The regional exhaustion of intellectual property

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First version: January 2012. This version: April 2012

Abstract

This paper analyzes the causes and consequences of regional exhaustion of intellectual property, a discriminatory policy regime under which a set of countries permit parallel imports from one another but not from the rest of the world. A three-country model is developed in which each country chooses between national (NE), international (IE), or regional exhaustion (RE). To the best of our knowledge, this is the first model to explicitly endogenize the choice between the three types of exhaustion regimes that are observed in the world. We find that when countries A and B are relatively similar to each other in size and country C is sufficiently small relative to them, in equilibrium, at least one of the large countries chooses RE with respect to the other large country (who either opts for RE or NE). We also consider a scenario where countries can only implement non-discriminatory exhaustion regimes (i.e. NE or IE). Comparing the outcomes under this non-discrimination scenario with those under the core model, we show that the option to choose RE makes all countries better off. Thus, there is some justification for the wide latitude available to WTO members with respect to their exhaustion policies.

Keywords: Regional Exhaustion of IPRs, National Exhaustion, International Exhaustion, Parallel imports, Market power, Welfare. JEL Classifications: F13, F10, F15.

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1 Introduction

By virtue of their membership in the World Trade Organization (WTO), policies of almost all major economies with respect to the protection and enforcement of intellectual property rights (IPRs) must abide by the Agreement on Trade Related Intellectual Property Rights (TRIPS). In a nutshell, this controversial agreement calls for virtually the complete harmonization of IPR policies across WTO member countries even though economic conditions and technological capabilities vary dramatically across them. While TRIPS is far-reaching in terms of what it demands of WTO member states in the realm of IPRs, there is an important set of IPR policies that it leaves completely unregulated and unconstrained, i.e., policies pertaining to the exhaustion of IPRs. Article 6 of TRIPS says that “nothing in this Agreement shall be used to address the issue of the exhaustion of intellectual property rights.” Quite surprisingly, TRIPS does not even require exhaustion policies to be non-discriminatory in nature. This freedom to discriminate with regard to exhaustion policies is a fundamental departure from the non-discrimination principle of most favored nation (MFN) that underlies all multilateral trade agreements of the WTO. In fact, with the exception of exhaustion policies, even within TRIPS virtually all other types of rules and regulations concerning IPRs have to be applied on an non-discriminatory basis.

Exhaustion policies affect market outcomes by determining the legality of parallel imports (PIs) – i.e. imports of goods protected by IPRs from foreign markets where they were originally sold by rights holders. These policies can be one of three types: national, international, or regional. Briefly speaking, if a country follows the principle of national exhaustion (NE), it effectively bans parallel trade since under this principle a right holder’s IPR over a product is deemed to expire only in the country of first sale, making it possible for the right holder to prevent resale of its product in other markets. Under the doctrine of international exhaustion (IE), the relevant IPR expires globally

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1 Data on parallel trade are hard to come by since it is not always possible to distinguish imports from reimports. Nevertheless, it is well established that such trade occurs in footwear and leather goods, musical recordings, cars, consumer electronics, domestic appliances, cosmetics, clothing, pharmaceuticals, soft drinks, and several other consumer products (NERA, 1999). As one might expect, both in the US and the EU parallel trade in pharmaceuticals receives the most attention from researchers and policymakers. See Kanavos and Costa-Font (2005) for stylized facts regarding parallel trade in pharmaceuticals within the EU.

2 Maskus (2000) provides a discussion of the observed variation in PI policies across countries.
with the first sale of a product anywhere so that a right holder cannot block parallel trade. Finally, under regional exhaustion (RE), the right expires upon first sale within a well-defined region comprising a group of countries but not outside it. As is clear, RE is inherently discriminatory in nature since it allows free parallel trade within a well-defined region but prohibits parallel imports from the rest of the world.

The option to implement discriminatory exhaustion policies provided under TRIPS has not gone unused. Indeed, the world’s largest economic market – i.e. the European Union (EU) – practises regional or community exhaustion of IPRs. In a series of important decisions made over the years, the European Court of Justice has essentially argued that the free flow of PIs within the EU coupled with a ban on such imports from the rest of the world is the only policy that is compatible with the underlying objective of establishing a common internal market within the EU (Baudenbacher, 1998). This side of the Atlantic, the politically charged question of whether PIs of pharmaceuticals should be permitted from Canada and Mexico has been debated repeatedly in the US Congress over the years. If such trade with its two neighboring countries were to be permitted by the US, it would essentially amount to the US implementing a policy of regional exhaustion in pharmaceuticals with its immediate neighbors.

