**North-South parallel import, trade liberalization and optimal taxation***

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*Abstract*

Building upon an international model of vertical product differentiation, this paper investigates the impact of *daigou* --- the parallel import of 'green and safe' products from a developed country (North) into a developing county (South) --- on South's incentive to liberalize trade with North, North's optimal taxation policy and welfare of the two countries. It finds that parameterizations exist in which *daigou* improves the profitability of Northern producers, enhances Northern welfare but lowers Southern welfare. South can, in this case, set a positive tariff rate on imports from North to contain, at least partially, the negative consequences of *daigou*; meanwhile it is not always optimal for North to impose a tax on *daigou* activities. Findings suggest that policy makers of both North and South should carefully assess the significance of North-to-South parallel import activities in the process of trade negotiation, an issue that has been overlooked in the economics literature.

*Key words: Daigou*; North-South parallel import; product differentiation; quality; welfare.

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# 1. INTRODUCTION

Parallel import activities in which individual traders purchase 'green and safe' products from a developed country (North) and sell them in a developing country (South) for a significant price markup, referred to in the media as *daigou*, have recently become a popular economic phenomenon in many countries. *Daigou* effectively connects the demand for high quality products by consumers in South---following the notable improvement in income and living standard of developing countries---with Northern supply of those products.[1] While serving as an alternative, substitutable channel, to official export, *daigou* has become a hotly debated issue in countries and territories that source products vulnerable to parallel import such as Australia, Canada, Hong Kong, Japan, New Zealand and the United States, for that it has resulted in product shortage, and thus market distortion, in many cases.[2] In Australia in 2016, for example, the local media reported that there were some 40,000 *daigou* traders whose daily activities are to empty shelves of vitamin and baby formula products at local supermarkets and/or pharmacies and ship them directly to customers in China.[3] Similar phenomena have also been observed in Hong Kong where parallel import of baby formula from Hong Kong to the mainland China were estimated to take up 6 to 10 per cent of the China's milk formula market, with about 7 billion yuan sales annually.[4]

Despite the growing roles played by *daigou* as somewhat a new form of international trade in the global economy, little has been known with regard to how it impacts the profitability of producers of the concerned products as well as consumer welfare of participating countries. On the one hand, such type parallel import helps to promote sales/revenue for the respective producers.[5] On the other hand, as goods are transported from North to South via the parallel import channel, Northern producers cannot extract the full rents from Southern consumers because such rents must be

[1] In this paper, *daigou* and parallel import are used interchangeably.
[2] See http://www.scmp.com/news/hong-kong/article/1246777/can-restricting-exports-milk-formula-prove-best-hong-kongs-babies.
[3] See http://www.smh.com.au/business/consumer-affairs/daigou-the-extra-50-million-customers-hiding-in-plain-sight-20160609-gpf8hf.html.
[4] See http://www.scmp.com/news/hong-kong/article/1246777/can-restricting-exports-milk-formula-prove-best-hong-kongs-babies.
[5] See the following article in which Peter Nathan, the Chief Executive of A2 Milk, the infant formula producer in New Zealand and Australia indicated that *daigou* is good for their business: http://www.theaustralian.com.au/news/latest-news/chinas-taste-for-aust-goods-feeds-biz/news-story/19b47c07e821531dd2213f55f0d3e986.

shared between them and *daigou* traders, who often have a good network of genuine customers in South, a market segment which may be too costly for Northern producers to capture directly. Apparently, consumer welfare in both North and South are affected by *daigou*. In this context, genuine (and timely) research questions arise that deserve the attention: (i) How does North-to-South parallel import (*daigou*) affect the profitability of the producer in North as well as social welfare of both countries?, (ii) Should *daigou* be taxed in North and, if so, what is the optimal tax rate should North impose on *daigou*?, and (iii) How does *daigou* impact South's incentive towards trade liberalization with North?.

This paper attempts to provide answers to above research questions which seem to be important not just from a research standpoint but also a practical standpoint. To this end, we develop an international model of vertical product differentiation that allows for the coexistence of *daigou* and the official export channel. In our consideration, a Northern firm produces a uniquely 'green and safe' (i.e. high quality) product to serve consumers in both North and South. While the product is sold directly to Northern consumers by the Northern firm by ways of local sales, it can reach Southern consumers either directly through a distributor who works for the Northern firm or indirectly through a representative *daigou* trader.[6] We attempt to capture the reality as close as possible so that we explore the framework where not only the product quality but also the heterogeneity among consumers play an important role. While allowing arbitrage activities to maintain equilibrium in prices across countries (in our benchmark model, see Section 3), we will introduce different tax/tariff rates to different sales channels: a North per-unit tax rate on domestic sales, a North per-unit tax rate on *daigou* and a specific North-South tariff rate on official export.

We find that parameterizations exist in which *daigou* improves the profitability of the Northern producer, enhances Northern welfare but lowers Southern welfare. South can, in this case, adjust the tariff rate on official export to minimize, and even benefit from, the negative consequences of parallel import; the optimal tariff for South is found to be strictly positive and increases in South's market size. As for North, it might, but not always, be optimal to impose a positive tax on *daigou*. Findings suggest that policy makers of both North and South should carefully assess

[6] Producers of many products in developed countries that are subjective of parallel trade often export directly to developing countries but incur significant set up cost and tariffs.

the significance of *daigou* in the process of trade negotiation. Policy makers of North should also consider a *daigou* tax to maximize Northern welfare. These are the issues that have been overlooked in the economics literature.

The fact that there has been a limited number of papers on parallel import from North into South stands in sharp contrast to a vast literature considering the opposite parallel import direction where products are exported from South into North --- a typical example of which is pharmaceuticals as largely discussed in the European countries (Kyle, 2010; Saggi, 2012; Stadhler et al. 2014). As pointed out by Maskus (2001), parallel import from developing countries into developed countries usually intensifies competition, hurts producers, changes market structures and adversely impacts social welfare of many related countries (see also Malueg and Schwartz, 1994; Abbott, 1998; Scherer and Watal 2001). Matteucci and Riverberi (2014) and Hwang et al. (2014) extend such earlier framework to allow for the role played by product quality and arrive at similar conclusions. However, Matteucci and Riverberi and Hwang et al. only consider the case in which consumers are homogeneous in their perceptions or valuations for the product. In reality, consumers are, heterogenous by nature and hence, a vertical product differentiation approach of Mussa and Rosen (1978) would be a suitable candidate model to analyze parallel import.

To the best of our knowledge, Saggi (2012), Nguyen et al. (2016) and Szymanski and Valletti (2005) have been the only theoretical papers that have studied parallel import using the approach of vertical product differentiation. Although related, the paper by Saggi (2012) has a different scope from what the current paper attempts to investigate. In particular, Saggi focuses on the impact of intellectual property rights protection regimes in North and South on Northern firms' choice to export to South when there is a potential entry thread in South by imitated firms. In contrast, we focus on implications of North-to-South parallel import by arbitragers on optimal tariff in South and optimal *daigou* taxation in North. Nguyen et al. (2016) and Szymanski and Valletti (2005), meanwhile, both consider a monopoly framework with two segmented (international) markets in a free trade world to study parallel import by cross-border travellers and cannibalization, respectively, which are not what examined in the current paper.

