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 aims to uncover the impact of parallel import of ‘green and safe’ products from developed countries (North) into developing countries (South) on producing firms’ profitability and social welfare of the related countries. We show that there are certain market configurations such that the presence of such North-South parallel import increases the profitability of producing firms, promotes trade between North and South and enhances social welfare for these countries. In this context, we study optimal taxation from a Northern perspective and investigate how such optimal taxation and South’s incentive towards trade liberalization with North is affected by North-South parallel import.

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

JEL classifications: F12; L11; L12; L13.

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1. INTRODUCTION

Recently, following the process of trade liberalization and online trading, 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) --- often China ---for a significant price markup, referred to in the media as daigou shopping, have become a popular economic phenomenon in many countries. Daigou shopping is a typical form of parallel import into developing countries, filling the local demand for high quality goods from other countries following the notable improvement in income and living standard of those countries.\(^1\) Daigou shopping is currently a hotly debated issue in countries and territories that source those high quality products such as Australia, Canada, Hong Kong, Japan, New Zealand and the United States.\(^2\) In Australia in 2016, for example, the local media reported that there were some 40,000 daigou traders who often clear shelves of vitamin and baby formula products at supermarkets or pharmacies and sell them directly to customers in China.\(^3\) Similar phenomena are also 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 North-South parallel import in international trade between these countries/regions, little has been known with regard to how it impacts the profitability of producers of the concerned products as well as consumer welfare. On the one hand, such parallel import helps to connect the demand in developing countries with the supply of those ‘green and safe’ goods produced in the developed countries, which in turn promote sales and 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

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1. In this paper, daigou and parallel import are used interchangeably.
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/19b47c07e821531ddd2213f55f0d3e986.
consumers (as with the case of the traditional export channel) because such rents must be shared between themselves and daigou traders, who often have a good network of genuine customers in South for the concerned products. Apparently, consumer welfare in both North and South are affected by North-South parallel import, as is often the case of typical parallel imports from South into North, such as those on pharmaceuticals (Saggi, 2012; Stadhler et al. 2014; Nguyen et al. 2016). In this context, it is crucial that these countries can implement effective policies to maximize the benefits of North-South parallel import: a suitable tax regime in North and a suitable trade liberalization incentive in South. These issues, however, have been a neglected topic thus far in the economics literature.

Building upon an international model of vertical product differentiation, this paper aims to uncover the economic significance of North-South parallel import of ‘green and safe’ products. We attempt to capture the reality as close as possible so that we consider the framework of vertical product differentiation where not only the product quality but the heterogeneity among consumers plays an important role, and augment it to allow for the coexistence of parallel import and the traditional export channel. Thus, a typical ‘green and safe’ product from North can reach consumers in South either through daigou traders or directly from the producer in our setting. While we allow arbitrage activities to maintain equilibrium in prices across, we attach different tax/tariff rates to different sales channels. That is, the trade cost on goods produced in North and sold in South via the official export channel is not the same as one facing by daigou shoppers; these trade costs are also different from that on goods sold domestically in North. With such a model, we attempt to answer the following key research questions are: (i) How does North-South parallel import affect the profitability of the producer in North as well as social welfare in both countries?, (ii) Should North-South parallel import activities be taxed and if so what is the optimal tax rate should North exercise to maximize its social welfare?, and (iii) How does North-South parallel import affect the optimal tax rate in North and South’s incentive towards liberalization with North?.

To answer these questions, we start our analysis for the case in which there is a single Northern producer of the uniquely ‘green and safe’ product that is demanded by both Northern and Southern consumers. We show that there are certain market

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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.
configurations—-notably a (middle) range of market size of South (versus North)--such that the presence of North-South parallel import increases the profitability of producing firms, promotes trade between North and South and enhances social welfare for these countries. In this context, we study the optimal taxation from a North’s perspective where we identify the existence of a positive tax rate on *daigou* shopping that can maximize Northern welfare. We also investigate how South’s incentive towards trade liberalization with North is affected by North-South parallel import by studying an optimal tariff rate for South on goods imported from North. We then verify the robustness of our results in a duopoly setting where there is a Southern producer supplying to South a lower quality version of the product. Based on the theoretical findings, we offer several policy recommendations for both North and South in this context.

