STRATEGIC COMPETITION AND OPTIMAL PARALLEL IMPORT POLICY

by

Santanu Roy and Kamal Saggi

Working Paper No. 11-W17

September 2011

DEPARTMENT OF ECONOMICS
VANDERBILT UNIVERSITY
NASHVILLE, TN 37235

www.vanderbilt.edu/econ

Strategic Competition and Optimal Parallel Import Policy.

Santanu Roy*
Southern Methodist University, Dallas, TX.

Kamal Saggi†
Vanderbilt University, Nashville, TN.

First draft: March 2011. Revised: September 2011

Abstract

This paper shows that parallel import policy can act as an instrument of strategic trade policy. We demonstrate this result in two-country international duopoly where a domestic monopolist competes with a rival firm in the foreign market if it chooses to incur the fixed investment cost of exporting. The two firms sell horizontally differentiated goods and compete in prices. When the foreign market is significantly larger than the domestic one, the home firm gains if it is *unable* to price discriminate; its desire to not deviate too far from its optimal monopoly price in the domestic market makes it (credibly) less aggressive in price competition abroad which softens price competition and raises profits. On the other hand, when the foreign market is not significantly larger, it is optimal for the home country to forbid parallel imports since international price discrimination yields higher profits to the home firm. We draw out the implications of the two types of parallel import policies for global welfare.

Keywords: Parallel Imports, Exports, Trade Policy, Oligopoly, Product Differentiation, Market Structure, Welfare.

JEL Classifications: F13, F10, F15.

*Department of Economics, Southern Methodist University, 3300 Dyer Street, Dallas, TX 75275-0496, USA. E-mail: sroy@smu.edu; Tel: (+1) 214 768 2714.

†Department of Economics, Vanderbilt University, Box 1819-Station B, Nashville, TN 37235-1819, USA. E-mail: k.saggi@Vanderbilt.Edu; phone: (+1) 615-322-3237.

1 Introduction

This paper shows that a country's policy stance towards parallel imports (PIs) can serve as an instrument of strategic trade policy by altering the behavior of its firm during price competition abroad.[1] It is well recognized that restrictions on PIs affect the ability of a monopolist to engage in price discrimination across markets with consequent welfare implications. What is somewhat less understood, however, is the effect PI policies have on strategic conduct and rent acquisition by firms engaged in *competition* in international markets, and how, in turn, these considerations influence the welfare calculus determining optimal PI policies.[2] In particular, when there are substantial differences in market structure and competitiveness across markets, permissive PI policies that tie the exercise of market power in one country to that in another may significantly modify the outcomes of strategic competition. Such asymmetries across markets often arise due to international differences in the degree of IPR protection, competition policy, and other such policies that determine market access.

In our two-country duopoly model, the products of the two firms are assumed to be differentiated horizontally on a Hotelling product space. To be able to export successfully, the home firm must first incur a fixed investment cost that is irreversible in nature. The endogenity of the home firm's export decision allows us to examines how the home country's PI policy affects the firm's incentive to export. The timing of decisions is as follows. First, the two governments (home and foreign) choose their PI policies: each government faces a discrete choice – to permit or forbid PIs. Next, the home firm decides whether or not to bear the fixed investment cost necessary to export. Finally, firms choose prices – if the home firm exports, firms compete in prices; otherwise each firm operates as a monopolist in its local market.

An important insight of our analysis is that, when PIs are prohibited by the home country, the domestic firm can reduce its price in the foreign market *without* a commensurate reduction in its domestic price, and as a result, it becomes a *more aggressive price competitor* in the foreign market relative to when PIs are permitted. While the freedom to reduce price abroad without lowering domestic profits tends to increase the domestic firm's foreign market share, it also tends to increase the intensity of price competition and therefore, reduces equilibrium market power in the foreign market. If sufficiently strong, this reduction in market power *reduces* the export profitability of the domestic firm and therefore creates a rationale for permitting PIs as opposed to restricting them.[3] It should be observed that this insight is

[1] Parallel imports arise when a product protected by some form of intellectual property rights sold by the rights holder in one country is re-sold in another country without the right holder's permission. The incentive to engage in such trade arises in the presence of significant price differences across countries.

[2] While much of the literature on parallel imports assumes a monopoly supplier, there do exist several analyses of international oligopoly with integrated and segmented markets where the underlying pricing regime is taken as exogenous: see, among others, Markusen and Venables (1988), Smith and Venables (1988) and Venables (1990). By contrast, in our model, national parallel import policies endogenously determine whether markets are segmented or integrated.

[3] In their seminal contribution to optimal strategic trade policy under oligopolistic competition, Grossman and Eaton (1986) showed that it may be optimal to impose an export tax on the home firm in order to soften international price competition; our paper indicates that parallel import policy can play a similar role.

novel to the existing literature on PIs that has tended to focus largely on the monopoly case.[4] To see why this matters, note that if the domestic firm were a global monopolist, then *ceteris paribus*, a restriction on PIs should (at least weakly) increase its incentive to serve the foreign market – after all, a monopolist is always free to charge a common price in both markets if it is profit maximizing to do so. Thus, by creating the possibility of international price discrimination, a prohibition of PIs by a country can only make its monopoly firm better off.

We find that when price competition abroad is intense, the home country is 'decisive' in the sense that only its PI policy affects the market outcome. Similarly, when competition abroad is weak, only the foreign country's policy is consequential. An important result of our analysis is that, despite the presence of strategic considerations, a country's nationally optimal policy can sometimes be globally optimal, making the need for international coordination over PI policies unnecessary. This congruence between national and global welfare obtains when the home country is decisive and the fixed costs of exporting are not too large so that inducing exports is nationally as well as globally optimal. Interestingly, we show that such a pro-trade (i.e. export inducing) PI policy is not unique; rather, underlying parameters determine whether permitting or prohibiting PIs induces exports.

On the other hand, when the foreign country is decisive, it always chooses to permit PIs. Such openness to PIs on its part can not only deter the home firm from exporting, but can also lower overall world welfare when the fixed cost of exporting is not too large. By showing that openness to PIs is not necessarily pro-trade and that such openness can create a significant international externality, the model helps gain some insight into the issue of when and why coordination over PI policies might be useful.

As is clear from above, an important aspect of our approach is that the home firm's decision to export is endogenous. This formulation is motivated by a host of empirical evidence which indicates that pricing regulations (which are another type of policy that affect the ability of firms to price discriminate internationally) have a strong influence on the entry of firms into foreign markets – see Danzon and Epstein (2008), Danzon et. al. (2005), Lanjouw (2005), and the recent overview article by Goldberg (2009). Furthermore, prior theoretical work on PIs has explicitly argued that price regulations and PI policies can lead firms to serve (or not serve) certain markets – see, for example, Malueg and Schwartz (1994).