In addition to product quality, the relative market size (of South versus North) plays an important role in our model. This is relevant with reality, especially given the rise of the Asian middle class population who, with higher income and more savings,

increasingly demand to substitute their daily needs by famous 'green and safe' products from developed countries.[7] More specifically, our results are built surrounding the product quality and market size, both of which are currently richly studied topics in the international trade literature and also the policy front.

In the next section, we present the basic structure of the model. Section 3 shows, in a monopoly setting, equilibrium outcomes in cases without and with *daigou*, respectively, and highlights the key results of the paper. Section 4 outlines results when the model is extended to the case of imperfect competition associated with *daigou* and the case of oligopolistic competition in South. Discussions of our results and policy recommendations are provided in Section 5.

## 2. THE MODEL

We develop an international model of vertical product differentiation to study the economic consequences of North-to-South parallel import on 'green and safe' products based on the framework of Mussa and Rosen (1978). The world consists of two countries: North (country 1) and South (country 2), each of which is populated with numerous consumers for a typical product produced by a Northern firm (firm 1). The producer has access to an advanced technology, which allows it to manufacture the product at a marginal cost $q^2/2$, where $q$ is the level of product quality that is assumed exogenous in our model.[8] In Section 4, we will extend the model to allow for quality competition in South with the inclusion of a local firm who produces a lower quality version of the product. While consumption of the product always occurs in country 1, in line with the parallel import literature, we consider two regimes in country 2: a national exhaustion regime that does not allow North-to-South parallel import, and an international exhaustion regime that allows such import (Maskus, 2001; Saggi, 2012; Matteucci and Riverberi, 2014; Hwang et al., 2014; Nguyen et al. 2016). In the former regime, the producer exports its product directly to the market of country 2 (official, or traditional export) and becomes a monopolist in both markets, whereas in the latter, a representative *daigou* trader buys the product from country 1

[7] See, for instance, the Australian White Paper 2012 which considers the 21st century as the "Asian century" with Asia being predicted to be home to the majority of the world's middle class, the place where most world outputs are produced and consumed.

[8] We abstract away from the technology development process, as that would unnecessarily complicate the model and results.

and competes with firm 1 in country 2. To simplify the analysis, we allow price arbitrage to occur so that *daigou* activities equalize the price across countries.

Consumers in both countries are heterogeneous in our model. Each consumer is endowed with a reservation utility equal to zero and obtains a net benefit equal to $u_i = v_i q - p_i$ if she purchases the product, where the subscript $i$ $(= 1,2)$ denotes the country, $v_{ik}$ is uniformly distributed, $v_1 \in [0,1]$ and $v_2 \in [0, b]$, and $p_i$ is the price of the product she pays for. Parameter $b(> 0)$ captures the relative market size of country 2 versus country 1 in our model: higher $b$ stands for a larger market size of country 2.[9]

Let $t_1$, $t_2$ and $t_3$ denote the per-unit tax rate on the product sold in country 1, the specific tariff rate in country 2 on official import and the per-unit tax on *daigou*, respectively. We consider a two-stage game. In the first stage, given $t_1$, $t_2$ and $t_3$, firm 1 sets the price for both markets ($p_1$ and $p_2$) and in the second stage, the *daigou* trader decides the quantity she wishes to purchase in country 1 for sale in country 2, $d_3$, and consumers make their purchasing decision. The game is solved by backward induction in what follows.

## 3. EQUILIBRIUM CHARACTERIZATIONS

### *3.1. Outcomes under the national exhaustion regime*

Under the national exhaustion regime prevailing in country 2, the producer is the monopolist in both markets of country 1 and country 2. Following the literature, let $v_i^*$ $(i = 1, 2)$ denote the valuation of the marginal consumer in the market of country $i$ who is indifferent between purchasing the product and not purchasing it. We know that $v_i^* q - p_i = 0$ holds, which leads to $v_i^* = p_i/q$ and subsequently the demand for the product in countries 1 and 2, $d_1 = 1 - v_1^* = 1 - p_1/q$ and $d_2 = b - v_2^* = b - p_2/q$ respectively.

In stage 1, firm 1 sets prices $p_1$ and $p_2$ to maximize his combined profit from both countries:

$$\pi_1 = d_1 \left(p_1 - \frac{q^2}{2} - t_1\right) + d_2 \left(p_2 - \frac{q^2}{2} - t_2\right), \quad (1)$$

[9] This utility function, proposed by Mussa and Rosen (1978) has been used largely in the vertical product differentiation literature.

which yields $p_1^* = \frac{q^2}{4} + \frac{q+t_1}{2}$ and $p_2^* = \frac{q^2}{4} + \frac{bq+t_2}{2}$. Equilibrium level of sales in country 1 and country 2 are respectively $d_1^* = \frac{2q-q^2-2t_1}{4q}$ and $d_2^* = \frac{2bq-q^2-2t_2}{4q}$. The condition required for these quantities to be positive are that $2q - q^2 - 2t_1 > 0$ and $2bq - q^2 - 2t_2 > 0$, which we assumed to be satisfied throughout the paper.

**Lemma 1.** Assume $2q - q^2 - 2t_1 > 0$ and $2bq - q^2 - 2t_2 > 0$. The following hold in equilibrium:

(i) $\frac{dp_i^*}{dt_i} > 0$,

(ii) $\frac{dd_i^*}{dt_i} < 0$.

*Proof.* It can be established in equilibrium, based on the above calculations, that $\frac{dp_1^*}{dt_1} = \frac{dp_2^*}{dt_2} = \frac{1}{2} > 0$ and $\frac{dd_1^*}{dt_1} = \frac{dd_2^*}{dt_2} = -\frac{1}{2q} < 0$. ■

Lemma 1 tells us that an increase in the tax/tariff rate in country *i* raises the equilibrium price but decreases the demand for the product therein. An implication of this result is that if the tax/tariff rate in country *i* is high enough, there may be no demand for the product in country *i* at all.

Notice that consumer surplus in country 1 and country 2 are calculated as follows:

$$CS_1 = \int_{v_1^*}^{1} (v_i q - p_1) dv_i = \frac{q}{2}\left(1 - \frac{p_1^2}{q^2}\right) - p_1\left(1 - \frac{p_1}{q}\right), \quad (2)$$

$$CS_2 = \int_{v_2^*}^{b} (v_i q - p_2) dv_i = \frac{q}{2}\left(b^2 - \frac{p_2^2}{q^2}\right) - p_2\left(1 - \frac{p_2}{q}\right), \quad (3)$$

and social welfare, consisting of any profit, consumer surplus and tariff/tax revenue, for the two countries are given by:

$W_1 = \pi_1 + CS_1 + t_1 d_1$,

$W_2 = CS_2 + t_2 d_2$.

Accordingly, the equilibrium levels of profit of firm 1, $\pi_1^*$, consumer surplus of country $i$ in equilibrium, $CS_i^*$, social welfare of country $i$, $W_i^*$, as well as the equilibrium level of the aggregated social welfare of countries 1 and 2, $WW^*$ (which is the sum of $W_1^*$ and $W_2^*$) can easily be computed. Their properties are recorded in Proposition 1.

