 0 will be the exporter either (i) if it has larger or the same size as market 1 and the consumer-friendly firm has enough technical advantage or (ii) if it has smaller size than market 1.

### 3.6 | Effects on welfare

Combining two effects on consumer surplus and the profits of the firm produces the total effects on welfare. First, the ratio of  $R_0^w > 1$  yields the following conditions.

**Proposition 3.10** *Globalization enhances the local welfare of market 0 either (i) if  $k > \frac{\sqrt{2}}{\gamma} + \frac{2}{\gamma(1+\gamma)}$  or (ii) if  $0 < \gamma < -1 + \sqrt{2}$  and  $0 < k < -\frac{\sqrt{2}}{\gamma} + \frac{2}{\gamma(1+\gamma)}$ .*

It includes the case that both consumer surplus in market 0 and the profit of the consumer-friendly firm are improved simultaneously. Also, the welfare of market 0 increases after globalization if its firm's losses are lower than its consumers' gains, or if its firm's gains exceed its loss in consumers' surplus.

Second, the ratio of  $R_1^w > 1$  yields the following condition:

$$(2 + k\gamma)^2 \left( -6 - 5\gamma - 2\gamma^2 + k^2\gamma(1 + \gamma)^2 + k(-3 - 2\gamma + \gamma^2) \right) + (2 + \gamma)^2((2 + k\gamma)(4 + k) + 2k) > 0. \quad (7)$$

Finally, the ratio of  $R^w > 1$  yields the following condition:

$$(2 + k + k\gamma)^2 \left( 2(-3 + k)\gamma^2 + 2k^2\gamma^3 + k^2\gamma^4 \right) + 8 \left( 3 + \gamma + 2\gamma^2 + k(\gamma - 1)^2(1 + \gamma) - k^2\gamma(1 + \gamma)^2 \right) > 0. \quad (8)$$

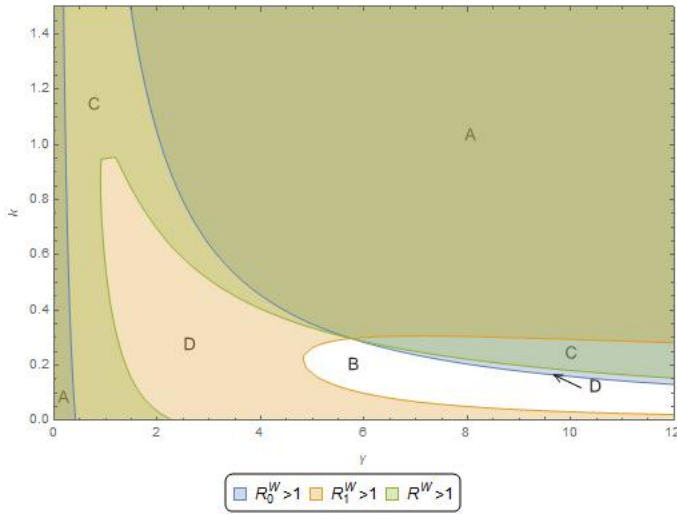
It is difficult to analyze exact conditions algebraically, but we can visualize these results in figure. Figure 1 shows how local welfare in both markets and global welfare are affected by the relative market size and the cost parameter. In figure 1, we can divide four different areas on the welfare effect. Area A represents that local welfare of both markets increases simultaneously, which induces Pareto-improving result, while area B represents that local welfare of both markets decreases simultaneously, which induces Pareto-deteriorating result. Area C and D indicate the welfare trade-off. Area C represents the case that the welfare gain in one market dominates the welfare loss in other market and thus global welfare increases. Area D represents the reversed case and thus global welfare decreases.

Now, we can propose the following sufficient conditions:

**Proposition 3.11** *Globalization enhances the local welfare of market 0 if  $k > 1$  and  $\gamma > 2.067$  approximately.*

It follows from Proposition 3.10. Thus, one of the sufficient conditions that guarantee a welfare gain for market 0 is that the market is less than half the size of its trading partner and the consumer-friendly firm has a technical advantage. Since firm 0 is friendly to global consumers, its output increases. However, a higher output does not guarantee a welfare gain for market 0. If the profits of firm 0 increase after globalization, the market must export, and the consumers are worse off after globalization. a welfare gain for market 1.