In the current literature on PIs, the incentive for individual nations to impose restrictions on PIs primarily takes into account three sets of factors that result from the increased ability of firms to engage in international price discrimination. First, the change in domestic consumer welfare resulting from higher domestic retail prices in markets with more inelastic demand including the possibility that certain markets with very elastic demands may be served only when firms can price discriminate sufficiently – see Malueg and Schwarz (1994). Second, the increased ability of manufacturers to engage in vertical controls such as resale price maintenance and exclusive territories to protect retailers from competitive rent dissipation and free riding by foreign sellers which on the one hand, reduces retail competition thus increasing retail price, and on the other hand, increases the incentive of retailers to invest in

[4] For example, Malueg and Schwartz (1994), Richardson (2002), Valletti (2006), all assume that the product market is monopolistic. Roy and Saggi (2010) do consider an oligopolistic product market but, as we note below, their model differs from ours in important ways.

marketing, advertising and retail infrastructure in the domestic market that eventually benefits domestic consumers and expands demand – see Maskus and Chen (2002 and 2004) and Raff and Schmitt (2007). Third, the increased ability of governments to regulate domestic market power for various purposes and to preserve rent for private investment in R&D and production of intellectual property without having to contend with the dissipation of this rent through international arbitrage – see Li and Maskus (2006), Valletti (2006), Valletti and Szymanski (2006), and Grossman and Lai (2008). The structure of our model highlights a novel consequence of a restrictive PI policy viz., the change in the *competitiveness* of the domestic firm in the foreign market arising from its ability to charge a low price abroad without suffering any erosion in its domestic market power, the consequent change in the rent earned by the firm abroad and, in the final analysis, its very incentive to export. Finally, Roy and Saggi (2010) analyze PI policies in a *vertically* differentiated international oligopoly where, unlike this paper, there is no asymmetry in potential market access for firms, and the focus is on relating equilibrium government policies to differences in the structure of demand between countries.

The literature on industrial organization contains extensive analysis of entry and oligopolistic competition when firms have captive market segments and may or may not be able to price discriminate across market segments (see, Stole 2007). In particular, various authors have examined the consequence of regulations such as "universal service obligations" that prevent price discrimination across market segments (see, among others, Armstrong and Vickers 1993, Valletti et al 2002, Anton et al 2002). The comparison of market outcomes and regulations in this literature is often based on aggregate welfare of all market segments. In our framework, the ability to price discriminate across national boundaries is determined by independent policy decisions of various nations, and each nation cares only about its own national surplus ignoring the surplus acquired by foreign firms and consumers. This divergence of national interests is exactly why PI policies can end up acting as a type of strategic trade policy.

The paper is organized as follows. Section 2 describes the model while sections 3 and 4 derive equilibrium PI policies under strong and weak competition respectively. Section 5 discusses to what degree our results are robust to the mode of competition by considering a model where firms compete in quantities as opposed to prices. Section 6 concludes.

2 Model

There are two countries: home (H) and foreign (F). Firm h, the home country's domestic firm, has an intellectual property right (IPR) over its product. For the sake of concreteness, we will suppose that this IPR is a product patent. We will assume that the home firm faces no competition in the domestic market and can export its product to the foreign market after incurring a fixed cost. The foreign country has its own domestic firm, called the foreign firm (denoted by f), whose product is horizontally differentiated from the product of the home firm. Firm f's product can be sold legally within the foreign country but is not exported. Thus, there is asymmetry in potential market access between the two firms. One way to think about this asymmetry in potential market access is in terms of differences in IPR protection across countries. The home country offers strong protection and a broad interpretation of the

product patent held by the home firm that, in particular, precludes any closely related product from being sold within its borders. The foreign country, on the other hand, offers relatively weak protection and narrow interpretation of the product patent held by the home firm that, in particular, allows a substitute product to be sold within its borders. The foreign firm cannot export to the home country because of the strong and broad enforcement of the home firm's product patent in the home country. However, the asymmetry in potential market access can also arise from many other sources such as differences in the cost of marketing products abroad.

We adopt the Hotelling linear city model of horizontal product differentiation where the product space is the unit interval [0,1]; the home firm's product is located at 0 and the foreign firm's product is located at 1. Note that here location does not refer to geographical location but rather a physical characteristic (or type) of the product. We assume that production cost is zero for both firms. The market in each country consists of a continuum of consumers whose most desired product types are distributed uniformly on the unit interval. Each consumer buys one or zero unit of a product and earns gross surplus V from consuming the product. If a consumer consumes a product whose actual product type is located at a distance d from her "most desired" product type, she incurs a (psychological) transport cost $t.d$, $t > 0$, in addition to paying the price charged. The total mass of consumers in country i is given by $n_i \geq 0$, $i = H, F$. Without loss of generality, we set

$$n_H = 1, n_F = \beta. \tag{1}$$

To be able to export to the foreign market, the home firm must first incur the fixed cost $\phi \geq 0$. The motivation behind this assumption is simple: selling its good in the foreign market may require the home firm to make certain kinds of investment in dissemination of product information, creation of consumer awareness and establishing access to the retail infrastructure etc. Further, the firm may need to authorize sales of its product in the foreign market. These export related decisions have to be made prior to actual selling of goods in the foreign market, and are therefore assumed to be observable by its competitor before market competition occurs. In particular, if the home firm makes no investment and does not authorize sales of its product abroad, the foreign firm will know that it has unrestrained monopoly power in its domestic market. In order to abstract from issues related to vertical relationships, we will assume that firms sell their products directly to consumers or, equivalently, the retailing sector in each market is perfectly competitive with zero marginal retailing cost (so consumers buy at the price set by the manufacturing firm).

Each country chooses between one of two options - to allow PIs with no restrictions (P) or to not allow them at all (N). While one can imagine various intermediate options, these are the two types of policies that are most commonly observed and, in fact, correspond exactly to the binary decision on whether to have national or international exhaustion of intellectual property rights.

It is generally recognized that the possibility of PIs reduces the ability of a firm to sell its product at significantly lower prices in other countries. In order to focus on the strategic interaction between firms and governments, we assume perfect arbitrage; in particular, if PIs are allowed and a firm sells abroad at even slightly lower price, the competitive retailing

sector in the country can acquire the same product from abroad and sell it domestically at zero transaction cost.[5] In that case, if a firm wishes to serve both markets, it cannot sell abroad at lower price. If both countries permit PIs, then the firm must in fact charge equal prices in both markets. We will see that such uniformity in pricing may actually hold even if only one of the two countries permits PIs.

Formally, the game proceeds in three stages. First, the two governments decide whether or not to allow PIs. Next, the home firm decides whether or not to enter the foreign market. Finally, firms set prices in every market they serve. We determine the subgame perfect Nash equilibrium outcome of this game.

We assume that:

$$\beta > \frac{2}{3}. \tag{2}$$

$$\frac{3}{2}t \leq V \leq 4t \tag{3}$$

Restriction (2) and the second inequality in (3) together ensure that when the home firm does not pre-commit to exclude the foreign market, there exists a pure strategy equilibrium where it sells a strictly positive quantity in that market; in particular, the equilibrium profit of the home firm when it serves both markets exceeds the profit from serving only the home market even if the fixed cost ϕ is zero. The first inequality in (3) ensures that when both firms serve the foreign market, all consumers buy in equilibrium (complete market coverage); it also implies that $V > t$ so that it is socially optimal for all consumers to buy.