**Proposition 1.** Assume $2q - q^2 - 2t_1 > 0$ and $2bq - q^2 - 2t_2 > 0$. The following hold in equilibrium:

(i) $\frac{\partial \pi_1^*}{\partial t_1} < 0, \frac{\partial \pi_1^*}{\partial t_2} < 0,$

(ii) $\frac{\partial CS_1^*}{\partial t_1} < 0, \frac{\partial CS_1^*}{\partial t_2} = 0,$

(iii) $\frac{\partial CS_2^*}{\partial t_1} = 0, \frac{\partial CS_2^*}{\partial t_2} < 0,$

(iv) $\frac{\partial W_1^*}{\partial t_1} < 0, \frac{\partial W_1^*}{\partial t_2} < 0,$

(v) $\frac{\partial W_2^*}{\partial t_1} = 0, \frac{\partial W_2^*}{\partial t_2} > (=, <) 0 \leftrightarrow b > (=, <) \bar{b}_1,$

(vi) $\frac{\partial WW^*}{\partial t_1} < 0, \frac{\partial WW^*}{\partial t_2} < 0.$

*Proof.* It can be established that $\frac{\partial \pi_1^*}{\partial t_1} = \frac{q^2 - 2q + 2t_1}{4q} < 0$; $\frac{\partial \pi_1^*}{\partial t_2} = \frac{q^2 - 2bq + 2t_2}{4q} < 0$; $\frac{\partial CS_1^*}{\partial t_1} = \frac{q^2 - 2q + 2t_1}{8q} < 0$; $\frac{\partial CS_2^*}{\partial t_2} = \frac{q^2 - 2bq + 2t_2}{8q} < 0$. Furthermore, $\frac{\partial W_1^*}{\partial t_1} = \frac{q^2 - 2q - 2t_1}{8q} < 0$; $\frac{\partial W_1^*}{\partial t_2} = \frac{q^2 - 2bq + 2t_2}{4q} < 0$; $\frac{\partial W_2^*}{\partial t_1} = 0$; $\frac{\partial W_2^*}{\partial t_2} = -\frac{q^2 - 2bq + 6t_2}{8q} > (=, <) 0 \leftrightarrow b > (=, <) \frac{q^2 + 6t_2}{2b} \equiv \bar{b}_1$; $\frac{\partial WW*}{\partial t_1} = \frac{q^2 - 2q - 2t_1}{8q} < 0$; and $\frac{\partial WW*}{\partial t_2} = \frac{q^2 - 2bq - 2t_2}{8q} < 0$. ■

Proposition 1(i) tells us that an increase in the tax rate in country 1 or the tariff rate in country 2 hurts firm 1, which is a straightforward result due to the fact that firm 1's profit declines following an increase in its effective marginal cost (that is, the sum of marginal cost and tax/tariff rate, if any). Likewise, consumers in country *i* generally lose if the tax/tariff rate in that country becomes higher because of the extra cost they would need to incur by purchasing the product as Proposition 1(ii) and (iii) tell us. The interesting results of Propotition1 are those presented in part (iv)-(vi) regarding the welfare implications of a change in the tax/tariff rate. Specifically, an increase in $t_1$ comes at the net social expense for country 1; in particular, the extra tax revenue is not enough to offset the reduction in consumer surplus and firm 1's profit. The situation is, however, different for country 2 because the value of $b$, the relative market size of South versus North, plays an important role in driving the welfare change in this country. When the market size of country 2 is large, tariff revenue has larger influence on the welfare of country 2 so that an increase in the tariff rate $t_2$ brings about an improvement for South's welfare despite a fall in consumer surplus.

At the aggregate level, the combined level of welfare of country 1 and country 2 always decreases for any rise in either $t_1$ or $t_2$. This reaffirms the popular views in

the international trade literature that free trade brings about some net social benefits for the world as a whole.

Results of Proposition 1 (iii) imply that an optimal tariff is possible from country 2's perspective. It should also be noted that country 2 may adjust the level of the tariff rate $t_2$ in such a way that it can influence country 1's welfare in this context, whereas country 1 does not have the similar trade tool against country 2 (observe that a change in $t_1$ does not affect country 2's welfare).

**Proposition 2.** Assume $2q - q^2 - 2t_1 > 0$ and $2bq - q^2 - 2t_2 > 0$. There optimal tariff rate that maximizes country 2's welfare, $t_2^*$, is strictly positive. Furthermore, $\frac{\partial t_2^*}{\partial b} > 0$ and $\frac{\partial t_2^*}{\partial q} > (=,<)0 \leftrightarrow q < (=,>)b$ hold.

*Proof.* The optimal tariff rate $t_2^*$ can be found by solving $\frac{\partial W_2^*}{\partial t_2} = -\frac{q^2-2bq+6t_2}{8q} = 0 \rightarrow t_2^* = \frac{2bq-q^2}{6}$. Then, $\frac{\partial t_2^*}{\partial b} = \frac{q}{3} > 0$ and $\frac{\partial t_2^*}{\partial q} = \frac{b-q}{3} > (=,<)0 \leftrightarrow q < (=,>)b$. ■

When the tariff rate imposed by country 2 increases, the producer in country 1 raises the price it charges consumers in country 2 through the official export channel, resulting in a lower level of demand. Recall that an increase in trade cost between countries 1 and 2 reduces consumer surplus in country 2 but enhances country 2's tariff revenue. As such, that the net effect of an increase in $t_2$ on social welfare of country 2 is not immediately obvious. Proposition 2 tells us that it is socially optimal for country 2 to set a positive tariff rate in this case. Along this line, if the market of country 2 grows in size, it is also beneficial for country 2 to raise the optimal tariff rate further given the dominance of the tariff revenue in welfare.

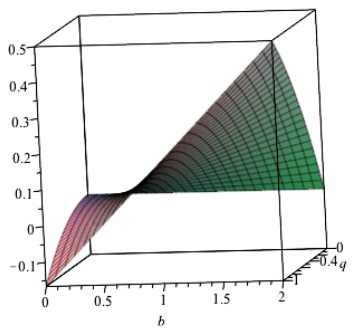


*Figure 1. Country 2's optimal tariff rate, market size and product quality*

As depicted in Figure 1, although the optimal tariff rate for country 2 is increasing in $b$, it is inverted-U in $q$, so that when the level of product quality increases, the optimal tariff rate increases at a faster speed. These findings are relatively new in the literature and will be discussed in detail in Section 5. It should be noted that the (positive) optimal tariff rate from country 2's welfare standpoint is clearly not optimal for country 1's welfare.

*3.2. Outcomes under the international exhaustion regime*

We now consider the game under the international exhaustion regime in country 2, which permits North-South parallel import (*daigou*). Our objective is twofold: to investigate whether the results presented in Section 3.1 would hold in this case and identify conditions such that *daigou* brings about benefit for both the producer and social welfare of North and South.

When *daigou* occurs, although firm 1 is still the only producer of the product serving consumers in both countries, the inclusion of *daigou* creates at least two important effects that were not observed in the case considered in the previous subsection. First, there will be over-demand for the product in country 1, leading to a potentially higher price country 1-consumers have to pay for the product. Second, there will be over-supply of the product in country 2, that might lead to a lower equilibrium price. To make the model not only tractable but also relevant with reality, we examine the case in which the market of country 2 is large enough such that there exist price arbitrage opportunities for the *daigou* trader.[10] We also focus our analysis to the case in which the trade cost of the official export channel is suitably high such that $t_2 > t_1 + t_3$ so that there is an obvious opportunity for *daigou* activities.