**FIGURE 1** Effects of globalization on welfare.



**Proposition 3.12** *Globalization enhances the local welfare of market 1 if  $k > \frac{1}{2}$  or  $\gamma < 4$ .*

It follows from (7). It states that if the for-profit has not a strong technical advantage, market 1 is better off after globalization. Globalization also benefits market 1, regardless of the technical advantage if its market size is no more than approximately four times bigger. As shown, consumers in market 1 are always better off. If the profits of firm 1 increase after globalization, the market must export and then its output increases. Thus, a higher output guarantees a welfare gain for market 1.

**Proposition 3.13** *Globalization enhances world welfare if  $k > 1$ .*

It states that there is no global welfare loss if firm 0 has technical advantage. (area A and C) That is, a global loss would happen only when firm 0 has technical disadvantage. Then, the loss of local welfare in one of the markets may exceed the gains in the other market which would lead to a reduction of global welfare. (area D) This reduction will also happen if the local welfare in each individual market decreases simultaneously. (area B)

## 4 | COMPARISON AND DISCUSSION

### 4.1 | When the consumer-friendly firm only cares about its original consumers

If firm 0 is friendly only to consumers of its original market, it only considers the consumer surplus of the local market  $CS_0(q_0^{(c)}) = \frac{1}{2} \left(\frac{Q}{\gamma+1}\right)^2$ , instead of the global consumer surplus. In that case, the consumer surplus in the local market will be more protected than the other case that the firm considers the global consumer surplus, while the profit of that firm might be reduced because of its less aggressiveness under the local protection. We will examine its welfare results and compare with the results in the previous section.

The objective function of firm 0 becomes:

$$U(q_0) = \pi_0(q_0) + CS_0 \left( q_0^{(c)} \right) \quad (9)$$

The equilibrium outputs and prices before and after globalization are shown in appendix C.

**Proposition 4.1** *When the consumer-friendly firm only cares about its original consumers, globalization benefits consumers in market 0 if and only if  $0 < k < \frac{1}{\gamma + \gamma^2}$ , while it benefits consumers in market 1 regardless of the relative market size and technical advantage.*

This proposition is the same in Proposition 3.6 that consumers in market 1 are always better off, but it requires a stronger condition than Proposition 3.5. As expected, the consumer-friendly firm produces less outputs because of the protection of its original market and the for-profit firm increases outputs to export more: there is an output substitution effect. In particular, we can show that the for-profit firm's original market is the exporter, i.e.,  $\tilde{q}_0 - \tilde{q}_0^{(c)} = - \left( \tilde{q}_1 - \tilde{q}_1^{(c)} \right) = \frac{a(1+\gamma)(-1+k\gamma(1+\gamma))}{4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma))}$ , which is negative if  $k < \frac{1}{\gamma + \gamma^2}$ . Thus, globalization benefits consumers in market 0 only when the for-profit firm has a higher technical advantage than the condition in Proposition 3.5.

**Proposition 4.2** *When the consumer-friendly firm only cares about its original consumers, globalization enhances the local welfare of market 0 regardless of the relative market size and technical advantage, while it enhances the local welfare of market 1 if  $k > \frac{1}{2}$  or  $\gamma < 6$ .*

As shown in Proposition 4.1 and Proposition C.3, the profits and the consumer surplus in market 0 cannot be worsened at the same time, but they cannot either be improved simultaneously. Thus, this proposition represents that the decrease in profits is less significant than the gain in consumer surplus, the welfare of this market increases after globalization, regardless of the relative size of the trading partner and which firm has technical advantage. Thus, if the conditions lead to a reduction of the welfare of market 0, it would be better for this market if firm 0 were friendly only to local consumers.

Further, Proposition 4.2 requires a weaker condition than Proposition 3.12 that the local welfare of market 1 can be better off. As shown, consumers in market 1 are always better off and the consumer-friendly firm is less aggressive. Also, if the for-profit firm increases its output, a higher production guarantees a welfare gain for market 1. Thus, globalization enhances the local welfare of market 1 when the relative market size is no more than approximately six times larger, which is a weaker condition than that in Proposition 3.12.

**Proposition 4.3** *When the consumer-friendly firm only cares about its original consumers, globalization enhances the global welfare regardless of the relative market size and technical advantage.*

This proposition states that the possible loss of welfare in market 1 is always compensated by the gain in market 0. This guarantee, in our setting, that global welfare won't fall after globalization if firm 0 cares only for local consumers. Again, if conditions for a increasing of global welfare in Proposition 3.13 are not satisfied, it would be better for the global market if firm 0 were friendly only to locals.