We begin with some general observations. For $i = h,\ f$, we denote the price, the quantity sold and the profit earned by firm i in its domestic and foreign markets by (p_i,q_i,π_i) and (p_i^*,q_i^*,π_i^*), respectively.

If firm i is the only firm serving its domestic market, then the domestic demand it faces is given by:

$$D_i(p_i) = n_i,\ p_i \leq V - t \tag{4}$$

$$= n_i\frac{V - p_i}{t},\ p_i \geq V - t. \tag{5}$$

The domestic monopoly price p_i^m and monopoly quantity q_i^m of firm i that maximize its domestic profit are given by:

$$p_i^m = V - t,\ q_i^m = 1, \text{ if } V \geq 2t \tag{6}$$

and

$$p_i^m = \frac{V}{2},\ q_i^m = \frac{V}{2t}, \text{ if } V \leq 2t. \tag{7}$$

If the home firm decides to export to the foreign country, then assuming that all buyers buy,

[5] This is obviously a simplifying assumption. In general, under an oligopolistic setting, the home firm can price discriminate internationally even if its country is open to parallel trade, provided that the number of firms is different in the two markets (see, among others, Ganslandt and Maskus, 2007).

the demand in the foreign country for the home firm's product is given by:

$$\begin{aligned} d_h(p_h^*, p_f) &= \beta\left[\frac{1}{2} + \frac{p_f - p_h^*}{2t}\right], \text{ if } (p_f - p_h^*) \in [-t, t] \\ &= 0, \text{if } (p_f - p_h^*) \leq -t \\ &= \beta, \text{ if } (p_f - p_h^*) \geq t, \end{aligned} \tag{8}$$

while

$$d_f(p_h^*, p_f) = \beta - d_h(p_h^*, p_f). \tag{9}$$

If the home firm can price discriminate across the two markets, it's reaction function in the foreign market is given by:

$$p_h^* = \frac{t + p_f}{2}. \tag{10}$$

The reaction function of the foreign firm is given by:

$$p_f = \frac{t + p_h^*}{2}. \tag{11}$$

These reaction functions assume that the prices are not too large so that the market is fully covered. If both firms have the reaction function as indicated above, then the it is easy to check that there is a unique Nash equilibrium outcome of price competition in country j's market given by:

$$p_h^* = p_f^* = t, \tag{12}$$

with each firm selling to half the market. Each firm's profits (gross of any fixed cost of serving the market) in the foreign country are given by:

$$\pi_f^* = \pi_f^* = \beta\frac{t}{2}. \tag{13}$$

Observe that in the above equilibrium, competitive price (t) is lower than the monopoly price ($\max\{V - t, \frac{V}{2}\}$) if, and only if, $V \geq 2t$. In particular, if $V < 2t$, then the competitive outcome generates prices in the foreign country that are higher than the monopoly price. The intuition here is that with competition, firms split the market and therefore the marginal buyer's taste or desired product is closer to the product each firm sells which, in turn, induces the firms to charge higher prices relative to a monopoly situation (the marginal buyer's taste is further away from the actual product type). We shall call this the *niche* effect.

In what follows, we refer to the situation where $V \geq 2t$ as *strong competition* and the situation where $V < 2t$ as *weak competition*; this also accords with the standard interpretation of higher values of t implying greater product differentiation and hence, softer price competition. As it turns out, there are major differences between the policy and market outcomes between these two cases. In particular, since only the home firm has the ability to export, only one country's PI policy ends up mattering. Under strong competition, if the home country is open to PIs then the home firm cannot price discriminate internationally since the price under competition is lower than its monopoly price and the foreign country's PI policy is irrelevant.

Similarly, when competition is weak, only the PI policy of the foreign country matters whereas the PI policy of the home country is not consequential. We begin with the strong competition case.

3 PI policy under strong competition

In this section, we analyze the policy and market outcomes where $V \geq 2t$ and competition in the foreign country is strong. Recall that under assumption (3), $V \leq 4t$ so that we effectively confine attention to $V \in [2t, 4t]$.

3.1 Market outcome

In this subsection, we characterize the market outcome (in stage 3) following each pair of PI policy choices, and the home firm's decision regarding whether or not to export.

Independent of the policy choices, if the home firm decides not to export to the foreign country, then the market outcome in each country is the autarkic monopoly outcome. In the rest of this subsection, we focus on the situation where the home firm chooses to export.

To begin, consider the situation where both countries prohibit parallel trade. This implies that the pricing decisions in the two markets are *independent* and, in particular, the home firm faces no constraint on its ability to price discriminate across the two markets. It follows then that in the home country, the home firm sets its domestic price at the monopoly level and sells the monopoly quantity as given by (6); in particular, all consumers buy in the home country. In the foreign country, the equilibrium prices are as indicated in (12) and firms split the market in the foreign country evenly. In particular, the profits (gross of the fixed cost of exporting) are given by:

$$\pi_h^N = V - t,\ \pi_h^{*N} = \pi_f^N = \beta\frac{t}{2}. \tag{14}$$

Observe that $V \geq 2t$ implies

$$p_h^N = V - t \geq p_h^{*B} = t$$

i.e., the domestic price of the home firm exceeds its foreign price, so that, as long as the home country prohibits parallel trade, the equilibrium market outcome remains unchanged even if the foreign country allows PIs (prevents the home firm from charging a *lower* price in its domestic market). Indeed, this is the unique equilibrium market outcome when the home country prohibits PIs, independent of the PI policy of the foreign country.

Next, consider the market outcome when *both* countries allow parallel trade so that the home firm is constrained to charge identical prices in both markets, i.e., $p_h = p_h^*$. In this case, the gross total profit of the home firm if it exports to the foreign country is given by:

$$p_h[1 + d_h(p_h, p_f)], \text{ for } p_h \geq V - t$$

and

$$p_h\left[\frac{V - p_h}{t} + d_h(p_h, p_f)\right], \text{ for } p_h \in [V - t, V]$$

where d_h is given by (8). Note that the profit function has a kink at $p_h = V - t$. Maximizing the two parts of the profit function with respect to p_h taking into account the boundary constraints, we obtain the reaction function of the home firm. Let $\underline{p}_f$ and $\overline{p}_f$ be defined as follows:

$$\underline{p}_f = 2V - t\left(3 + \frac{2}{\beta}\right) \text{ and } \overline{p}_f = 2\left(1 + \frac{1}{\beta}\right)V - t\left(3 + \frac{4}{\beta}\right).$$

It is easy to check that $\underline{p}_f < \overline{p}_f$ and that $\underline{p}_f$ and $\overline{p}_f$ are strictly positive if V is large relative to t, and less than zero if V is close to t.