In stage 1, firm 1 sets prices $p_1$ and $p_2$ to maximize his combined profit from both countries. Notice first that comparing to the national exhaustion regime, the total demand for the product in country 1 is now given by $d_1 + d_3$, whereas that in country 2 is given by $d_2 + d_3$. Then, the profit of firm 1 becomes:

$$\pi_1 = (d_1 + d_3)\left(p_1 - \frac{q^2}{2} - t_1\right) + d_2\left(p_2 - \frac{q^2}{2} - t_2\right), \quad (4)$$

and the *daigou* trader obtains the following profit:

$$\pi_2 = d_3(p_2 - p_1 - t_3). \quad (5)$$

[10] As will appear, the condition is of the form $b > 1 + \frac{t_1 + 2t_3 - t_2}{q}$ which ensures that $d_3^{**} > 0$.

At stage 2, price arbitrage between country 1 and country 2 leads to $\pi_2 = 0$.[11] Then, (5) implies $p_2 - p_1 - t_3 = 0$. Using this result and solve for stage 1's optimal prices, we obtain $p_1^{**} = \frac{bq+q+q^2+t_1+t_2-2t_3}{4}$ and $p_2^{**} = \frac{bq+q+q^2+t_1+t_2+2t_3}{4}$ and consequently at stage 2 we find that:

$$d_3^{**} = \frac{bq-q-t_1+t_2-2t_3}{2q}. \quad (6)$$

The equilibrium sales levels in country 1 and country 2 are respectively given by $d_1^{**} = \frac{3q-bq-q^2-t_1-t_2+2t_3}{4q}$,

$d_2^{**} = \frac{3bq-q-q^2-t_1-t_2-2t_3}{4q}$.

In what follows, we consider parameterizations such that $d_1^{**} > 0$, $d_2^{**} > 0$ and $d_3^{**} > 0$, which are given by $1 + \frac{t_1-t_2+2t_3}{q} < b < 3 - q - \frac{t_1+t_2+2t_3}{q}$.

**Lemma 2.** Assume $1 + \frac{t_1-t_2+2t_3}{q} < b < 3 - q - \frac{t_1+t_2+2t_3}{q}$. The following hold in equilibrium:

(i) $\frac{dp_1^{**}}{dt_1} = \frac{dp_1^{**}}{dt_2} = \frac{dp_2^{**}}{dt_1} = \frac{dp_2^{**}}{d2} > 0$, $\frac{dp_1^{**}}{dt_3} = -\frac{dp_2^{**}}{dt_3} < 0$,

(ii) $\frac{dd_1^{**}}{dt_1} = \frac{dd_1^{**}}{dt_2} = \frac{dd_2^{**}}{dt_1} = \frac{dd_2^{**}}{dt_2} < 0$, $\frac{dd_1^{**}}{dt_3} = -\frac{dd_2^{**}}{dt_3} > 0$,

(iii) $\frac{dd_3^{**}}{dt_1} = -\frac{dd_3^{**}}{dt_2} = \frac{dd_3^{**}}{dt_3} < 0$.

*Proof.* It can be established that $\frac{dp_1^{**}}{dt_1} = \frac{dp_1^{**}}{dt_2} = \frac{dp_2^{**}}{dt_1} = \frac{dp_2^{**}}{d2} = \frac{1}{4} > 0$; $\frac{dp_1^{**}}{dt_3} = -\frac{dp_2^{**}}{dt_3} = -\frac{1}{2} < 0$; $\frac{dd_1^{**}}{dt_1} = \frac{dd_1^{**}}{dt_2} = \frac{dd_2^{**}}{dt_1} = \frac{dd_2^{**}}{dt_2} = -\frac{1}{4q} < 0$; $\frac{dd_1^{**}}{dt_3} = -\frac{dd_2^{**}}{dt_3} = \frac{1}{2q} > 0$ and $\frac{dd_3^{**}}{dt_1} = -\frac{dd_3^{**}}{dt_2} = \frac{dd_3^{**}}{dt_3} = -\frac{1}{2q} < 0$. ■

Lemma 2 tell us results which are consistent with those obtained in Lemma 1 with regard to the price and quantity impact in country $i$ of a change in the tax/tariff rate $t_i$. It says that an increase in country $i$'s tax/tariff rate raises the equilibrium price in country $i$ and and lowers the demand for the product therein. Interestingly, higher the tax rate in country 1 or the tariff rate in country 2 raises the equilibrium price in both countries 1 and country 2, which is different to what stated by Lemma 1. Furthermore, an increase in the *daigou* tax rate $t_3$---trade cost/tax that that the *daigou* traders incur---raises the price in country 2 but lowers the price in country 1 and,

[11] Hence, we consider a long run analysis in our paper. A short run analysis is also possible and considered in the supplementary note.

subsequently, yield a higher demand in country 1 but a lower the demand in country 2 for the product.

Lemma 2 also reports expected results with regard to how the sale volumes in country 2 through the parallel import channel change when trade costs change: this quantity increases if the tariff rate $t_2$ increases while it decreases if either the tax rate $t_1$ or $t_3$ increases. In other words, *daigou* plays the role of substituting for the official export channel of North-South trade in this case.

Next, Proposition 3 provides comparative statics results concerning tariff/tax rates. It should be noted that while the calculations of firm 1's profit, consumer surplus for the two countries and country 2's welfare are as before, the welfare equation for country 1 is now given by:

$W_1 = \pi_1 + CS_1 + t_1 d_1 + (t_1 + t_3) d_3$.

That is, the tax revenue in country 1 now contains the contribution from *daigou*.

**Proposition 3.** Assume $1 + \frac{t_1 - t_2 + 2t_3}{q} < b < 3 - q - \frac{t_1 + t_2 + 2t_3}{q}$. The following hold in equilibrium:

(i) $\frac{\partial \pi_1^{**}}{\partial t_1} < 0, \frac{\partial \pi_1^{**}}{\partial t_2} > (=<) 0 \leftrightarrow b < (=,>) \bar{b}_2, \frac{\partial \pi_1^{**}}{\partial t_3} < 0,$

(ii) $\frac{\partial CS_1^{**}}{\partial t_1} < 0, \frac{\partial CS_1^{**}}{\partial t_2} < 0, \frac{\partial CS_1^{**}}{\partial t_3} > 0,$

(iii) $\frac{\partial CS_2^{**}}{\partial t_1} < 0, \frac{\partial CS_2^{**}}{\partial t_2} < 0, \frac{\partial CS_2^{**}}{\partial t_3} < 0,$

(iv) $\frac{\partial W_1^{**}}{\partial t_1} < 0, \frac{\partial W_1^{**}}{\partial t_2} > (=<) 0 \leftrightarrow b < (=,>) \bar{b}_3, \frac{\partial W_1^{**}}{\partial t_3} > (=,<) 0 \leftrightarrow b > (=,<) \bar{b}_4,$

(v) $\frac{\partial W_2^{**}}{\partial t_1} < 0, \frac{\partial W_2^{**}}{\partial t_2} > (=,<) 0 \leftrightarrow b > (=,<) \bar{b}_5, \frac{\partial W_2^{**}}{\partial t_3} < 0,$