## 4.2 | When the market is a mixed oligopoly

Before globalization, a consumer-friendly firm in a market 0 becomes a public monopoly which maximizes the local welfare of market 0. However, if there is a rival firm in this market, then it becomes a mixed duopoly, in which a consumer-friendly firm competes with a for-profit firm. In that case, the total outputs and the profitability depends also on the

technical advantage and the relative market size. We will extend this analysis of a localized mixed duopoly model into a globalized mixed oligopoly market and examine the welfare consequences of competition effect.

Although a generalization with  $n_j$  firms in each market is difficult, we can show an example with  $n_0 = 2$  firms in market 0. The demand functions are given by Assumptions A1.1 and A2.1. Consider that firm 0 in market 0 is consumer-friendly and produces an output  $q_{0,0}$ . The for-profit in market 0 produces  $q_{0,1}$  units of the good. The firms in market 0 have identical cost:  $\frac{1}{2}q_{0,j}^2, j \in \{0, 1\}$ .

The profits of the firms in market 0 are denoted as follows: before globalization,  $\pi_{0,j}^B = p_0 q_{0,j} - \frac{1}{2}q_{0,j}^2$  and after globalization,  $\pi_{0,j}^A = p_w q_{0,j} - \frac{1}{2}q_{0,j}^2$ . Before globalization firm 0 in market 0 maximizes  $U^B = \pi_{0,0}^B + CS_0(q_0)$ , where  $q_0 = q_{0,0} + q_{0,1}$ . After globalization it maximizes:  $U^A = \pi_{0,0}^A + CS(Q)$ .

Firm 1 in market 1 maximizes its own profits before and after globalization, as assumed in the previous section. Then, firm 1 in market 1 chooses  $q_1$  to maximize its profits: before globalization,  $\pi_1^B = p_1 q_1 - \frac{1}{2}k q_1^2$  and after globalization,  $\pi_1^A = p_w q_1 - \frac{1}{2}k q_1^2$ .

Figure 2 and Figure 3 compare the mixed duopoly and the mixed oligopoly, and show the effects of globalization on market 0 and 1, respectively.<sup>14</sup>

**Proposition 4.4** *In the case of mixed duopoly in market 0, globalization benefits consumers in the consumer-friendly firm's original market if  $0 < \gamma < 2$  and  $0 < k < \frac{2-\gamma}{2\gamma(1+\gamma)}$ , while it benefits consumers in market 1 regardless of the relative market size and technical advantage.*

**Proposition 4.5** *In the case of mixed duopoly in market 0, globalization enhances the local welfare of market 0 either (i) if  $k > \frac{1}{8}(4 + \sqrt{70}) \approx 1.54583$  and  $\gamma > 1$  or (ii) if  $k > 1$  and  $\gamma > \frac{7}{3}$ , while it enhances the local welfare of market 1 if  $0 < \gamma < 3$  or if  $k > 0.25$ .*

It implies that the more trading partners in market 0, for the consumers of market 0 to be better off after globalization, it is required the less market 1's size than twice market 0's size and the more technical advantage by market 1's firm. This is because more competition induces the consumer-friendly firm to reduce its production more in the market 0 after globalization, even though it will increase its total production in the global market.<sup>15</sup> Hence, due to this output substitution effect between the consumer-friendly firm and the for-profit firms, it requires certain conditions, but it is a weaker than Proposition 3.5. Figure 2 also shows that market 0's welfare improvement happens with large values of  $\gamma$  and  $k$ , that is, if market 0 is very small and firms in the market 0 have a higher technical advantage.

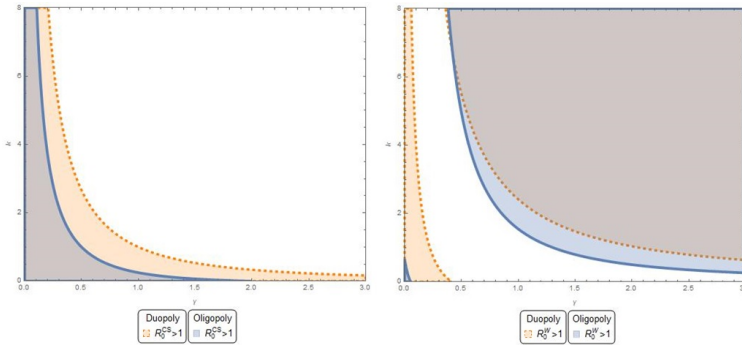
Similarly to the global duopoly case in Proposition 3.6, consumers in the market 1 are better off after globalization, regardless of the relative size of the trading partner and technical advantage, which is shown in Figure 3. However, the welfare increases after globalization as well, if the market 1's size is less than three times market 0's size and the firm in market 1 has not a sufficiently larger technical advantage, which is weaker condition than Proposition 3.6.