The reaction function of the home firm is given by:

$$\begin{aligned} p_h &= \left(\frac{2+\beta}{\beta}\right)\frac{t}{2} + \frac{p_f}{2}, \text{ if } \underline{p}_f > 0 \text{ and } p_f \in \left[0, \underline{p}_f\right] \\ &= V - t, \text{ if } \overline{p}_f > 0 \text{ and } p_f \in \left[\max\{0, \underline{p}_f\}, \overline{p}_f\right] \\ &= \frac{1}{2(2+\beta)}[(2V + \beta t) + \beta p_f], \text{ if } p_f \geq \max\{0, \overline{p}_f\}. \end{aligned} \tag{15}$$

Observe that the above reaction function is flat for a certain range of the rival's price; this flat range corresponds to a discontinuity in the marginal revenue of the home firm at the kink point of its gross revenue function. The first part of the reaction function corresponds to the situation where the rival's price is sufficiently low so that the home firm also charges a low price (below its home monopoly price) to be competitive abroad; at such price, the home firm sells to all buyers at home. The second part of the reaction function reflects a situation where the price charged by the foreign firm is moderately high so that the home firm can charge its optimal monopoly price in the home market without losing much market share in the foreign market. In this range, even when the rival raises its price, the jump discontinuity in the marginal revenue of the home firm (at the home monopoly price where it sells to all home consumers) prevents the home firm from altering its best response. The last part of the reaction function corresponds to the situation where the foreign firm's price is so high that the home firm is induced to expropriate more revenue out of foreign buyers that have a closer taste for its product by raising its home rice *above* the optimal monopoly price – under such a situation, the home firm forsakes some profit in the domestic market to increase its profit in the foreign market.

The foreign firm 's reaction function is identical to that in (11). It can be checked that the (unique) Nash equilibrium outcome is given by:

$$p_h^P = t\left(\frac{4}{3\beta} + 1\right) \text{ and } p_f^P = t\left(\frac{2}{3\beta} + 1\right) \text{ if } V > 2t\left(\frac{2}{3\beta} + 1\right) \tag{16}$$

and

$$p_h^P = V - t \text{ and } p_f^P = \frac{V}{2} \text{ if } 2t \leq V \leq 2t\left(\frac{2}{3\beta} + 1\right). \tag{17}$$

Note that if $V > 2t\left(\frac{2}{3\beta}+1\right)$ then

$$t\left(\frac{4}{3\beta}+1\right) < V - t$$

so that the equilibrium described in (16) corresponds to a situation where the foreign firm's reaction intersects the home firm's reaction in the first of its three parts described in (15); the equilibrium described in (17) corresponds to an intersection in the second part of the home firm's reaction. In both cases, the home firm charges a price less than or equal to $V - t$, its optimal monopoly price at home. The Nash equilibrium outcome described above remains unperturbed even if the foreign country does not allow PIs so that the home firm is free to charge a *lower* price in its domestic market in the home country. Indeed, for $V \geq 2t$, this is the unique Nash equilibrium outcome when the home country allows PIs, independent of the PI policy of the foreign country. The quantities sold in this equilibrium are given by:

$$q_h^P = 1,\ q_h^{*P} = \frac{\beta}{2} - \frac{1}{3},\ q_f^P = \frac{\beta}{2} + \frac{1}{3},\ \text{if } V > 2t\left(\frac{2}{3\beta}+1\right) \tag{18}$$

and

$$q_h^P = 1,\ q_h^{*P} = \beta\left(1 - \frac{V}{4t}\right),\ q_f^P = \frac{\beta V}{4t},\ \text{if } 2t \leq V \leq 2t\left(\frac{2}{3\beta}+1\right). \tag{19}$$

Assumption (2) ensures that that all quantities are strictly positive. Observe that, $p_h^P > p_f^P$ which reflects the fact that the home firm is less aggressive in price competition than the foreign firm because it loses profit in its home market if it reduces price (below its monopoly price); this is reflected in the lower market share of the home firm. Since $p_h^P \leq V - t$, all consumers buy in the home country and therefore, the quantity sold in the home country is identical to that when the home firm is free to price discriminate between the two countries. Also observe that the prices are higher than what the two firms charge in the foreign market when the home firm can price discriminate: in other words, *non-discrimination softens price competition.*

The literature on PIs has emphasized that allowing PIs reduces domestic price and increase domestic consumers surplus. This effect can be seen here as long the home firm serves the foreign market. Whether or not PIs are permitted, all consumers buy in the home market. If $V > 2t\left(\frac{2}{3\beta}+1\right)$, then the home price falls from $(V-t)$ to $t\left(\frac{4}{3\beta}+1\right)$ when the home country moves from a policy of prohibiting PIs to allowing it, which raises the domestic consumer surplus at home (total transport cost remains unchanged). If $V \leq 2t\left(\frac{2}{3\beta}+1\right)$, the home price and home consumers surplus remain unaffected by PI policy.

In the range of parameter values where the equilibrium price of the home firm is strictly below $(V-t)$, the prices charged by both firms decline with β, the relative size of the market in the foreign country. If $V > 2t\left(\frac{2}{3\beta}+1\right)$ firm profits (gross of the fixed cost of exporting)

are as follows:

$$\pi_h^P = t\left(\frac{4}{3\beta}+1\right),\ \pi_h^{*P} = t\left(\frac{4}{3\beta}+1\right)\left(\frac{\beta}{2}-\frac{1}{3}\right),\ \text{and}\ \pi_f^P = t\left(\frac{2}{3\beta}+1\right)\left(\frac{\beta}{2}+\frac{1}{3}\right) \tag{20}$$

whereas if $2t \leq V \leq 2t\left(\frac{2}{3\beta}+1\right)$ we have

$$\pi_h^P = V - t,\ \pi_h^{*P} = \beta(V-t)\left(1-\frac{V}{4t}\right),\ \text{and}\ \pi_f^P = \frac{\beta V^2}{8t} \tag{21}$$

It can be checked that

$$\pi_h^{*P} \geq \pi_h^{*N} \Longleftrightarrow \beta \geq \beta^* \equiv \frac{4}{3}\max\left\{1, \frac{t}{V-2t}\right\}. \tag{22}$$

i.e., if the home firm exports, it earns higher profit under non-discriminatory pricing (than under price discrimination) if, and only if, the size of the foreign market (β) exceeds the critical threshold β^*.

Using (2) and the second inequality in (3), we have

$$\pi_h^P + \pi_h^{*P} \geq V - t,$$

so that the home firm is always better off serving both markets than simply serving the home market, if the fixed cost $\phi = 0$.

To sum up, when $V \geq 2t$ (strong competition) and the home country allows PIs, the following hold: (*i*) If the home firm chooses to export, it charges a common price in both markets that does not exceed the monopoly price in its domestic market and lies strictly below the latter if competition is very strong (in which case it sacrifices domestic profit when it serves the foreign market). (*ii*) All consumers buy in the home country. (*iii*) Both firms charge prices that are higher than what they would if the home firm could price discriminate between the two markets. (*iv*) The home firm charges a higher price and has lower market share in the foreign country than the foreign firm and the gross foreign profit of the home firm is higher than what it earns if it is free to price discriminate between the two markets if, and only, if $\beta \geq \beta^*$ i.e., the foreign market is relatively large.