(vi) $\frac{\partial WW^{**}}{\partial t_1} < 0, \frac{\partial WW^{**}}{\partial t_2} > (=,<) 0 \leftrightarrow b > (=,<) \bar{b}_6, \frac{\partial WW^{**}}{\partial t_3} < 0.$

*Proof.* In equilibrium, one can established that $\frac{\partial \pi_1^{**}}{\partial t_1} = -\frac{bq - q^2 + q - 5t_1 + 3t_2 - 4t_3}{4q} = -\frac{(bq - q - t_1 + t_2 - 2t_3) - (q^2 - 2q + 2t_1) + 2(t_2 - t_1 - t_3)}{4q} < 0; \frac{\partial \pi_1^{**}}{\partial t_2} = -\frac{bq - q^2 + q + 3t_1 - 5t_2 + 4t_3}{4q} > 0 \leftrightarrow b < 1 - q + \frac{5t_2 - 3t_1 - 4t_3}{q} \equiv \bar{b}_2; \frac{\partial \pi_1^{**}}{\partial t_3} = -\frac{t_2 - t_1 - t_3}{q} < 0; \frac{\partial CS_1^{**}}{\partial t_1} = \frac{\partial CS_1^{**}}{\partial t_2} = -\frac{3q - bq - q^2 - t_1 - t_2 + 2t_3}{16q} < 0; \frac{\partial CS_1^{**}}{\partial t_3} = \frac{3q - bq - q^2 - t_1 - t_2 + 2t_3}{8q} > 0; \frac{\partial CS_2^{**}}{\partial t_1} = \frac{\partial CS_2^{**}}{\partial t_2} = \frac{1}{2}\frac{\partial CS_2^{**}}{\partial t_3} = -\frac{(3bq - q^2 - q - t_1 - t_2 - 2t_3)}{16q} < 0$. Furthermore, $\frac{\partial W_1^{**}}{\partial t_1} = \frac{(bq + q^2 - 3q + t_1 + t_2 - 2t_3) - 7t_1 - 15t_2}{16q} < 0; \frac{\partial W_1^{**}}{\partial t_2} = \frac{-3bq + 5q^2 - 7q7t_1 + 21t_2 - 10t_3}{16q} > (=,<) 0 \leftrightarrow b < (=,>) \frac{5q^2 - 7q7t_1 + 21t_2 - 10t_3}{3q} \equiv \bar{b}_3; \frac{\partial W_1^{**}}{\partial t_3} = \frac{3bq - q^2 - q - t_1 - 5t_2 - 6t_3}{16q} > (=,<) 0 \leftrightarrow b > \equiv \bar{b}_4; \frac{\partial W_2^{**}}{\partial t_1} = \frac{1}{2}\frac{\partial W_2^{**}}{\partial t_3} =$

$\frac{-(3bq-q^2-q-t_1-t_2-2t_3)-4t_2}{16q} < 0$; $\frac{\partial W_2^{**}}{\partial t_2} = \frac{9bq-3q^2-3q-3t_1-7t_2-6t_3}{16q} > (=,<)0 \leftrightarrow b > (=$ $,<)\frac{3q^2+3q+3t_1+7t_2+6t_3}{9q} \equiv \bar{b}_5$. Finally, $\frac{\partial WW^{**}}{\partial t_1} = \frac{\partial W_1^{**}}{\partial t_1} + \frac{\partial W_2^{**}}{\partial t_1} < 0$; $\frac{\partial WW^{**}}{\partial t_2} = \frac{3bq+q^2-5q-5t_1+7t_2-8t_3}{8q} >$ $(=,<)0 \leftrightarrow b > (=,<)\frac{-q^2+5q+5t_1-7t_2+8t_3}{3q} \equiv \bar{b}_6$ and $\frac{\partial WW^{**}}{\partial t_3} = -\frac{2t_2+t_3}{2q} < 0$ hold. ■

Proposition 3(ii) and (iii) tell us that consumers in both countries lose following an increase in either $t_1$ or $t_2$. While the negative effect of an increase in $t_i$ on consumer surplus in country $i$ is obvious, the impact of an increase in $t_2$ on $CS_1$ and of an increase in $t_1$ on $CS_2$ can now be observed, which is due to the inclusion of parallel import: higher $t_2$ raises the demand for *daigou* (by Lemma 2) and thus the price in country 1, whereas higher $t_1$ makes parallel import more expensive leading to lower demand for it by country 2-consumers. Interestingly, an increase in $t_3$ hurts consumers in country 2 but benefits those in country 1. The logic behind this result is that a rise in *daigou* tax rate reduces the demand for it; in turn, this reduces the sales volume through *daigou* yet lowers the price that country 1-consumers pay for the product. Consequently, consumer surplus for country 2 decreases while that for country 1 increases.

The remainder of Proposition 3 is related to effects of changes in tax/tariff rates on firm 1's profitability and social welfare of the two countries. Effects of an increase in $t_1$ are in line with our expectations: it reduces firm 1's profitability and social welfare of both countries. The fact that a rise in $t_1$ hurts not only welfare of country 1 but also that of country 2 is because a rise in $t_1$ increases the trade cost that the *daigou* trader. In contrast, effects of an increase in either $t_2$ or $t_3$ are more complex. This is a result of the complementary between the official export channel, where tariff rate $t_2$ is the primary concern, and the parallel import channel, where the *daigou* tax rate $t_3$ is the primary concern as we pointed out in the discussion of Lemma 2.

Let us consider the effects of an increase in $t_2$ in a region where the official export channel is profitable for firm 1. If the relative market size of South versus North, $b$, is large enough, the official export channel might be the main source of supply for country 2 so that a rise in $t_2$ reduces country 2's demand for the product and hurts firm 1's profitability. Given that parallel import competes with official export in this case (and the fact that $t_3$ is low by assumption), if $b$ is significantly low,

the majority of supply for country 2 might come from the parallel import channel so that a rise in $t_2$ might improve firm 1's profitability through the increased sales to the *daigou* trader despite reducing firm 1's profit from official export.

Finally, consider an increase in $t_3$. By Lemma 2 we know that the sales volume in country 2 through the parallel import channel will fall and equilibrium price in country 1 will fall whereas that in country 2 will rise. As a consequence, firm 1's profit declines while consumers in country 1 gain and consumers in country 2 lose in this case as Proposition 1 tells us. Furthermore, while the impact of a change in $t_3$ on welfare of country 2 and aggregated social welfare is clear (and negative), that on welfare of country 1 is not obvious due to different direction of change in firm 1's profit and tariff revenue and consumer surplus in country 1. We find that when the relative size of South versus North is small (that is country 1's market is large), the effects on firm 1's profit and tariff revenue in country 1 of an increase in $t_3$ dominate the effects on consumer surplus resulting in a fall in country 1's welfare. In contrast, when the relative market size is large the effects on consumer surplus in country 1 dominate leading to an improvement in welfare in country 1 when $t_3$ increases.