Finally, Figure 4 show the effects of globalization on global welfare. The global welfare increase in the oligopoly case with a less restrictive value of  $k$  compared to the duopoly case. That is, it is sufficient that the firm in the market 1 does not have a higher technical advantage, which is also weaker condition than Proposition 3.7. Hence, global welfare might fall only when firms in market 0 are in technical disadvantage; however, that is not a sufficient condition.

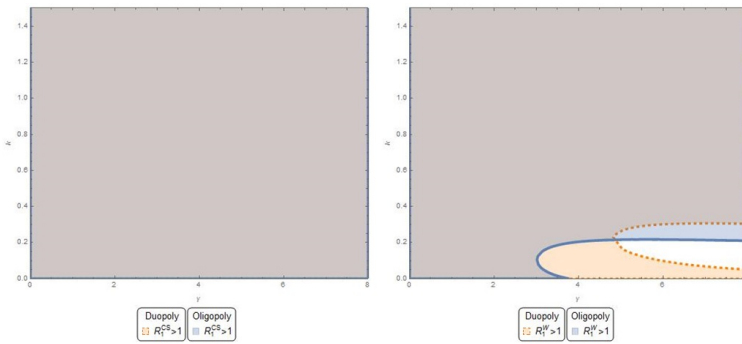
<sup>14</sup>The equilibrium results before and after globalization, and the corresponding ratios are shown in Appendix D.

<sup>15</sup>Before globalization, the competition between a for-profit firm in the original market does not change the output of a consumer-friendly firm. Thus, there is no output substitution effect between the consumer-friendly firm and the for-profit firms before globalization. This result contrasts with the result in a mixed duopoly where a welfare-maximizing public firm competes with a for-profit firm in the same market. In that case, public firm cares not only consumer surplus and its profit but also its rival firm's profit. Thus, less production by the public firm reduces its production cost and thus raises industry profits even though decreasing total outputs induce a loss of consumer surplus. Thus, the welfare results depend on the output substitution effect and cost-saving effect between the two firms. (See Matsumura (1998) and Lee and Hwang (2003)). However, in our setting it is not applied before globalization, but it can be applied after globalization.

**FIGURE 2** Effects of globalization on market 0: Mixed Oligopoly Example



**FIGURE 3** Effects of globalization on market 1: Mixed Oligopoly Example



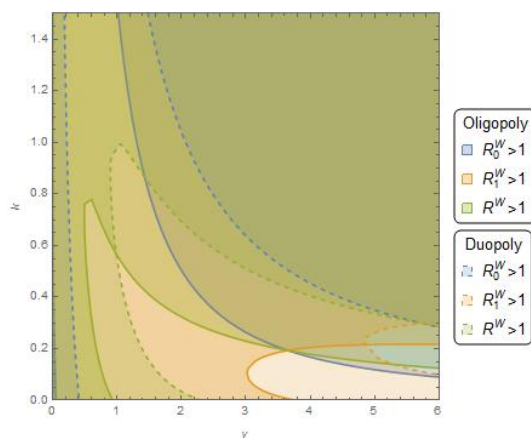
**Proposition 4.6** *In the case of mixed duopoly in market 0, globalization enhances global welfare if  $k > \frac{9}{10}$ .*

## 5 | CONCLUSION

We have studied the effects of uniting two separated markets, each monopolized by a producer, into a single globalized duopoly market. We consider one of firms is a consumer-friendly firm and examine the effect that technical advantage and the relative markets size have on price, output, profits, consumer surplus and welfare ratios before and after globalization. These ratios help us determine whether or not globalization is good or not for firm, consumers and the markets in general.

Our results suggest that despite the existence of a consumer-friendly firm, some of the consumers may be worse after globalization. Specifically, consumers in the market which the consumer-friendly firm is from may have their surplus reduced under certain conditions. It happens when the for-profit firm does not have sufficient technical advantage or it has a relative larger market size of its original market. But, due to the existence of a consumer-friendly firm, consumers in the market of the for-profit firm are always better off after globalization than before.

Accordingly, under certain conditions of costs and relative market size, the welfare of one market or the other can be reduced, even that of both simultaneously. If these conditions were met it would be better, in a globalizing context,

**FIGURE 4** Effects of globalization on welfare: Mixed Oligopoly Example

that the socially responsible company was friendly only with the consumers of its original market and not with those of the global market.