3.2 Policy outcome

From our discussion in the previous section, it follows that under strong competition, the market outcome is independent of the PI policy of the foreign country. All that matters is whether or not the home country allows PIs. The next proposition describes the optimal policy of the home country:

Proposition 1 *Suppose $V \geq 2t$ (strong competition). Then, the following hold:*

(*i*) *If $\beta \leq \beta^*$ then it is optimal for the the home country to prohibit PIs. This is the unique optimal policy if $\beta < \beta^*$ and $\phi < \pi_h^{*N}$ (otherwise the home country is indifferent between the*

two policies). Further, for $\beta < \beta^*$ and $\phi \in [\pi_h^{*P}, \pi_h^{*N}]$, the home country's prohibition of PIs is pro-trade i.e. it induces the home firm to export.

(ii) If $\beta \geq \beta^*$ then it is optimal for the home country to allow PIs. This is the unique optimal policy if $\beta > \beta^*$ and $\phi < \pi_h^{*P}$ (otherwise the home country is indifferent between the two policies). Further, for $\beta > \beta^*$ and $\phi \in [\pi_h^{*N}, \pi_h^{*P}]$, the home country's openness to PIs is pro-trade i.e. it induces the home firm to export.

The proof of the proposition is straightforward. Regardless of the home country's policy, the home firm sells to all consumers in the home market so that total *domestic* surplus generated in the home country is independent of its PI policy. Thus, the only way in which PI policy of the home country affects domestic welfare is via its impact on the net foreign rent acquired by the home firm in the foreign country. From our discussion in the previous section (and particularly, using (22)), we know that the home country can increase the rent acquired by the home firm in the foreign market by allowing PIs if, and only if, $\beta \geq \beta^*$. The rest of the proposition follows immediately.

Thus, when competition in the foreign market is strong, the home country's PI policy (which is all that matters for the market outcome) is based exclusively on the profitability of its firm. When the foreign market is not significantly larger a home prohibition on PIs allows the domestic firm to price discriminate internationally and thereby creates the most profitable conditions for it in the foreign market (and therefore provides the most inducement to export). On the other hand, if the foreign market is significantly larger, allowing PIs and preventing the domestic firm from price discrimination creates the best opportunity for it to profit from the foreign market. This is because such a policy softens price competition abroad by making the domestic firm *less willing* to lower its price and the profit gain from being able to charge higher prices outweighs the competitive disadvantage that the domestic firm suffers by being constrained to charge the same price in both markets. The nationally optimal PI policy under strong competition is always pro-trade; in particular, when the foreign market is not significantly larger in size and the fixed cost of exporting is moderately large, it is the prohibition of PIs that induces the home firm to export.

3.3 Global welfare analysis under strong competition

In this section, we analyze the implications of the optimal policy choice by the decisive country (the home country in the case of strong competition) for global welfare (which in our model, reduces to the total net surplus of the two countries).

To begin, observe that as both markets are fully covered in equilibrium, as long as the home firm serves the foreign market, the only difference in global surplus across market outcomes induced by PI policies is in the total transport cost incurred by consumers in the foreign market. If PIs are not allowed and the home firm exports, then the market outcome in the foreign country is one where each firm has equal market share; this is the "first best" outcome as it minimizes total transport cost. If PIs are not allowed and the home firm exports, the home firm sells to less than half the foreign market which adds to the transport cost in the foreign market and therefore leads to loss of welfare. However, this does not mean that prohibiting PIs is always globally efficient as the home firm may then choose to not serve the

foreign market. If the home firm chooses to abandon the foreign market as a consequence of change in PI policy, then the global welfare implication is based on a comparison of the increase in transport cost when only one (instead of two) products are sold in the foreign market and the fixed cost of serving the foreign market. The next proposition outlines the welfare implications of optimal policy:

Proposition 2 *Suppose $V \geq 2t$ (strong competition).Then, the following hold:*

(i) Suppose $\phi \leq \min\{\pi_h^{*P}, \pi_h^{*N}\}$. If $\beta \leq \beta^*$ then the home country's policy decision to prohibit PIs is globally efficient. On the other hand, if $\beta > \beta^*$ then the home country's policy decision to permit PIs is globally inefficient.

(ii) Suppose $\min\{\pi_h^{*P}, \pi_h^{*N}\} \leq \phi \leq \max\{\pi_h^{*P}, \pi_h^{*N}\}$. Then, the following hold:

(ii.a) When $\beta \leq \beta^*$ the home country's policy decision to prohibit PIs is globally efficient if $\phi \leq \frac{t\beta}{4}$; otherwise, it is inefficient.

(ii.b) When $\beta > \beta^*$ the home country's policy decision to permit PIs is globally efficient if $\phi \leq t\beta(\frac{1}{4} - \frac{1}{9\beta^2})$; otherwise it is inefficient.

A formal proof of this proposition is contained in Roy and Saggi (2011a), the working paper version of this paper.

Part (i) of Proposition 2 describes a situation where the fixed costs of exporting are small and the home firm exports to the foreign country regardless of the PI policy of the home country. As indicated above, in that case, the equilibrium policy outcome is efficient (first best) if, and only if, the home country prohibits PIs and using Proposition 1, this occurs if, and only if, $\beta \leq \beta^*$. Parts $(ii.a)$ and $(ii.b)$ refer to a situation where the PI policy of the home country does affect the home firm's incentive to export. Under such a scenario, the home country's optimal policy is one that induces its firm to export to the foreign country. However, this product market outcome is globally efficient only when the fixed cost of exporting is not larger than the reduction in total transport cost in the foreign market when the home firm exports (at uniform or discriminatory pricing depending on the nature of the optimal PI policy of the home government which, as we have seen in Proposition 1 depends on whether β is above or below β^*).

Proposition 2 generally indicates that *unless the fixed cost of exporting is large, the home country's policy choice is globally optimal.* This implies that in markets where fixed costs of exporting are minor, there may be little reason for international intervention or coordination over PI policies. Note that this conclusion also applies to nations that choose to prohibit PIs from relatively similar sized countries.

4 Weak competition and PI policy

In this section, we analyze the policy and market outcomes where $V < 2t$ i.e., competition in the foreign country is weak. Recall that under assumption (3), $V \geq \frac{3}{2}t$ so that we effectively confine attention to $V \in (\frac{3}{2}t, 2t)$. In order to ensure that the duopoly outcome in the foreign market is always one with complete market coverage (all consumers buy), we need the following

additional restriction:

$$t < \frac{5+3\beta}{4+3\beta} \tag{23}$$

Note that (23) is always satisfied if $t < 1$.

4.1 Market outcome with weak competition

In this subsection, we characterize the market outcome following each pair of PI policy choices and the decision of the home firm on whether or not to serve the foreign market.

As before, independent of the policy choices, if the home firm decides not to serve the foreign market (in the foreign country), then the market outcome in each country is the autarkic monopoly outcome as indicated in (7). Note that $V < 2t$ implies that (unlike the case of strong competition) the monopoly outcome now is one where some consumers do not buy and monopoly power causes domestic distortion. In the rest of this subsection, we focus on the situation where the home firm does serve its foreign market.