This paper addresses several positive and normative questions: What factors determine a country’s optimal exhaustion policy? When and why does regional exhaustion arise as an equilibrium outcome? Can the unrestricted pursuit of unilateral exhaustion policies result in socially undesirable outcomes? What benefits, if any, can be obtained from international cooperation over exhaustion of IPRs? Is there a case for constraining exhaustion policies to be non-discriminatory in nature?

The issue of regional cooperation is especially relevant in the context of exhaustion policies because parallel trade is more likely to occur between geographically proximate

3For example, in 2009 a measure to allow importation of prescription drugs from abroad fell short in the US Senate by just 9 votes due to fierce opposition from the pharmaceutical industry (Wall Street Journal, Dec 16, 2009). Similarly, earlier in 2000 a measure to permit drug reimports from Canada passed the US Congress but was not implemented by the then Secretary of Health and Human Services. On both instances, safety concerns were used as a justification for not allowing reimports but it is clear that the central issue for the pharmaceutical industry is the adverse impact of PIs on prices and profitability in the US market. See Goldberg (2010) and the empirical studies summarized therein for a discussion of how the practice of "global reference pricing" for pharmaceuticals on the part of rich country governments has adverse consequences for poor countries.
countries. This is because such trade arises when retailers or other parties attempt to arbitrage away existing price differentials across international markets so that the margins earned by those engaged in parallel trade are likely to be rather small, at least relative to mark-ups earned by monopoly suppliers. Therefore, it is not surprising that policy discussions with respect to parallel trade have tended to be either about goods that have low trade costs relative to price differentials (such as software, DVDs, or pharmaceuticals) or between neighboring countries (within EU or NAFTA) or both.

Motivated by these considerations, this paper develops a three-country model in which international arbitrage can occur costlessly except when it is explicitly forbidden by exhaustion policies. In the model, two countries \((A\) and \(B\)) have larger markets than the third \((C)\) and a single patent holder/firm exists in each large country. The timing of decision making is as follows. First, governments of the two large countries set their exhaustion policies, choosing among (a) \(NE\) under which no PIs are permitted (b) \(IE\) under which PIs from both trading partners are allowed, or (c) \(RE\) under which PIs from only the other large country are allowed. Next, taking the exhaustion policies set by governments into account, firms choose prices for their products and trade occurs. To the best of our knowledge, this is the first paper to provide a model in which the choice between three types of exhaustion regimes observed in the world is explicitly endogenized.

Two intuitive ideas drive the model. One, if a large country chooses \(IE\) and the small (low price) market is sufficiently smaller, firms choose not to sell there in order to sustain high prices in the two large markets. Two, since a firm cares only about its global profit while a welfare-maximizing government cares also about local consumer surplus, firms are more willing to eschew sales in the small (low price) market to sustain high prices in the larger countries than is optimal from the perspective of national welfare of those countries.

As might be expected, the market outcome \(\overline{ABC}\) under which global markets are fully integrated – i.e. each firms serve all markets at a uniform price – arises only when the largest market (i.e. \(A\)) is open to PIs and the degree of asymmetry across markets is not too large. Furthermore, as long as either country \(A\) or \(B\) implements \(RE\) and the other one does not choose \(IE\), the market outcome is the same as that when both countries
implement RE: under this outcome called partial integration \( \langle \overline{AB};C \rangle \), the markets of the two large countries are integrated whereas that of the small country is segmented from the rest of the world and each firm sells there at a locally optimal price that is lower than its common price in the two large markets.

In equilibrium, each large country’s exhaustion policy takes into account local consumer surplus over both goods, the global profits of the local firm, and the policy stance of the other large country. When the degree of market asymmetry is small, the largest country chooses IE and global market integration – its most preferred market outcome – obtains. However, when countries A and B are relatively similar in size and country C is sufficiently small relative to them, at least one of the large countries chooses RE with respect to the other large country (who either opts for RE or NE) and partial integration \( \langle \overline{AB};C \rangle \) obtains as the equilibrium market outcome.