Although we have adopted the simplest formulation of a two-markets with only one firm each, it would be interesting to study a multi-market model or markets with more than one firms in each market. It would be also necessary to consider multiple for-profit and consumer-friendly firms. Further, we can consider how much weight consumer-friendly firms place on consumer surplus. It remains for future research.

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## A | EQUILIBRIUM RESULTS

Before globalization

$$\bar{q}_0 = \frac{a}{2}, \quad \bar{p}_0 = \frac{a}{2}, \quad \text{and} \quad \bar{q}_1 = \frac{a\gamma}{2+k\gamma}, \quad \bar{p}_1 = \frac{a(1+k\gamma)}{2+k\gamma} \quad (10)$$

After globalization

$$\tilde{q}_0 = \frac{a(1+\gamma)}{2+\gamma}, \quad \tilde{q}_1 = \frac{a(1+\gamma)^2}{(2+\gamma)(2+k(1+\gamma))}, \quad \tilde{p}_w = \frac{a(1+\gamma)(1+k(1+\gamma))}{(2+\gamma)(2+k(1+\gamma))} \quad (11)$$

## B | PROOFS OF PROPOSITIONS.

We find conditions under which the ratios are larger or smaller than 1. A ratio larger than 1 indicates that the variable increases after globalization, if it is equal to 1 it remains the same, otherwise it decreases.

**Proof of Proposition 3.1**

$$R_0^p = \frac{2(1+\gamma)(1+k(1+\gamma))}{(2+\gamma)(2+k(1+\gamma))} \quad (12)$$

$0 < k < \frac{2}{\gamma+\gamma^2}$  then  $R_0^p < 1$ . If  $k = \frac{2}{\gamma+\gamma^2}$  then  $R_0^p = 1$ . Otherwise,  $R_0^p > 1$ .

**Proof of Proposition 3.2**

$$R_1^p = \frac{(2+k\gamma)(1+\gamma)(1+k(1+\gamma))}{(1+k\gamma)(2+\gamma)(2+k(1+\gamma))} \quad (13)$$

For any  $k > 0$  and  $\gamma > 0$ ,  $R_1^p < 1$ .

**Proof of Proposition 3.3**

$$R^Q = \frac{2(\gamma+1)(\gamma k+2)(\gamma+\gamma k+k+3)}{2+\gamma} \quad \text{and} \quad R_0^g = \frac{2(1+\gamma)}{2+\gamma} \quad (14)$$



For any  $k > 0$  and  $\gamma > 0$ , we have  $R_0^q > 1$  and  $R^Q > 1$ .

**Proof of Proposition 3.4**

$$R_1^q = \frac{(1 + \gamma)^2(2 + k\gamma)}{\gamma(2 + \gamma)(2 + k(1 + \gamma))} \quad (15)$$

If  $k < \frac{2}{\gamma + \gamma^2}$  then  $R_1^q > 1$ . If  $k = \frac{2}{\gamma + \gamma^2}$  then  $R_1^q = 1$ . Otherwise,  $R_1^q < 1$ .

**Proof of Proposition 3.5**

$$R_0^{cs} = \left(R_0^{q(c)}\right)^2 = \left(\frac{2(2 + (1 + k)(1 + \gamma))}{(2 + \gamma)(2 + k(1 + \gamma))}\right)^2 \quad (16)$$

If  $0 < k < \frac{2}{\gamma + \gamma^2}$ , then  $R_0^{cs} > 1$ . If  $k = \frac{2}{\gamma + \gamma^2}$ , then  $R_0^{cs} = 1$ .  $R_0^{cs} < 1$  elsewhere.

**Proof of Proposition 3.6**

$$R_1^{cs} = \left(R_1^{q(c)}\right)^2 = \left(\frac{(2 + k\gamma)(2 + (1 + k)(1 + \gamma))}{(2 + \gamma)(2 + k(1 + \gamma))}\right)^2 \quad (17)$$

For any  $k > 0$  and  $\gamma > 0$  we have  $R_1^{cs} > 1$ .

**Proof of Proposition 3.7**

$$R_0^\pi = \frac{4k(1 + \gamma)^3}{(2 + \gamma)^2(2 + k(1 + \gamma))} \quad (18)$$

If  $0 < k < \frac{2(2 + \gamma)^2}{\gamma(1 + \gamma)(4 + 3\gamma)}$ , then  $R_0^\pi < 1$ . Otherwise,  $R_0^\pi \geq 1$ .