**Proposition 4.** Assume $1+\frac{t_1-t_2+2t_3}{q}<b<3-q-\frac{t_1+t_2+2t_3}{q}$. There optimal tariff rate that maximizes country 2's welfare, $t_2^{**}$, is strictly positive. Furthermore, $\frac{\partial t_2^{**}}{\partial b}>0$, $\frac{\partial t_2^{**}}{\partial q}>(<,=)0\leftrightarrow q<(=,>)\frac{(3b-1)}{2}$, $\frac{\partial t_2^{**}}{\partial t_1}<0$ and $\frac{\partial t_2^{**}}{\partial t_3}<0$ hold.

*Proof.* The optimal tariff rate $t_2^{**}$ can be found by solving $\frac{\partial W_2^*}{\partial t_2}=0\rightarrow t_2^{**}=\frac{3(3bq-q-q^2-t_1-2t_3)}{7}>0$ due to the condition $d_2^*>0$. We also have that, $\frac{\partial t_2^{**}}{\partial b}=\frac{9q}{7}>0$, $\frac{\partial t_2^{**}}{\partial q}=\frac{3(3b-1-2q)}{7}>(<,=)0\leftrightarrow q<(=,>)\frac{(3b-1)}{2}$, $\frac{\partial t_2^{**}}{\partial t_1}=-\frac{3}{7}<0$ and $\frac{\partial t_2^{**}}{\partial t_3}=-\frac{6}{7}<0$. ■

Proposition 4 tells us results which are consistent with proposition 2, that the optimal tariff rate $t_2$ is positive, increasing in $b$ and inverted-U in $q$, except for the addition of the role played by the tariff rate $t_1$. It is stated that an increase in $t_1$ leads to a lower optimal tariff rate for country 2. In absence of parallel import, markets of country 1 and country 2 are independent and thus a change in $t_1$ does have no role in the equilibrium outcome of the market in country 2. In the presence of parallel import, however, a rise in $t_1$ lowers the incentive for *daigou*. This in turn induces country 2 to

raise the tariff rate $t_2$ to enhance its tariff revenue compensating for the loss in welfare resulting from fewer products available through (and thus consumer benefits with) the *daigou* channel. An implication of this result is that in the process of trade liberalization negotiation, countries should take into account the domestic tax rates in the presence of *daigou*. More in Section 5.

**Corollary 1.** $t_2^{**} > (=,<) t_2^* \leftrightarrow b > (=,<) \bar{b}_7$.

*Proof.* We have $t_2^{**} - t_2^* = \frac{40bq-18q-11q^2-18t_1-36t_3}{42} > (=,<) 0 \leftrightarrow b > (=,<) \frac{(18q+11q^2+18t_1+36t_3)}{40} \equiv \bar{b}_7$. ■

How does *daigou* affect country 2's incentive toward trade liberalization with country 1? Corollary 1 reveals that indeed the answer depends on the relative market size: if $b$ is sufficiently low, country 2 would have stronger incentive to liberalize trade with country 1 in the presence of *daigou* than in the absence of *daigou* (i.e., $t_2^{**} < t_2^*$ holds).

**Proposition 5.** Assume $1 + \frac{t_1-t_2+2t_3}{q} < b < 3 - q - \frac{t_1+t_2+2t_3}{q}$. Let optimal tax rate on parallel import that maximizes country 1's welfare be $t_3^*$. Then, $t_3^* > (=) 0 \leftrightarrow b > (\leq) \bar{b}_8$, $\frac{\partial t_3^*}{\partial b} \geq 0$, $\frac{\partial t_3^*}{\partial q} > (<,=) 0 \leftrightarrow q < (=,>) \frac{(3b-1)}{2}$, $\frac{\partial t_3^*}{\partial t_1} \leq 0$ and $\frac{\partial t_3^*}{\partial t_2} \leq 0$ hold.

*Proof.* The optimal tariff rate on *daigou* can be found by solving $\frac{\partial W_1^*}{\partial t_3} = 0 \rightarrow \bar{t}_3 = \frac{3bq-q^2-q-t_1-5t_2}{7} > (=,<) 0 \leftrightarrow b > (=,<) \frac{q^2+q+t_1+5t_2}{3} \equiv \bar{b}_8$. Define $t_3^* = \max(0, \bar{t}_3)$. When $t_3^* > 0$ it follows that $\frac{\partial t_3^*}{\partial b} = \frac{q}{2} > 0$, $\frac{\partial t_3^*}{\partial q} = \frac{3b-1-2q}{6} > (<,=) 0 \leftrightarrow q < (=,>) \frac{3b-1}{2}$, $\frac{\partial t_3^*}{\partial t_1} = -\frac{1}{6} < 0$ and $\frac{\partial t_3^*}{\partial t_2} = -\frac{5}{6} < 0$. ■

Should *daigou* activities be taxed in country 1? Proposition 5 provides an answer to this question. It says that it is not always the case that taxing *daigou* activities would bring about net welfare benefits for country 1. This is because the relative market size plays an important role. If $b$ is too low, the market of country 2 is not large enough to generate significant sales for firm 1 and tax revenue on *daigou* activities would be too small so that it is optimal for country 1 to set a zero tax rate for $t_3$. It is only when the size of country 2 is large enough that tax revenue on *daigou* activities forms an important part in country 1's welfare that provides incentive for a positive tax rate for $t_3$ as Proposition 5 tells us.

Other interesting results of Proposition 5 are that the optimal tax rate $t_3^*$ shares certain patterns with the optimal tariff rate $t_2^{**}$: they are both rising in $b$ falling in $t_1$ and concave (inverted-U shape) in $q$. Indeed the negative effect of $t_1$ on $t_3^*$ is a meaningful finding and deserves some discussion. More in Section 5.

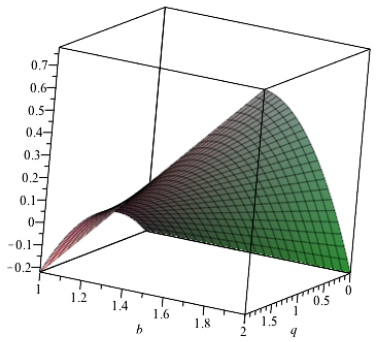


*Figure 2. Optimal tax rate on daigou, market size and product quality*

*Notes: based on following parameterizations:* $t_1 = 0.075, t_2 = 0.25$*; positive values indicating* $t_3^* > 0$.

*3.3. Impacts of daigou*

We are now in a position to study the impacts of *daigou*. That is, we can compare outcome under the national exhaustion regime with that under the international exhaustion regime and draw some conclusion as to how *daigou* changes profit of firm 1 and welfare of the two countries and the world. Given that there are a number of parameters in the model, to make the analysis transparent we will focus on the impact of a change in the relative market size of South versus North, $b$, which, as pointed out in Proposition 3, plays an important role in determining the impacts of North-South parallel import.

**Proposition 6.** Assume $2q - q^2 - 2t_1 > 0$, $2bq - q^2 - 2t_2 > 0$ and $1 + \frac{t_1 - t_2 + 2t_3}{q} < b < 3 - q - \frac{t_1 + t_2 + 2t_3}{q}$. There exist positive values $\hat{b}_1$, $\hat{b}_2$ and $\hat{b}_3$ with the following properties:

(ii) $\pi_1^{**} > \pi_1^*$ if $b \in (\hat{b}_1, \hat{b}_2)$ and $\pi_1^{**} \leq \pi_1^*$ otherwise,

(ii) $W_1^{**} > W_1^*$ if $b \in (\hat{b}_1, \hat{b}_3)$ and $W_1^{**} \leq W_1^*$ otherwise,

(iii) $W_2^{**} > W_2^*$ if $b > \hat{b}_1$ and $W_2^{**} \leq W_2^*$ otherwise,

(iv) $WW^{**} > WW^*$ if $b > \hat{b}_1$ and $WW^{**} \leq WW^*$ otherwise,

where $\hat{b}_2 < \hat{b}_3$ holds under a range of parameterizations.