To isolate the consequences of being able to discriminate with respect to exhaustion policies, we address the following counterfactual question: what if countries could only choose between the two non-discriminatory exhaustion policies of NE or IE? This counterfactual analysis provides two crucial insights. One, the degree of market integration achieved in the global economy is actually lower when the freedom to discriminate with respect to exhaustion policies is absent since regional integration \( \langle \overline{AB} \rangle \) – under which the two large markets are fully integrated but neither firm sells in the small market – is more likely to obtain. Second, and more importantly, whenever RE arises in equilibrium, the market outcome under it Pareto-dominates the outcome that arises under non-discriminatory exhaustion policies. This is because allowing for RE leads to partial integration \( \langle \overline{AB};C \rangle \) replacing regional integration \( \langle \overline{AB} \rangle \) as the market outcome. By freeing firms from the threat of PIs from the small/low-price market, RE between the two large (high-price) markets makes it optimal for firms to also sell in the small market. Why \( \langle \overline{AB};C \rangle \) Pareto dominates \( \langle \overline{AB} \rangle \) is easy to see. Firms prefer \( \langle \overline{AB};C \rangle \) to \( \langle \overline{AB} \rangle \) since their global profits are higher while consumers in the small country prefer it because they have access to foreign goods only under the former outcome. Indeed, the prices at which consumers in the small market have access to both goods under \( \langle \overline{AB};C \rangle \) are the lowest over all possible market outcomes. Finally, consumers in the two large markets are indifferent between \( \langle \overline{AB};C \rangle \) and \( \langle \overline{AB} \rangle \) since they face the same prices under the two
outcomes.

Malueg and Schwarz (1994) compare the global welfare effects of various types of exhaustion policies taking the global policy regime to be exogenously given. In their model, when confronted with the possibility of arbitrage induced PIs, a monopolist chooses to serve only markets where demand is relatively inelastic (i.e. price is high) since PIs from low-price markets lower its aggregate profit. While this mechanism also plays a central role in the present model, it is worth noting, however, that openness to PIs does not necessarily lower a firm’s profit when there is strategic interaction between the firm and another party. For example, Pecorino (2002) shows how the possibility of PIs can tilt the outcome of a bargaining game between a monopolist and a foreign government in favor of the monopolist by reducing its willingness to supply the foreign market. Similarly, Roy and Saggi (2012a and 2012b) show how openness to PIs can soften price competition under oligopoly and how this change in product market interaction between firms affects equilibrium policies implemented by governments.

Richardson (2002) considers the viewpoint of importing countries facing a global monopoly supplier and shows that, in equilibrium, all countries choose to allow PIs since doing so ensures that the good is available locally at the lowest possible price. While this analysis delivers useful insights regarding the economic effects of IE and NE, it does not address when and why RE might arise as an equilibrium policy choice. This is important because, as was noted earlier, RE is not only the policy of the largest common market in the world (i.e. the EU) but has also been frequently considered for adoption by policy-makers concerned about the high prices of pharmaceuticals in the United States.

2 A simple model of regional exhaustion

We consider a world comprised of three countries (indexed by \( j = A, B, \) or \( C \)) in order to understand the causes and consequences of RE of intellectual property.

Consumers in each country consume two (patented) goods: \( a \) and \( b \) indexed by \( i = a, b \). Good \( a \) is produced by a monopolist/patent holder in country \( A \) called firm \( a \). Similarly, firm \( b \) in country \( B \) is the sole producer of good \( y \). The quality of each good is denoted by \( q \) and the production cost is normalized to zero. Country \( C \) is an importer of both goods.
The retail sector in each country is assumed to be competitive with zero unit cost so that the prices set by firms/patent holders equal those facing consumers. Each consumer buys at most one unit of good \( i \). Utility under no purchase equals zero. If consumer \( k \) in country \( j \) buys good \( i \) at price \( p_{ij} \), the utility it derives from the good given by

\[
    u^k_i = \theta_j^k q_i - p_{ij}
\]  

(1)

As is well known, the taste parameter \( \theta_j^k \geq 0 \) can be interpreted one of two ways. Either one can view it as capturing differences in primitive preferences (such as the marginal utility of quality) or as capturing differences in income across consumers with poorer consumers having lower \( \theta_j^k \)'s and the distribution of \( \theta_j \) being the income distribution in country \( j \). In what follows, we will adopt the latter interpretation.