**Proof of Proposition 3.8**

$$R_1^\pi = \frac{(2 + k\gamma)(1 + \gamma)^3}{\gamma(2 + \gamma)^2(2 + k(1 + \gamma))} \quad (19)$$

If  $0 < \gamma \leq \frac{1}{2}(-1 + \sqrt{5})$  and  $k > \frac{2(1 - \gamma - \gamma^2)}{\gamma(1 + \gamma)(3 + 2\gamma)}$ , or if  $\gamma > \frac{1}{2}(-1 + \sqrt{5})$  and  $k > 0$  then  $R_1^\pi < 1$ . Otherwise,  $R_1^\pi \geq 1$ .

**Proof of Proposition 3.10**

$$R_0^W = \frac{2\left((3 + \gamma)^2 + k^2(1 + \gamma)^2(2 + \gamma(2 + \gamma)) + 2k(1 + \gamma)(4 + \gamma(3 + \gamma))\right)}{(2 + \gamma)^2(2 + k(1 + \gamma))^2} \quad (20)$$

$R_0^W > 1$  either (i) if  $k > \frac{\sqrt{2}}{\gamma} + \frac{2}{\gamma(1 + \gamma)}$  or (ii) if  $0 < \gamma < -1 + \sqrt{2}$  and  $0 < k < -\frac{\sqrt{2}}{\gamma} + \frac{2}{\gamma(1 + \gamma)}$ . Otherwise,  $R_0^W \leq 1$

## C | WHEN FIRM 0 ONLY CARES ABOUT THE CONSUMERS OF ITS ORIGINAL MARKET.

Equilibrium output and price after globalization

$$\begin{aligned}\bar{q}_0 &= \frac{a(1+\gamma)(2+k+\gamma+2k\gamma+k\gamma^2)}{4+2k+7\gamma+6k\gamma+2\gamma^2+5k\gamma^2+k\gamma^3}, & \bar{q}_1 &= \frac{a(1+\gamma)(1+3\gamma+\gamma^2)}{4+2k+7\gamma+6k\gamma+2\gamma^2+5k\gamma^2+k\gamma^3}, \\ \bar{p}_w &= \frac{a(1+k+k\gamma)(1+3\gamma+\gamma^2)}{4+7\gamma+2\gamma^2+k(2+6\gamma+5\gamma^2+\gamma^3)}\end{aligned}\quad (21)$$

Price ratios

$$R_0^p = \frac{2(1+k+k\gamma)(1+\gamma(3+\gamma))}{4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma))}\quad (22)$$

If  $0 < k < \frac{1}{\gamma+\gamma^2}$  then  $R_0^p < 1$ . If  $k = \frac{1}{\gamma+\gamma^2}$  then  $R_0^p = 1$ . Otherwise,  $R_0^p > 1$ .

$$R_1^p = \frac{(2+k\gamma)(1+k+k\gamma)(1+\gamma(3+\gamma))}{(1+k\gamma)(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))}\quad (23)$$

For any  $k > 0$  and  $\gamma > 0$ ,  $R_1^p < 1$ .

Output ratios

$$R_0^q = \frac{2(1+\gamma)(2+\gamma+k(1+\gamma)^2)}{4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma))}\quad (24)$$

If  $0 < k < \frac{1}{\gamma+\gamma^2}$  then  $R_0^q < 1$ . If  $k = \frac{1}{\gamma+\gamma^2}$  then  $R_0^q = 1$ . Otherwise,  $R_0^q > 1$ .

$$R_1^q = \frac{(1+\gamma)(2+k\gamma)(1+\gamma(3+\gamma))}{\gamma(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))}\quad (25)$$

If  $k > \frac{2+4\gamma+\gamma^2}{\gamma(1+\gamma)^2}$  then  $R_1^q < 1$ . If  $k = \frac{2+4\gamma+\gamma^2}{\gamma(1+\gamma)^2}$  then  $R_1^q = 1$ . Otherwise,  $R_1^q > 1$ .

$$R^Q = \frac{2(1+\gamma)^2(2+k\gamma)(3+k+\gamma+k\gamma)}{(2+(2+k)\gamma)(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))}\quad (26)$$

Total production increases if market 0 is the smallest or the same size as market 1. However, if it is very large compared to market 1 and the consumer-friendly firm is at a lot of disadvantage, total production decreases after globalization.