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 in the context of the rise of the Asian middle class population, in particular in China. More specifically, our results are built surrounding product quality and the relative market size, both of which are currently hotly debated in both the international trade literature as well as the policy front. Interestingly, we find that although the Northern optimal taxation on *daigou* activities and South’s incentive towards trade liberalization with North are both increasing when the said relative market size rises, they are not monotonic in the level of product quality, suggesting the North-South ‘technology gap’ plays a role. Furthermore, we find that the optimal *daigou* taxation is closely linked to the retail (per-unit) tax rate in North, which provides possible framework for the tax authority to consider the reform of the taxation system when North-South parallel import is taking a shape.

To the best of our knowledge, Nguyen (2016), Saggi (2012) and Szymanski and Valletti (2005) have been only theoretical papers that have studied parallel import when vertical product differentiation matters. Although related, Saggi (2012) has a different scope from what the current paper attempts to investigate. In particular, Saggi focuses on the implication of intellectual property rights (IPR) protection regimes in North and South on Northern firms’ choice to export to South when there

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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.
is a potential entry thread in South by imitated firms. In contrast, we focuses on implications of North-South parallel import by arbitragers on optimal tariff in South and optimal taxation in North. Nguyen et al. (2016) and Szymanski and Valletti (2005), meanwhile, both consider a monopoly framework with two segmented (international) markets to study parallel import by cross-border travellers and cannibalization, respectively, which are not examined in the current paper.

The limited number of papers on parallel import from North into South stand in sharp contrast to the 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). 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. Such a conclusion is, however, based upon a survey of the many papers that adopt a horizontal product differentiation model where product quality is often neglected (see also Malueg and Schwartz, 1994; Abbott, 1998; Scherer and Watal 2001). Matteucci and Riverberi (2014) and Hwang et al. (2014) introduce product quality into the traditional horizontal product differentiation approach but they only consider the case in which consumers are homogeneous in their perceptions or valuations for the product. In reality, consumers are, however, 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.

Our results yield insightful implications for both North and South. In particular, we provide a menu of policy options for governments in these countries to implement in order to maximize the welfare benefits of North-South parallel import on ‘green and safe’ products—a Northern taxation policy and a Southern tariff policy. To the best of our knowledge, this is the first paper that attempts to uncover this issue.

In the next section, we present the basic structure of the model. Section 3 shows, in a monopoly setting, equilibrium outcomes in cases without North-South parallel import and with such import and highlights the key results of the paper. Section 4 outlines results when the benchmark model is extended to the case of oligopoly in which there is a Southern producer of a lower quality version of the product for South consumers. Discussions of our results and policy recommendations are presented in 5.
2. THE MODEL

We develop an international model of vertical product differentiation to study the economic consequences of North-South parallel import on ‘green and safe’ products based on the framework of Mussa and Rosen (1978). The world consists of two countries: a developed country (country 1) and a developing country (country 2) each of which is populated with numerous consumers for a typical product produced by a producer homed in country 1 (or 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. Given the scope of the paper we assume that $q$ is exogenous in the model and is the only quality that matters for our benchmark monopoly model --- in Section 4 we will extend the benchmark model to include quality competition in the developing country with an inclusion of a local firm their in 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-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 export) and becomes a monopolist therein, whereas in the latter regime, a representative daigou trader buys the product from country 1 and sells it in country 2 to exploit the price difference between the two countries. To simplify the analysis we allow price arbitrage to occur so that daigou activities result in a unique price for the product in country 2.