*Proof.* The results are obtained by comparing equilibrium profit of firm 1 and welfare (of country 1, country 2 and the world) under the international exhaustion regime with their counterpart under the national exhaustion regime. It is found that differences $\pi_1^{**} - \pi_1^*$, $W_1^{**} > W_1^*$, $W_2^{**} - W_2^*$ and $WW^{**} - WW^*$ are all quadratic functions of $b$. Furthermore, $\frac{d(\pi_1^{**}-\pi_1^*)}{db} = -\frac{q}{8} < 0$, $\frac{d(W_1^{**}>W_1^*)}{db} = -\frac{3q}{32} < 0$, $\frac{d(W_2^{**}-W_2^*)}{db} = \frac{5q}{32} > 0$ and $\frac{d(WW^{**}-WW^*)}{db} = \frac{q}{16} > 0$ hold. Equating these differences to zero allows us to find the thresholds for $b$, with $\hat{b}_1 \equiv 1 + \frac{t_1-t_2+2t_3}{q}$, $\hat{b}_2 \equiv 1 + \frac{3(t_2-t_1-t_3)}{q}$ and $\hat{b}_3 \equiv 2q - 1 + \frac{-t_1+13t_2+6t_3}{3q}$. It also follows that $\hat{b}_2 < \hat{b}_3 \leftrightarrow t_2 < \frac{2q-q^2+2t_1}{8}$. ■

Does North-South parallel import benefit firm 1? The answer to this question is not straightforward although it might seem that such channel of export is harmful for firm 1 as it cannot control the *daigou* activities. However, with a low tax rate on *daigou* activities comparing to the tariff rate that prevails in the official export channel, if the size of country 2 is large enough, allowing parallel import activities actually enhances firm 1's profitability and improves welfare for both countries and the world, as Proposition 6 tells us. The logic behind this result is as follow. When $b$ us sufficiently large, the official export channel is an expensive way to service the market of country 2 from the social planner's standpoint. Hence, allowing parallel import generates efficiency at the aggregate level (given that $t_3 < t_2$). This also benefits firm 1 because it can sell more quantity in country 1 thanks to *daigou* activities. This perhaps explains why a number of companies have supported *daigou* activities knowing that would hurt their direct export to relevant markets. See Section 5 for some discussions.

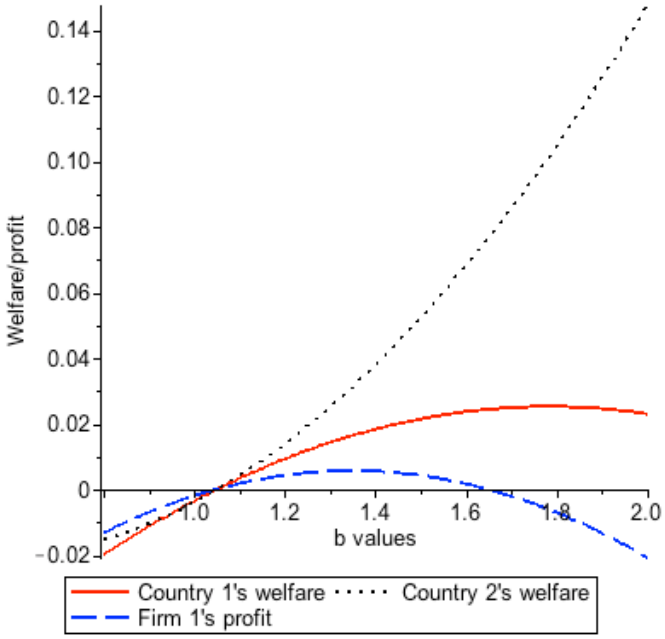


*Figure 3. Impacts of daigou (perfect competition in daigou market).*

*Notes: based on following parameterizations:* $t_1 = 0.075, t_2 = 0.25, t_3 = 0.1, q = 0.5$*; positive values indicating the benefits of daigou.*

When the size of country 2 is too large, although North-South parallel import continues to benefit country 2 and world welfare, it hurts firm 1 and social welfare of country 1 (see Figure 3 for an example of this case). This is because with a significantly large market size of country 2, it is optimal for firm 1 if it can exercise its monopoly power therein. The important implication of this finding is that when designing the trade/taxation policies, countries should take into account the significant roles played by market sizes, an issue that has mostly been neglected in the literature.

## 4. ROBUSTNESS OF THE RESULTS

In this section, we consider two extensions to the benchmark model: imperfect competition in *daigou* market and duopolistic competition in South. We will show that our main results, are presented in Propositions 2-6, still hold under these modeling alternatives.

### *4.1. Imperfect competition in daigou market*

Consider an extension to the model presented in Section 3 where there is a representative *daigou* trader who can effectively control the *daigou* market. This is

often the case when the concerned product is of superior quality and/or when the entry into the *daigou* market is very costly. Then, instead of being a price taker, the *daigou* trader can limit the volume traded (i.e. $d_3$) so as to maximize his *daigou* profit. With this change, the game will be similar to that described in Section 3 except for one change under the international exhaustion regime: the *daigou* trader chooses $d_3$ endogenously to maximize $\pi_2$ (equation 5).

When allowing those changes in the model, we find all of our results are presented in Propositions 2-6 would continue to hold.[12] That is, the (positive) optimal tariff rate for South and the optimal *daigou* tax rate still exist, which are both increasing in the relative market size of South versus North, $b$, and inverted-U shape in product quality $q$. Furthermore, if $b$ is in a middle range, *daigou* not only increases Southern welfare but also enhances firm 1's profit and Northern welfare. Figure 4 below provides an illustration of these results.

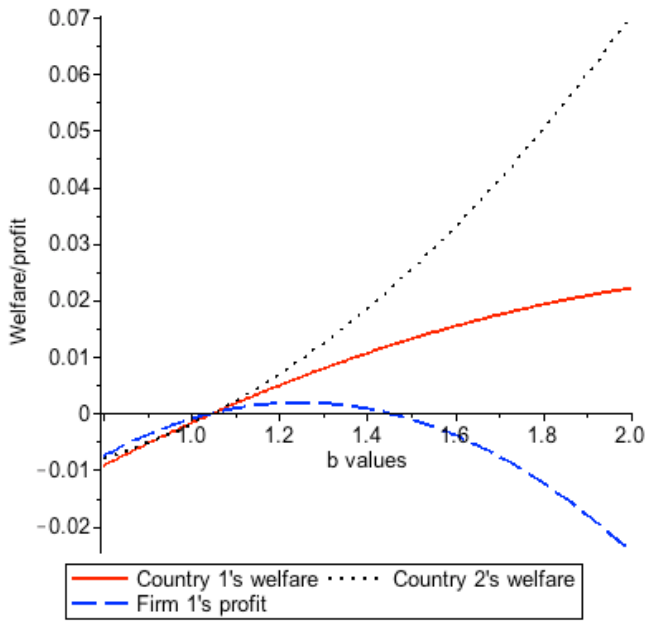


*Figure 4. Impacts of daigou (imperfect competition in daigou market).*

*Notes: based on following parameterizations:* $t_1 = 0.075, t_2 = 0.25, t_3 = 0.1, q = 0.5$*; positive values indicating the benefits of daigou.*

[12] The detailed analysis is available from the authors upon the request.