Effects on consumer surplus

**Proposition C.1** Globalization benefits consumers of consumer-friendly firm's original market if and only if  $0 < k < \frac{1}{\gamma+\gamma^2}$ .

$$R_0^{cs} = \frac{4(1+\gamma)^2(3+k+\gamma+k\gamma)^2}{(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))^2} \quad (27)$$

If  $0 < k < \frac{1}{\gamma+\gamma^2}$ , then  $R_0^{cs} > 1$ . If  $k = \frac{1}{\gamma+\gamma^2}$ , then  $R_0^{cs} = 1$ .  $R_0^{cs} < 1$  elsewhere.

**Proposition C.2** Consumers in market 1 are better off after globalization, regardless of the relative size of the trading partner and which firm has technical advantage.

$$R_1^{cs} = \frac{(1+\gamma)^2(2+k\gamma)^2(3+k+\gamma+k\gamma)^2}{(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))^2} \quad (28)$$

$R_1^{cs} > 1$  for all  $k > 0$  and  $\gamma > 0$

Effects on profits

**Proposition C.3** Globalization benefits the consumer-friendly firm if and only if  $k > \frac{1}{\gamma+\gamma^2}$

$$R_0^\pi = \frac{4(1+\gamma)(2+\gamma+k(1+\gamma)^2)(\gamma(3+\gamma)+k(1+\gamma)(1+\gamma(4+\gamma)))}{(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))^2} \quad (29)$$

**Proposition C.4** Globalization benefits the for-profit firm if and only if  $0 < k < k^\pi$ , where  $k^\pi = \frac{1-\gamma-6\gamma^2-2\gamma^3}{\gamma(3+10\gamma+9\gamma^2+2\gamma^3)} +$

$$\sqrt{\frac{(1+3\gamma+\gamma^2)^2(1+5\gamma+10\gamma^2+4\gamma^3)}{\gamma^2(1+\gamma)^3(3+7\gamma+2\gamma^2)^2}}.$$

$$R_1^\pi = \frac{(1+\gamma)(2+k\gamma)(2+k+k\gamma)(1+\gamma(3+\gamma))^2}{\gamma(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))^2} \quad (30)$$

Effects on market's welfare and global welfare

**Proposition C.5** Globalization enhances market 0's welfare, regardless of the relative size of the trading partner and which firm has technical advantage.

$$R_0^W = \frac{2(1+\gamma)\left((3+\gamma)(3+2\gamma(3+\gamma))+k^2(1+\gamma)^3(2+\gamma(4+\gamma))+2k(1+\gamma)(2+\gamma)(2+\gamma(4+\gamma))\right)}{(4+\gamma(7+2\gamma)+k(1+\gamma)(2+\gamma(4+\gamma)))^2} \quad (31)$$

$R_0^W > 1$  for any  $k > 0$  and  $\gamma > 0$ .

**Proposition C.6** If  $k > \frac{1}{2}$  or  $\gamma < 6$  then globalization enhances the welfare of the for-profit firm's original market.

$$R_1^W = \frac{(1+\gamma)(2+k\gamma)^2 \left( 2+k^2\gamma(1+\gamma)^3 + \gamma(1+\gamma)(3+\gamma)(7+3\gamma) + k(1+\gamma)(1+\gamma(1+\gamma)(3+\gamma)(4+\gamma)) \right)}{\gamma(3+k\gamma)(4+\gamma(7+2\gamma)) + k(1+\gamma)(2+\gamma(4+\gamma))^2} \quad (32)$$

$R_1^W > 1$  if  $k > \frac{1}{2}$  or  $\gamma < 6$ .

**Proposition C.7** *Globalization enhances world welfare, regardless of the relative size of the markets and which firm has technical advantage.*

$$R^W = \frac{2(1+\gamma)^2(2+k\gamma)^2 \left( 11+k^2(1+\gamma)^2(2+\gamma(5+\gamma)) + \gamma(31+3\gamma(6+\gamma)) + k(9+\gamma(32+\gamma(31+\gamma(10+\gamma)))) \right)}{(4+\gamma(7+2\gamma)) + k(1+\gamma)(2+\gamma(4+\gamma))^2(4+\gamma(6+k(4+(2+k)\gamma)))} \quad (33)$$

$R^W > 1$  for any  $k > 0$  and  $\gamma > 0$ .