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 he/she purchases the product in the market 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.9

8 We abstract away from the technology development process, as that would unnecessarily complicate the model and results.
9 This utility function, proposed by Mussa and Rosen (1978) has been used largely in the vertical product differentiation literature.
To fit what often observed in reality, let $t_1$, $t_2$ and $t_3$ denote the per-unit tax rate on the product sold in market 1, the specific tariff rate in market 2 on official import and the per-unit tax on *daigou* shopping, 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. While $d_3$ is endogenously determined in the model, the consumers’ demand for the product through the direct sales from the producer in country 1 and country 2, $d_1$ and $d_2$, follow from directly from the utility equation and market prices (see the next section). The game is solved by backward induction.

### 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 $v_i^\ast$ ($i = 1, 2$) 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 $v_i^\ast q - p_i = 0$ holds, which leads to $v_i^\ast = p_i/q$ and subsequently $d_1 = 1 - v_1^\ast = 1 - p_1/q$ and $d_2 = b - v_2^\ast = b - p_2/q$ when consumers in both countries make their purchasing decision (stage 2).

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

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

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.** 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 \( \frac{dp_i^*}{dt_1} = \frac{dp_i^*}{dt_2} = \frac{1}{2} > 0 \) and \( \frac{dd_i}{dt_1} = \frac{dd_i}{dt_2} = -\frac{1}{2q} < 0. \)

Lemma 1 tells us that an increase in the tax/tariff rate in country \( i \) raises the equilibrium price therein but decreases the demand for the product. 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 that country at all.

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

\[
CS_1 = \int_{p_1^*}^b (v_i q - p_1) dv_i = \frac{q}{2} \left( 1 - \frac{p_1^*}{q} \right) - p_1 (1 - \frac{p_1}{q}), \tag{2}
\]

\[
CS_2 = \int_{p_2^*}^b (v_i q - p_2) dv_i = \frac{q}{2} \left( b^2 - \frac{p_2^*}{q} \right) - p_2 (1 - \frac{p_2}{q}), \tag{3}
\]

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.** 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) \( \frac{\partial W_2^*}{\partial t_1} = 0 \), \( \frac{\partial W_2^*}{\partial t_2} > (\leq, \leq) 0 \leftrightarrow b > (\leq, \leq) b_1 \),
(vi) \( \frac{\partial WW^*}{\partial t_1} < 0, \frac{\partial WW^*}{\partial t_2} < 0. \)

Proof. It can be established that \( \frac{\partial \pi_1^*}{\partial t_1} = \frac{q^2 - 2q + 2t_1}{4q} < 0; \frac{\partial \pi_1^*}{\partial t_2} = \frac{q^2 - 2q + 2t_2}{4q} < 0; \frac{\partial CS_1^*}{\partial t_1} = \frac{q^2 - 2q + 2t_1}{8q} < 0; \frac{\partial CS_1^*}{\partial t_2} = \frac{q^2 - 2q + 2t_2}{8q} < 0. \) Furthermore, \( \frac{\partial W_1^*}{\partial t_1} = \frac{q^2 - 2q - 2t_1}{8q} < 0; \frac{\partial W_1^*}{\partial t_2} = \frac{q^2 - 2q + 2t_2}{4q} < 0; \frac{\partial W_2^*}{\partial t_1} = 0; \frac{\partial W_2^*}{\partial t_2} = 0. \) 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, its tariff revenue might be the dominant factor in the welfare of country 2 so that an increase in the tariff rate \( t_2 \) brings about an improvement for South’s welfare despite some losses 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 (note that a change in $t_1$ does not affect country 2’s welfare at all).

**Proposition 2.** 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 $\frac{\partial W_2^*}{\partial t_2} = -\frac{q^2 - 2bq + 6t_2}{aq} = 0 \rightarrow t_2^* = \frac{2bq - q^2}{6}$. 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 for the product. Notice that an increase in trade cost between countries 1 and 2 reduces consumer surplus in country 2 (for the same discussion of Proposition 1 as above) but enhances tariff revenue for country 2, so 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 the welfare for sufficiently low tariff rates. Interestingly, a higher product quality level also provides stronger incentives for country 2 to raise its optimal tariff rate.