Interestingly, comparing outcomes of the extended model (imperfect competition in *daigou* market) with that of the benchmark model (perfect competition in *daigou* market), we find that as the relative market size of South versus North increases, the benefit accrued to firm 1 from *daigou* vanishes sooner in the former, holding other factors constant. That is, when the *daigou* quantity is determined endogenously, the extent (i.e. range of $b$) to which *daigou* is profitable for firm 1 becomes relatively small. However, the same is not concluded in regard to the likewise implications on Northern welfare. In particular, if $t_2$ is large enough, the range of $b$ to which *daigo*u is welfare enhancing for North can be larger with imperfect competition in *daigou* market than that with the benchmark model.

*4.2. Duopolistic competition in South*

Would our results hold when the Southern market is served also by a Southern firm (firm 2) who, upon observing the Northern firm's product in South, produces a lower quality version of the product by way of imitating the Northern technology?.[13] In this subsection, we augment out benchmark model to accommodate this change.

In line with Saggi (2012), given the strict IPR protection (enforcement) in North, the Southern producing firm cannot sell its product (that is export its product) to North. Hence, the major modification of our model would be that related to the Southern market where we now have two product quality levels: $q$ (high quality, supplied by firm 1) and $kq$ (low quality, supplied by firm 2). Here, $k \in (0,1)$ captures the quality gap between North and South: a lower value of this parameter indicates a large North-South quality gap. To avoid complications, we assume away tax rate $t_1$ in North and any tax rate that firm 2 incurs in South. We however retain both $t_2$, the tariff rate of South on Northern products, and $t_3$, the *daigou* tax rate in North. Stages of the game remain the same except for an additional activity: at stage 1 firm 2 sets the price for its product in South. Observe that the Southern consumers have a choice of purchasing a high-quality product from firm 1 and *daigou* traders or a low-quality product from firm 2, or not purchasing any product.

[13] See Maskus (2004) for a survey article that outlines technology imitation/spillovers in China as an example.

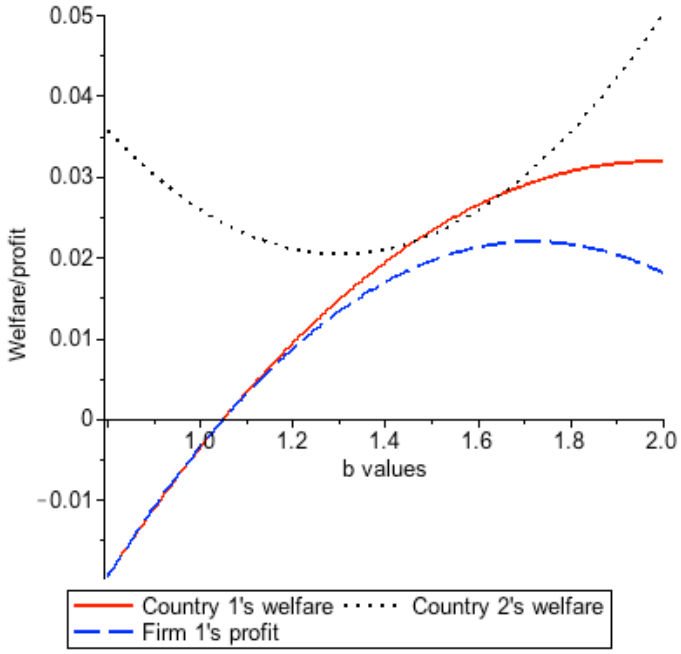


*Figure 5. Impacts of daigou (duopolistic competition in South).*

*Notes: based on following parameterizations:* $t_1 = 0, t_2 = 0.25, t_3 = 0.1, q = 0.5, k = 0.25$*; positive values indicating the benefits of daigou.*

With the inclusion of the Southern firm, we find that results of Propositions 2-6 go through.[14] That is, there exists a (positive) optimal tariff rate for South that maximizes Southern welfare, which is increasing in the relative market size of South versus North, $b$, and inverted-U shape in (Northern) product quality, $q$. Likewise, there is a (positive) optimal *daigou* tax rate for North, which is increasing in $b$ and inverted-U shape in $q$. If $b$ is in a middle value range, *daigou* improves firm 1's profitability and enhances both Northern and Southern welfare but it might hurt Southern welfare when $b$ falls below such a value range. Although the North-South quality gap, represented by $k$, plays a role in the model, it does not affect the nature of our findings. Figure 5 provides a graphical representation of these results.

In summary, we have been able to confirm the robustness of our results in both the setting with imperfect competition in *daigou* market and duopolistic competition in South. It is worth mentioning that our model can also be augmented to accommodate the following modeling alternatives: Northern firm's investment in technology development, Northern firm producing multiple products, homogenous

[14] The detailed analysis is available from the authors upon the request.

consumers and low North-South tariff (or free trade) case. Given the complications of our model when adding these elements, we however leave these for future research.

## 5. DISCUSSION AND CONCLUSIONS

We study the economic significance of *daigou* activities in developed countries (North)---the purchase of 'green and safe' products for sales in developing countries (South) by individual traders. This new form of international trade that coexists with the official export channel is currently a hotly debated topic in many countries. We find, in an international model of vertical product differentiation, that parameterizations exist in which the presence of such *daigou* benefits Northern producers and Northern welfare but hurts Southern welfare. Thus, *daigou* should be allowed from a Northern perspective but prohibited from a Southern perspective, the results which are somewhat counterintuitive.

In this context, we study the impact that *daigou* has on South's incentive to liberalize trade with North through the official export channel and explore a potential *daigou* tax that North can impose on *daigou* activities. It is shown that there exists a positive tariff rate that maximizes Southern welfare, which is higher with the inclusion of *daigou* than not, provided that the market size of South is suitably high. This suggests that South's incentive toward trade liberalization may decrease when North allows for the inclusion of *daigou* activities in the economy. Meanwhile, North only benefits from a *daigou* tax if and only if sales volume through such channel is large enough to offset any distortion in its domestic market where, due to *daigou*, Northern consumers must pay a higher price for the product. In any case, both the optimal tariff rate for South and optimal *daigou* tax rate for North are found to be dependent on the domestic tax rate in North, suggesting that Northern policy makers should not ignore the important roles played by *daigou* when undertaking tax reform.

Given the burgeoning (and unavoidable) trend of the *daigou* in North-South trade, we believe the findings of the paper are timely and useful. In particular, our model and results provide possibly new policy instruments for both North and South to contain and/or utilize the effects of *daigou*. It also helps Northern producers to better design the strategy serving Southern consumers, especially in regard to whether or not these firms should utilize the *daigou* channel to maximize their profitability in an increasingly complex world.

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