To begin, consider the situation where *both countries prohibit parallel trade*. This implies that the home firm faces no constraint on its ability to price discriminate between its domestic and foreign markets. It follows then that in the home country, the home firm sets its domestic price at the monopoly level and sells the monopoly quantity as given by (7). In the foreign country, the equilibrium prices are as indicated in (12) and the firms split the market in the foreign country evenly. In particular, the profits (gross of the fixed cost of serving the foreign market) are given by:

$$\pi_h^N = \frac{V^2}{4t},\ \pi_h^{*N} = \pi_f^N = \beta\frac{t}{2}. \tag{24}$$

Observe that $V < 2t$ implies

$$p_h^N = \frac{V}{2} < p_h^{*N} = t$$

i.e., the domestic price of the home firm is below its competitive foreign price. This equilibrium market outcome remains unchanged even if the home country allows parallel trade as long as the foreign country prohibits parallel trade. Indeed, this is the unique equilibrium market outcome when the foreign country prohibits parallel trade, independent of the PI policy of the home country. Note that that the net welfare generated in the foreign country in the above market outcome if the home firm serves both markets is given by:

$$\begin{aligned} W_F^N &= \beta V - \beta \int_0^{\frac{q_h^{*N}}{\beta}} txdx - \beta \int_0^{\frac{q_f^N}{\beta}} txdx - \pi_h^{*N} \\ &= \beta\left(V - \frac{3t}{4}\right). \end{aligned} \tag{25}$$

Next, suppose that both countries allow PIs so that the home firm cannot price discriminate between home and foreign markets. Recall that in this case the domestic monopoly price of the home firm is $\frac{V}{2} > V - t$. Suppose the home firm serves its foreign market in the foreign country. The reaction functions of the two firms continue to be as given by (15) and (**??**) that

were derived in the previous section. However, it can be checked that the (unique) Nash equilibrium outcome is one where the foreign firm's reaction function intersects the home firm's reaction in the third part of the three parts described in (15). In particular, the equilibrium prices are:

$$p_h^P = \left(\frac{4V + 3\beta t}{8 + 3\beta}\right) \text{ and } p_f^P = \left(\frac{2V + (3\beta + 4)t}{8 + 3\beta}\right). \tag{26}$$

The quantities sold in this equilibrium are given by:

$$q_h^P = \frac{1}{t}\left(\frac{4V + 3\beta(V - t)}{8 + 3\beta}\right),\ q_h^{*P} = \beta\left(\frac{1}{2} + \frac{1}{t}\frac{2t - V}{8 + 3\beta}\right), \text{ and } q_f^P = \beta\left(\frac{1}{2} - \frac{1}{t}\frac{2t - V}{8 + 3\beta}\right). \tag{27}$$

It is easy to check that under (23), all consumers earn positive net surplus. The equilibrium common price p_h^P charged by the home firm satisfies:

$$p_h^P > \frac{V}{2} > V - t$$

and further

$$p_h^P < p_f^P \text{ and } q_h^{*P} > q_f^P.$$

In other words, in trying to compete with the foreign firm in the foreign market using a non-discriminatory pricing, the home firm actually ends up raising both its own price (as well as its rival's price) above its domestic monopoly price. As the home firm incurs a loss of domestic profit whenever it raises its price above the domestic monopoly price, it is actually more reluctant to raise its price than the foreign firm, and hence *more aggressive* in price competition (over this range of prices) than the foreign firm, despite the fact that the foreign firm has no captive market to reckon with. This reflects the niche effect that we discussed earlier; as competition is weak and consumers care strongly about taste, firms have an incentive to raise their price sharply when they serve smaller number of consumers whose tastes are closer to their product type.

The fact that p_h^P exceeds the home monopoly price ($\frac{V}{2}$) that the home firm would like to charge in its domestic market if it was allowed to price discriminate, also implies that the above Nash equilibrium outcome remains unperturbed if the home country prohibits parallel trade i.e., if the home firm is allowed to charge a *higher* price in its domestic market. Indeed, for $V < 2t$, this is the unique Nash equilibrium outcome when the foreign country allows parallel trade, independent of the PI policy of the home country.

The gross foreign profit earned by the home firm when it charges a common price in both markets is given by:

$$\pi_h^{*P} = \frac{\beta(4V + 3\beta t)}{8 + 3\beta}\left(\frac{1}{2} + \frac{1}{t}\frac{2t - V}{8 + 3\beta}\right). \tag{28}$$

It should be noted that even though the price charged by the home firm is higher than its domestic monopoly price (i.e. $p_f^P > \frac{V}{2}$), it is lower than what it would charge in the foreign country if it could price discriminate (wherein it charges t abroad) since $V < 2t$ implies $p_h^P < t$. It is straightforward to check that even though the home firm earns higher market share in

the foreign country than it would if it could price discriminate (where firms split the market evenly), the profit it earns under non-discriminatory pricing in the foreign country is lower:

$$\pi_h^{*P} < \pi_h^{*N} = \frac{t\beta}{2}. \tag{29}$$

Using the fact that $V \in (\frac{3}{2}t, 2t)$, it is easy to check that the equilibrium total profit of the home firm exceeds its optimal monopoly profit at home and the home firm always serves the foreign market if the fixed cost $\phi = 0$.

The total welfare generated in the foreign country (when $V < 2t$ and the home firm exports) is given by the gross surplus net of total transport cost and the profit lost to the home firm:

$$\begin{aligned} W_F^P &= \beta V - \beta \int_0^{\frac{q_h^{*P}}{\beta}} txdx - \beta \int_0^{\frac{q_f^P}{\beta}} txdx - \pi_h^{*P} \\ &= q_h^{*P}\left(\frac{t}{\beta}q_f^P - p_h^P\right) + \frac{\beta}{2}(2V - t). \end{aligned} \tag{30}$$

It can be checked that:

$$W_F^P > W_F^N \tag{31}$$

i.e., the home firm generates higher net welfare in the foreign country when it serves that market with nondiscriminatory pricing rather than with discrimination. Even though the home firm holds higher market share under non-discrimination and, in particular, causes loss of welfare by increasing the taste related "psychological cost" incurred by buyers, it also expropriates less rent and the latter effect dominates.

4.2 Policy outcome with weak competition

In this subsection, we outline the implications for PI policy that follow from our analysis of the effect of PI policy on market outcomes for the case of weak competition.