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 for both markets, the fact that the representative daigou trader purchases the product from country 1 for sale in country 2 creates at least two important effects comparing to the case considered in Section 3.1. First, there will be over demand for the product in country 1, leading to potentially higher prices consumers therein have to pay for the product. Second, there will also be over supply of the product in country 2, resulting in lower equilibrium prices. As such, to make the model not only tractable but connect to reality, we examine the case in which country 2 is large enough in market size such that there exist price arbitrage opportunities for the daigou trader.\(^\text{10}\) We also focus our analysis to the case in which the trade cost of the official export channel is significantly 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

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

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

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

$$d_1^{**} = \frac{3q-bq-q^2-t_1-t_2+2t_3}{4q},$$

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

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. The following hold in equilibrium

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

(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) $\frac{dd_1^{**}}{dt_1} = - \frac{dd_1^{**}}{dt_2} = \frac{dd_2^{**}}{dt_2} < 0$.

Proof: It can be established that $\frac{dp_1^{**}}{dt_1} = \frac{dp_1^{**}}{dt_2} = \frac{dp_2^{**}}{dt_1} = \frac{dp_2^{**}}{dt_2} = \frac{1}{4} > 0$; $\frac{dp_1^{**}}{dt_3} = - \frac{dp_2^{**}}{dt_3} = - \frac{1}{2} < 0$;

$\frac{dd_1^{**}}{dt_1} = \frac{dd_1^{**}}{dt_2} = \frac{dd_2^{**}}{dt_1} = \frac{dd_2^{**}}{dt_2} = - \frac{1}{4q} < 0$; $\frac{dd_1^{**}}{dt_3} = - \frac{dd_2^{**}}{dt_3} = \frac{1}{2q} > 0$ and $\frac{dd_1^{**}}{dt_1} = - \frac{dd_2^{**}}{dt_2} = \frac{dd_1^{**}}{dt_2} = \frac{1}{2q} < 0$.

Lemma 2 tell us results which are consistent with those obtained in Lemma 1(1) and (ii) with regard to the price and quantity impact in country $i$ of a change in the tax/tariff rate $t_i$. They say that an increase in this tax/tariff rate raises the equilibrium price in country $i$ and and lowers the demand for the product. Interestingly, higher the

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11 Hence, we consider a long run analysis in our paper. A short run analysis is also possible and considered in the supplementary note.
tax rate in country 1 or the tariff rate in country 2 raises the equilibrium price in both country 1 and country 2, which is different to Lemma 1. Furthermore, an increase in the daigou tax rate $t_3$ ---trade cost/tax that that the daigou shoppers incur---raises the price in country 2 but lowers the price in country 1, whereas it raises the demand in country 1 but lowers the demand in country 2.

Lemma 2 also reports expected results with regard to how the sale volumes in country 2 through the parallel import channel: 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 shopping plays the role of substituting for the official export channel of North-South trade in this case.

Next, Proposition 3 below provides comparative statics results concerning tariff/tax rates.

**Proposition 3.** The following hold in equilibrium:

(i) $\frac{\partial \pi^*_1}{\partial t_1} < 0, \frac{\partial \pi^*_2}{\partial t_2} > (\Rightarrow) 0 \leftrightarrow b < (\Rightarrow, >) \bar{b}_2, \frac{\partial \pi^*_3}{\partial t_3} < 0,

(ii) $\frac{\partial C_{S1}^*}{\partial t_1} < 0, \frac{\partial C_{S2}^*}{\partial t_2} < 0, \frac{\partial C_{S3}^*}{\partial t_3} > 0,

(iii) $\frac{\partial C_{S2}^*}{\partial t_1} < 0, \frac{\partial C_{S3}^*}{\partial t_2} < 0, \frac{\partial C_{S2}^*}{\partial t_3} < 0,