## D | MIXED OLIGOPOLY CASE

*Equilibrium before globalization*

$$\bar{q}_{0,0} = \frac{a}{2}, \quad \bar{q}_{0,1} = \frac{a}{6}, \quad \bar{p}_0 = \frac{a}{3} \quad \text{and} \quad \bar{q}_1 = \frac{a\gamma}{2+k\gamma}, \quad \bar{p}_1 = \frac{a(\gamma k+1)}{\gamma k+2}$$

*Equilibrium after globalization*

$$\bar{q}_{0,0} = \frac{a(1+\gamma)}{2+\gamma}, \quad \bar{q}_{0,1} = \frac{a(1+\gamma)^2(1+k+k\gamma)}{(2+\gamma)(5+3k+2\gamma+4k\gamma+k\gamma^2)},$$

$$\bar{q}_1 = \frac{a(1+\gamma)^2}{5+3k+2\gamma+4k\gamma+k\gamma^2}, \quad \bar{p}_w = \frac{a(\gamma+1)(\gamma k+k+1)}{2\gamma+(\gamma+1)(\gamma+3)k+5}$$

*Ratios*

$$R_0^p = \frac{3(1+\gamma)(1+k+k\gamma)}{5+2\gamma+k(1+\gamma)(3+\gamma)}, \quad R_1^p = \frac{(1+\gamma)(2+k\gamma)(1+k+k\gamma)}{(1+k\gamma)(5+2\gamma+k(1+\gamma)(3+\gamma))} \quad (34)$$

$$R_0^{q^{(c)}} = \frac{3(4+\gamma+2k(1+\gamma))}{2(5+2\gamma+k(1+\gamma)(3+\gamma))}, \quad R_1^{q^{(c)}} = \frac{(2+k\gamma)(4+\gamma+2k(1+\gamma))}{5+2\gamma+k(1+\gamma)(3+\gamma)} \quad (35)$$

$$R_{0,0}^q = \frac{2(1+\gamma)}{2+\gamma}, \quad R_{0,1}^q = \frac{6(1+\gamma)^2(1+k+k\gamma)}{(2+\gamma)(5+2\gamma+k(1+\gamma)(3+\gamma))}, \quad R_1^q = \frac{(1+\gamma)^2(2+k\gamma)}{\gamma(5+2\gamma+k(1+\gamma)(3+\gamma))} \quad (36)$$

$$R_0^{CS} = \frac{9(4 + \gamma + 2k(1 + \gamma))^2}{4(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2}, \quad R_1^{CS} = \frac{(2 + k\gamma)^2(4 + \gamma + 2k(1 + \gamma))^2}{(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2} \quad (37)$$

$$R_{0,0}^\pi = \frac{12(1 + \gamma)^2(-1 + k(1 + \gamma)^2)}{(2 + \gamma)^2(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))}, \quad R_{0,1}^\pi = \frac{12(1 + \gamma)^3(3 + \gamma)(1 + k + k\gamma)^2}{(2 + \gamma)^2(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2} \quad (38)$$

$$R_1^\pi = \frac{(1 + \gamma)^3(2 + k\gamma)(2 + k + k\gamma)}{\gamma(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2}$$

$$R_0^W = 18 \frac{\left( \begin{aligned} &62 + 94\gamma + 55\gamma^2 + 16\gamma^3 + 2\gamma^4 + 2k^2(1 + \gamma)^2(11 + 18\gamma + 14\gamma^2 + 6\gamma^3 + \gamma^4) \\ &+ 2k(36 + 91\gamma + 91\gamma^2 + 49\gamma^3 + 15\gamma^4 + 2\gamma^5) \end{aligned} \right)}{11(2 + \gamma)^2(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2} \quad (39)$$

$$R_1^W = \frac{(2 + k\gamma)^2(2 + 4k^2\gamma(1 + \gamma)^2 + \gamma(22 + \gamma(14 + 3\gamma)) + k(1 + \gamma)(1 + \gamma(19 + \gamma(7 + \gamma))))}{\gamma(3 + k\gamma)(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2} \quad (40)$$

$$R^W = 18(1 + \gamma)(2 + k\gamma)^2 \frac{\left( \begin{aligned} &(7 + \gamma(5 + \gamma))(10 + \gamma(10 + 3\gamma)) + 2k^2(1 + \gamma)^2(11 + \gamma(15 + \gamma(7 + \gamma))) \\ &+ k(1 + \gamma)(76 + \gamma(114 + \gamma(63 + \gamma(14 + \gamma)))) \end{aligned} \right)}{(2 + \gamma)^2(5 + 2\gamma + k(1 + \gamma)(3 + \gamma))^2(44 + \gamma(54 + k(44 + (18 + 11k)\gamma)))} \quad (41)$$