From our discussion in the previous subsection, it follows that the market outcome is independent of the PI policy of the home country, the exporting nation. All that matters is whether or not the foreign country, the importing nation, allows PIs. The next proposition outlines the optimal policy of the foreign country:

Proposition 3 *Suppose $V < 2t$. If $\phi \leq \pi_h^{*N}$, then it is optimal for the foreign country to permit PIs, while for $\phi > \pi_h^{*N}$ the PI policy of the foreign country has no impact on the market outcome. In particular, if $\phi \leq \pi_h^{*P}$, if the foreign country allows PIs then the home firm exports to its market charging a non-discriminatory price in both countries whereas if $\phi \in [\pi_h^{*P}, \pi_h^{*N}]$, then the foreign country's openness to PIs deters the home firm from exporting and preserves the foreign firm's local monopoly.*

The proof of the proposition follows directly from our discussion in the previous subsection. When the foreign country permits PIs it generates the nondiscriminatory pricing outcome,

while prohibiting PIs allows the home firm to price discriminate in equilibrium. As shown in the previous we have that the home firm generates higher net welfare in the foreign country when it serves that market with nondiscriminatory pricing rather than with discrimination i.e., $W_F^P > W_F^N$. However, we have also seen that the gross foreign profit of the home firm under the two PI policy options of the foreign country satisfy: $\pi_h^{*P} < \pi_h^{*N}$. It follows therefore that if $\phi \leq \pi_h^{*P}$, the home firm serves the foreign market independent of the PI policy of the foreign country and in that case, it is optimal for the foreign country to allow PIs. On the other hand, if $\phi \in [\pi_h^{*P}, \pi_h^{*N}]$, then the home firm serves the foreign market only if the foreign country prohibits PIs, in which case the welfare of the foreign country is given by W_F^N; if the foreign country allows PIs, the market in the foreign country is monopolized by the foreign firm which then charges the monopoly price $\frac{V}{2}$, sells to $\beta \frac{V}{2t}$ buyers and leads to welfare:

$$\widehat{W}_F = \beta \left(\frac{V^2}{2t} - \int_0^{\frac{V}{2t}} txdx \right)$$

It can be shown that $W_F^N < \widehat{W}_F$ for $V \in (t, 2t)$ so that it is optimal for the foreign country to permit PIs to prevent the home firm from entering its market.[6]

Proposition 3 indicates that unlike the case of strong competition, for the range of parameters for which the choice of PI policy matters for the market outcome, the decisive country under weak competition has a *unique* nationally optimal policy choice and it is one of allowing PIs. By allowing PIs, the foreign country prevents price discrimination by the home firm that, in turn, actually *reduces* the rent that the home firm can extract via exporting (though it increases the firm's market share in the foreign country). With weak competition, reducing rent transfer abroad becomes the driving motive of the foreign country's policy. In fact, if the fixed cost of exporting exceeds a certain level, the optimal policy of allowing PIs by the foreign country deters entry by the home firm and leads to autarky.

4.3 Global welfare under weak competition

We now analyze the global welfare implication when competition is weak. Since the foreign country is decisive here, it is sufficient to focus on its policy.

Proposition 4 *Suppose $V < 2t$ (Weak Competition). Then, the following hold:*

(i) If $\phi \leq \pi_h^{*P}$ then the foreign country's decision to permit PIs is globally inefficient.

(ii) If $\pi_h^{*P} < \phi \leq \pi_h^{*N}$ then the foreign country's policy to permit PIs is globally suboptimal if ϕ is small whereas it is globally optimal if ϕ is large enough i.e. it lies within the interval $(\pi_h^{*P}, \pi_h^{*N}]$.

A formal proof of this proposition is contained in Roy and Saggi (2011a), the working paper version of this paper.

[6] It is straightforward to establish that $W_2^N < \widehat{W}_2$ if $3V^2+6t^2-8tV > 0$. Furthermore, we have $3V^2+6t^2-8tV = (2t-V)^2 + 2t(\frac{2}{3}V - t)$ which is positive for $V \geq \frac{3}{2}t$ and $3V^2 + 6t^2 - 8tV = (V-t)^2 + t(t - \frac{2}{3}V)$ which is positive for $V \leq \frac{3}{2}t$.

Thus, under weak competition, not only is the market outcome dependent only on the PI policy of the importing nation (the foreign country), but the nationally optimal policy choice of the foreign country generates an outcome that is globally inefficient unless the fixed cost ϕ of serving the foreign market is very large. In particular, with weak competition the foreign country's optimal policy of allowing PIs to prevent price discrimination is geared towards reducing the rent expropriated by the foreign firm, and this is what leads to global inefficiency. This suggests that with weak competition (that may be closely related to weak protection of IPRs available to foreign firms in importing nations), there is a case for reversing the apparently open PI policies of such nations since such policies can simply driven by the desire to preserve the rents of local firms and may, in fact, restrict trade if the fixed cost of exporting is moderately large.

5 Discussion: Robustness to Alternative Modeling.

It is well known that results in the literature on strategic trade policy are often sensitive to whether the underlying strategic interaction between firms takes place in a game of strategic complementarity or substitutability. Our results on the nature of strategic PI policy have been derived in a framework where firms engage in price competition in the foreign market (i.e., the market game is one of strategic complementarity). It is natural to wonder whether the qualitative results would be overturned if firms engaged in Cournot quantity competition instead (game of strategic substitutability).

Roy and Saggi (2011b) contains a simple treatment of a Cournot version of our model assuming that firms produce homogenous goods and that market demand is linear in both countries. For simplicity, the fixed cost of exporting is ignored. In such a framework, whether the home monopoly price exceeds the foreign competitive price (with segmented markets) depends on the relative size of home demand and this, in turn, determines whether the home or the foreign government's PI policy is consequential; if the relative size of home demand exceeds a threshold, only the home government's PI policy matters, while the foreign government's policy is decisive below the threshold. As one would expect, relative to price competition, Cournot competition generates very different strategic incentives for the firms and the governments. Nonetheless, several key qualitative results developed in the model with price competition continue to hold.

First, a permissive PI policy regime that forces the home firm to engage in uniform pricing at home and abroad can increase its total profit, and therefore its incentive to serve the foreign market. This is one of the key effects underlying our results in Section 3. Under price competition, the captive market at home makes the home firm unwilling to price low in the foreign market under uniform pricing, and due to strategic complementarity it also induces to the foreign firm to charge a higher price; the net result is that both firms may end up charging higher prices in equilibrium and earning higher profits than under discriminatory pricing. In the Cournot competition case, the mechanism through which uniform pricing benefits the home firm is somewhat different and can be decomposed into two opposing forces. When home demand is relatively smaller than foreign demand, the captive market at home induces the home firm to maintain low uniform price across the two markets which, in turn, induces

it to produce large quantity in the foreign markets; the no discrimination constraint in effect helps the home firm to credibly commit to sell large quantities and *shifts its reaction function out*. Because of strategic substitutability, this tends to reduce the market share of the foreign firm thus creating an advantage for the home firm (and does not necessarily aggravate the intensity of competition as would be true under strategic complementarity). But there is an opposing effect of the no discrimination constraint: the home firm is much more willing to contract its output in response to any expansion of the rival's output *(i.e. it makes the home firm's reaction function steeper*). This is because the home firm may to sell more at home to equalize prices suffering loss in its home profit and, to reduce this loss, it is willing to cut back its foreign output more aggressively. This "more accommodating" stance of the home firm in response to expansion of output by the foreign firm works against the first effect; the foreign firm is likely to take advantage of this and push its own sales more aggressively. Whether the first effect dominates the second depends on the relative size of home demand. When home demand is relatively low, the uniform pricing constraint induced by a permissive PI policy raises the home firm's profit and in fact, increases its market share in the foreign market as well as the volume of trade.

Second, in the Cournot case when home demand is significantly large relative to foreign demand, the home government prohibits PIs in order to induce the home firm to serve the foreign market; if there were a positive fixed cost of serving the foreign market this effect would be further enhanced. This is very similar to the result obtained with price competition.