(iv) $\frac{\partial W_{1}^*}{\partial t_1} < 0, \frac{\partial W_{1}^*}{\partial t_2} > (\Rightarrow) 0 \leftrightarrow b < (\Rightarrow, >) \bar{b}_3, \frac{\partial W_{1}^*}{\partial t_3} > (\Rightarrow, <) 0 \leftrightarrow b > (\Rightarrow, <) \bar{b}_4,

(v) $\frac{\partial W_{2}^*}{\partial t_1} < 0, \frac{\partial W_{2}^*}{\partial t_2} > (\Rightarrow, <) 0 \leftrightarrow b > (\Rightarrow, <) \bar{b}_5, \frac{\partial W_{2}^*}{\partial t_3} < 0,

(vi) $\frac{\partial W_{3}^*}{\partial t_1} < 0, \frac{\partial W_{3}^*}{\partial t_2} > (\Rightarrow, <) 0 \leftrightarrow b > (\Rightarrow, <) \bar{b}_6, \frac{\partial W_{3}^*}{\partial t_3} < 0.

**Proof.** In equilibrium, one can established that

\[
\frac{\partial \pi^*_1}{\partial t_1} = -\frac{bq - q^2 + q - 5t_1 + 3t_2 - 4t_3}{4q} = -\frac{(bq - q - t_1 + t_2 - 2t_3 - (q - 2q + 2t_3) + 2(t_2 - t_3) - t_2 - t_3)}{4q} < 0;
\]

\[
\frac{\partial \pi^*_2}{\partial t_2} = -\frac{bq - q^2 + q - 3t_1 - 5t_2 + 4t_3}{4q} > 0 \leftrightarrow b < 1 - q + \frac{5t_2 - 3t_1 - 4t_3}{q} \equiv \bar{b}_2; \frac{\partial \pi^*_2}{\partial t_3} = -\frac{t_2 - t_1 - t_3}{q} < 0; \frac{\partial C_{S1}^*}{\partial t_1} = \frac{3q - bq - q^2 - t_1 - 2t_2 - 2t_3}{16q} < 0; \frac{\partial C_{S2}^*}{\partial t_3} = \frac{3q - bq - q^2 - t_1 - 2t_2 - 2t_3}{16q} < 0; \frac{\partial C_{S1}^*}{\partial t_1} = \frac{1}{2}; \frac{\partial C_{S2}^*}{\partial t_3} = \frac{1}{2}; \frac{\partial C_{S3}^*}{\partial t_2} = \frac{1}{2}.
\]

\[
\frac{\partial W_{1}^*}{\partial t_1} = \frac{(bq + q^2 - 3q + t_1 + t_2 - 2t_3) - 7t_1 - 15t_2}{16q} = \frac{(bq + q^2 - 3q + t_1 + t_2 - 2t_3) - 7t_1 - 15t_2}{16q} < 0; \frac{\partial W_{1}^*}{\partial t_3} = \frac{-3bq + b - q^2 - 3q + t_1 + t_2 - 2t_3}{16q} < 0; \frac{\partial W_{1}^*}{\partial t_2} = \frac{-3bq + b - q^2 - 3q + t_1 + t_2 - 2t_3}{16q} < 0; \frac{\partial W_{1}^*}{\partial t_3} = \frac{-3bq + b - q^2 - 3q + t_1 + t_2 - 2t_3}{16q} < 0.
\]

Finally, $\frac{\partial W_{3}^*}{\partial t_1} = \frac{3q^2 + 3q + t_1 + t_2 + 6t_3}{9q} \equiv \bar{b}_5$. Finally, $\frac{\partial W_{3}^*}{\partial t_1} = \frac{3q^2 + 3q + t_1 + t_2 + 6t_3}{9q}$.
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 \( CS_i \) 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 shopping (by Lemma 2) and thus the price in country 1, whereas higher \( t_3 \) makes parallel import expensive and in turn the daigou trader passes on the price hike to country 2’s consumers. Interestingly, an increase in \( t_3 \) hurts consumers in country 2 but benefits those in country 1. This comes as a result of a reduction in demand for daigou shopping as the tariff rate on these activities 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.** 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 \( \frac{\partial w_2^*}{\partial t_2} = 0 \rightarrow t_2^* = \frac{3(3b-a-a^2-t_1-2t_3)}{7} > 0 \) due to the condition \( d_2 > 0 \). We also have that, \( \frac{\partial t_2^*}{\partial b} = \frac{9a}{7} > 0 \), \( \frac{\partial t_2^*}{\partial q} = \frac{3(3b-1-2q^2)}{7} > (, =)0 \leftrightarrow q < (=, >) \frac{(3b-1)}{2} \), \( \frac{\partial t_2^*}{\partial t_1} = -\frac{3}{7} < 0 \) and \( \frac{\partial t_2^*}{\partial t_3} = -\frac{6}{7} < 0 \). \( \blacksquare \)

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* shopping. 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 rate in the presence of *daigou* shopping. More in Section 5.
Corollary 1. \( t_2^*> (=,\langle t_2^* \leftrightarrow b > (=,\langle b \rangle 5_7) \).

Proof. We have \( t_2^* - t_2^* = \frac{40bq-10g^2-11q^2+8b_1+36b_2}{42} > (=,\langle 0 \leftrightarrow b > (=,\langle 1/8+12q^2+18b_1+36b_2) \equiv 5_7. \) ■

How does daigou shopping 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 shopping than in the absence of daigou shopping (i.e., \( t_2^* < t_2^* \) holds).

Proposition 5. Let optimal tax rate on parallel import that maximizes country 1’s welfare be \( t_3^* \). Then, \( t_3^* > (=) 0 \leftrightarrow b > (\leq) 5_8, \frac{\partial t_3^*}{\partial b} \geq 0, \frac{\partial t_3^*}{\partial q} > (,=) 0 \leftrightarrow q < (,> \)

\( \frac{(3b-1)}{2} \frac{\partial t_3^*}{\partial t_1} \leq 0 \) and \( \frac{\partial t_3^*}{\partial t_2} \leq 0 \) hold.

Proof. The optimal tariff rate on daigou shopping can be found by solving \( \frac{\partial w_2}{\partial t_3} = 0 \leftrightarrow 5_3 = \frac{3bq-a^2-a+t_1+5t_2}{7} > (=,\langle 0 \leftrightarrow b > (=,\langle a^2+a+t_1+5t_2}{3} \equiv 5_8. \) Define \( t_3^* = \max (0, 5_3) \).

When \( t_3^* > 0 \) it follows that \( \frac{\partial t_3^*}{\partial b} = \frac{q}{2} > 0, \frac{\partial t_3^*}{\partial q} = \frac{3b-1-2a}{6} > (,=) 0 \leftrightarrow q < (,> \frac{3b-1}{2} \frac{\partial t_3^*}{\partial t_1} = -\frac{1}{6} < 0 \) 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.
3.1. Impacts of daigou shopping

We are now in a position to study the impacts of daigou shopping. 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 shopping 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.** 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, $\frac{d(\pi_1^* - \pi_1^*)}{db} = -\frac{g}{8} < 0$, $\frac{d(W_1^* - W_1^*)}{db} = -\frac{3a}{32} < 0$, $\frac{d(W_2^* - W_2^*)}{db} = \frac{5q}{32} > 0$ 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 $\bar{b}_1 \equiv 1 + \frac{t_1 - t_2 + 2t_3}{q}$, $\bar{b}_2 \equiv 1 + \frac{3(t_2 - t_1 - t_3)}{q}$ and $\bar{b}_3 \equiv 2q - 1 + \frac{-t_1 + 13t_2 + 6t_3}{3q}$. It also follows that $\bar{b}_2 < \bar{b}_3 \leftrightarrow t_2 < \frac{2q - q^2 + 2t_1}{8}$.

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 suppor daigou shopping knowing that would hurt their direct export to relevant markets. See Section 5 for some discussions.

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.
Figure 3. Impacts of daigou shopping.
Notes: based on following parameterizations: \( t_1 = 0.075, t_2 = 0.25, t_3 = 0, q = 0.5 \); positive values indicating the benefits of daigou shopping.