Third, in the Cournot case, if home demand is not significantly larger than foreign demand and the home government's PI policy is decisive, it prefers to allow PIs; this is comparable to our result that with price competition, the home government permits PIs under price competition when the foreign market is significantly larger and the home government is decisive (which happens when competition is strong).

Finally, wherever the foreign government's PIs policy is decisive, it allows PIs (as in the weak competition case under price competition).

As one would expect, not all results under quantity competition are qualitatively similar to that under price competition. The main differences between quantity and price competition are regarding the effect of policy on quantity exported and whether the optimal policy is pro-trade. Further, unlike the case of price competition, the effects of PI policy on profits of the two firms may go in opposite directions; this is also true about the effect on home welfare and the profit of home firm.

An important feature of our model is that the home firm enjoys monopoly power at home but faces competition in the foreign market. As noted in Section 2, this asymmetry can be seen as a way to capture the differences in IPR protection across countries; the home government ensures broad and strong protection of the IPR of the home firm that in effect creates monopoly power at home, but the same is not true in the foreign market. Such asymmetries often exist between developed and developing country markets for many products. While the existence of asymmetry in market power is important for our results, the precise nature of this asymmetry is less so. We expect that our qualitative results should hold even if the home firm faces some competition in the home market (from, say, a local firm) as long as the intensity of competition is significantly lower in the home market than in the foreign market.

6 Conclusion

This paper derives optimal national PI policies in an environment where such policies affect strategic price competition as well as global market structure. This is in sharp contrast with existing literature that has tended to focus almost exclusively on monopoly. By incorporating strategic interaction in the product market, we are able to highlight some hitherto ignored consequences of PI policies. Our findings suggest that a country's PI policy can act as a strategic trade policy by altering the competitiveness of its firms engaged in oligopolistic competition in foreign markets. More specifically, in our two-country model, when product market competition is intense, a prohibition of PIs by the home country eliminates the threat of arbitrage induced PIs and allows the home firm to lower its price abroad without suffering any reduction in its domestic market power. This increased ability to compete abroad without having to lower its domestic price can in turn increase the firm's incentive to export. In this way, a prohibition on PIs by the home can actually end up acting as a pro-trade policy by making exporting more attractive to its firm.

Our analysis also points out that when market competition is weak, openness to PIs on the part of the home country makes its firm less willing to lower price abroad thereby softening international price competition and making exporting more attractive. Thus, whether forbidding PIs is in the national interest or not depends upon whether the home firm is better off having the freedom to price discriminate internationally or not.

We also investigate the welfare properties of national PI policies. An important and somewhat surprising result of our analysis is that nationally optimal PI policies can sometimes be globally optimal, eliminating the need for international coordination over such policies. Such congruence between national and global interests occurs when the policy chosen is pro-trade (i.e. export inducing) and the fixed costs of exporting small. On the other hand, openness to PIs that results in the preservation of a local monopoly is not only anti-trade but can also be globally inefficient.

To focus on the novel considerations that arise from strategic interaction between firms, we have abstracted from aspects of PI restrictions related to incentives for investment in R&D, protection of IPRs, exercise of vertical controls and investment by retailers. Future research might address to what extent the findings of the literature examining these considerations in the context of PIs hold under the type of oligopolistic environment considered by us.

References

[1] Anton, J., Vander Weide, J. and N. Vettas, 2002. Entry auctions and strategic behavior under cross-market price constraints. International Journal of Industrial Organization 20, 611-629.

[2] Armstrong, M. and J. Vickers, 2001. Competitive price discrimination. The Rand Journal of Economics 32, 579-605.

[3] Danzon, P. and A. Epstein, 2008. Effects of regulation on drug launch and pricing in interdependent markets. National Bureau of Economic Research Working Paper No. 14041.

[4] Danzon, P., Wang, Y. R., and L. Wang, 2005. The impact of price regulation on the launch delay of new drugs. Journal of Health Economics 14, 269-92.

[5] Eaton, J., Grossman, G.M., 1986. Optimal trade and industrial policy under oligopoly. The Quarterly Journal of Economics 101, 383-406.

[6] Ganslandt, M., Maskus, K., 2007. Vertical distribution, parallel trade, and price divergence in integrated markets. European Economic Review 51, 943-970.

[7] Goldberg, P. K., 2009. Intellectual property rights protection in developing countries: the case of pharmaceuticals. Journal of the European Economic Association, forthcoming.

[8] Grossman, G.M., Lai, E., 2008. Parallel imports and price controls. Rand Journal of Economics 39, 378-402.

[9] Lanjouw, J. O., 2005. Patents, price controls and access to new drugs: how policy affects global market entry. National Bureau of Economic Research Working Paper No. 11321.

[10] Li, C., Maskus, K.E., 2006. The impact of parallel imports on investment in cost-reducing research and development. Journal of International Economics 68, 443-455.

[11] Malueg, D.A., Schwartz, M., 1994. Parallel imports, demand dispersion, and international price discrimination. Journal of International Economics 37, 167-195.

[12] Markusen, J.R., Venables, A.J., 1988. Trade policy with increasing returns and imperfect competition. Journal of International Economics 24, 299-316.

[13] Maskus, K.E., 2000. Parallel imports. World economy 23, 1269-1284.

[14] Maskus, K.E., Chen, Y., 2002. Parallel imports in a model of vertical distribution: theory, evidence, and policy. Pacific Economic Review 7, 319-334.

[15] Maskus, K.E., Chen, Y., 2004. Vertical price control and parallel imports: theory and evidence. Review of International Economics 12, 551-570.

[16] Raff, H., Schmitt, N., 2007. Why parallel trade may raise producers' profits. Journal of International Economics 71, 434-447.

[17] Richardson, M., 2002. An elementary proposition concerning parallel imports. Journal of International Economics 56, 233-245.

[18] Roy, S., Saggi, K., 2010. Equilibrium parallel import policies and international market structure. Mimeo.

[19] Roy, S., Saggi, K., 2011a. Strategic competition and optimal parallel import policy. Working Paper. Department of Economics, Southern Methodist University, Dallas, Texas.

[20] Roy, S., Saggi, K., 2011b. Notes on optimal parallel import policy under Cournot competition. Miemo.

[21] Smith, A., Venables, A.J., 1988. Completing the internal market in the European Community: Some industry simulations. European Economic Review 32, 1501-1525.

[22] Valleti, T.M., 2006. Differential pricing, parallel trade, and the incentive to invest. Journal of International Economics 70, 314-324.

[23] Valletti, T.M., Hoernig, S. and P. Barros, 2002. Universal service and entry: the role of uniform pricing and coverage constraints. Journal of Regulatory Economics 21, 169-190.

[24] Valletti, T.M., Szymanski, S., 2006. Parallel trade, international exhaustion and intellectual property rights: a welfare analysis. Journal of Industrial Economics 54, 499-526.

[25] Venables, A.J., 1990. The economic integration of oligopolistic markets. European Economic Review 34, 753-73.