4. ROBUSTNESS OF THE RESULTS: DUOPOLY

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?\(^{12}\) In this section, we augment our benchmark model as presented in the previous section 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 instead of there is a single product quality as was in the benchmark case 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 complication, we assume away tax rate \( t_1 \) in North and also any tax rate

\(^{12}\)See Maskus (2004) for a survey article that outlines technology imitation/spillovers in China as an example.
that firm 2 incurs in South. We however retain $t_3$, the daigou tax 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. Note that the Southern market is now served with a high quality product by firm 1 and daigou shoppers and a low quality product by firm 2.

With such modifications of the model, we find that under the national exhaustion regime, among other things, the results as stated in Proposition 2 would continue to hold.\textsuperscript{13} That is, there exists an 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 $q$. Under the international exhaustion regime, positive optimal tariff rate for South and optimal daigou tax for North are also verified which are both inverted-U shape in $q$. However, while the optimal daigou tax for North is increasing in $b$ (consistent with results of our benchmark case), the optimal tariff rate for South is increasing in $b$ if and only if $k \geq 0.75$ and it is decreasing in $b$ otherwise, suggesting the North-South quality gap plays a role in the case of duopoly.

Finally, welfare implications of daigou shopping for North carries over but not that for South. That is, if $b$ is in a middle range, daigou shopping enhances firm 1’s profit and Northern welfare but might lower Southern welfare, especially if the North-South quality gap is large. This comes at no surprise given that daigou shopping might reduce the net social benefits for South given the extra competition between low and high quality products that could hurts firm 2 and tariff revenue more benefit Southern consumers. Figure 4 below provides an illustration of the welfare implications of daigou shopping under duopoly.

In summary, we have been able to confirm the robustness of most of our results in a duopoly setting. It is worth mentioning that our model can also be augmented to accommodate the following possible alternatives: imperfect competition in the daigou market, Northern firm’s investment in technology development, Northern firm producing multiple products, homogenous consumers and low tariff (or free trade) case. Given the complication of our model when adding these elements, we however leave these for future research.

\textsuperscript{13}The detailed analysis is available from the authors upon the request.
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) for a price mark-up. This is currently a hotly debated topic in many countries, given the rise of internet/online trading that makes daigou shopping an ultimate alternative for the traditional export channel.

Our theoretical model reveals that daigou shopping, under certain conditions, might bring about the welfare benefits for both North and South. The benefits are to be shared between consumers of the two countries and both the producer of the product and daigou shoppers. The policy implication (for North) is that since daigou shopping can generate efficiency, it should be encouraged, despite the fact that the producer of the product does not have a direct control on their sales in South through such a channel. However, as daigou shopping cannot replace entirely the official export, several important questions arise: Should daigou shopping be taxed, and if so what should the optimal tax rate be? and, does daigou shopping impact the optimal tariff rate that South sets on Northern import through the official export channel?

Figure 4. Impacts of daigou shopping (duopoly).

Notes: based on following parameterizations: $t_1 = 0$, $t_2 = 0.25$, $t_3 = 0$, $q = 0.5$, $k = 0.25$; positive values indicating the benefits of daigou shopping.
Our model and results provide an answer, and subsequently policy recommendations, to the above research questions. Notably, we have been able to show the existence of both a positive optimal daigou shopping tax rate in North and a positive optimal tariff rate in South on Northern products. These tax/tariff rates depend crucially on the relative market size of South versus North and the level of product quality and their relationship is determined by the nature of competition (monopoly or duopoly). These findings provide a possible framework for policy makers of both North and South with extra instruments (tariff policy for South and tax policy for North) to maximize social welfare with the inclusion of daigou activities in the economy. We believe these findings deserve the attention of not only researchers in the field but also producers and policy makers in countries that are vulnerable to parallel imports given the burgeoning (unavoidable) trend of the daigou shopping in the international economy.

REFERENCES


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