The distribution of income differs across countries in that the parameter \( \theta_j \) is uniformly distributed over the interval \( [0, \mu_j] \) in country \( j = A, B, or C \) where \( \mu_A \geq \mu_B \geq \mu_C \). Countries \( A \) and \( B \) will be referred to as the two large countries. It proves convenient to denote them by uppercase letters \( I \) and \( J \) where \( I, J = A \) or \( B \) and the home market of firm \( i \) by \( i \).

The interaction between governments and firms occurs as follows:

**Stage 1:** In the first stage, the two large countries (i.e. \( A \) and \( B \)) simultaneously choose whether to follow (i) NE (ii) IE or (iii) RE of intellectual property.\(^5\) Under NE, each large country prohibits PIs; under IE it allows them from both trading partners; whereas under RE it allows them only from the other large country. The global policy environment determined by the policy choices of the countries \( A \) and \( B \) is denoted by the pair \((X,Y)\) where \( X = IE, NE, \) or \( RE \).

**Stage 2:** After governments have chosen their exhaustion policies, firms choose prices for their products and trade occurs. If a country chooses NE (i.e. prohibits PIs),

\(^4\)Note that, an alternative and more general formulation would be allow consumer preferences to differ across goods so that if consumer \( k \) in country \( j \) buys good \( i \) at price \( p_{ij} \), the utility it derives from good \( i \) given by \( u^k_{ij} = \theta_{ij}^k q_i - p_{ij} \). Setting \( \theta_{ij}^k = \theta^k \) makes demand functions symmetric across goods. This simplification makes it convenient to focus on market size asymmetries across countries by eliminating asymmetries with respect to consumer valuations of different goods.

\(^5\)Since country \( C \) has the smallest market, its exhaustion policy turns out to be irrelevant for determining market outcomes and can therefore be ignored.
foreign retailers cannot sell in its market. However, under the other two regimes, foreign retailers from the relevant market(s) can engage in parallel trade if it is profitable for them to do so.

3 Outcomes under non-discriminatory exhaustion regimes

To understand how different exhaustion policies affect firm behavior, we begin by analyzing firm decisions under non-discriminatory exhaustion policies.

Suppose the policy regime is \((\text{NE}, \text{NE})\). When PIs are forbidden by the two large countries, firms are free to price discriminate internationally and each firm sets a different (i.e. market specific) price in each country. In country \(j\) firm \(i\) choose \(p_{ij}\) to solve:

\[
\max_{p_{ij}} \pi_{ij}(p_{ij}) = p_{ij} x_{ij}(p_{ij}) = \frac{p_{ij}}{\mu_j} (\mu_j - \frac{p_{ij}}{q})
\]

which gives firm \(i\)'s optimal price in country \(j\) as:

\[
p^*_ij = \frac{\mu_j q}{2}
\]

Note that \(p^*_ij\) is increasing in \(\mu_j\); i.e. the pattern of optimal price discrimination is such that \(p^*_iA \geq p^*_iB \geq p^*_iC\). We refer to this market outcome as global segmentation \(\langle A; B; C \rangle\).

Firm \(i\)'s global profit under global market segmentation \(\langle A; B; C \rangle\) equals

\[
\pi^*_i = \sum_j \pi^*_ij \quad \text{where} \quad \pi^*_ij = \frac{\mu_j q}{4}
\]

As is clear, \(\pi^*_i\) is the maximum (i.e. optimal monopoly) profit a firm can earn on the global market. When even one of the large countries opts for \(\text{IE}\), it is not possible for firms to earn this profit since openness to PIs undermines their ability to price discriminate internationally.

Consider market outcomes under the symmetric policy regime \((\text{IE}, \text{IE})\). If both large countries permit PIs, firms are most constrained in their pricing behavior under \((\text{IE}, \text{IE})\). Since markets are asymmetric, each firm faces a trade-off between charging its optimal market specific prices and the number of markets served: the more markets a firm serves, the further away it gets from its optimal price in each market. Thus, when PIs can flow
freely in the global economy, as they do under \((\text{IE,IE})\), each firm chooses between the following three pricing strategies:

(a) Sell in all markets at a single globally optimal price.

(b) Sell only in the two larger markets at a common price that maximizes its profits in those two markets.

(c) Sell only in its home market at its optimal monopoly price.

To derive conditions under which it is profit-maximizing for a firm to adopt each of these pricing strategies, we first derive optimal prices under each strategy. If both firms choose to sell in all markets under \((\text{IE,IE})\), the market outcome is referred to as \textit{global integration} or \(\langle \overline{ABC} \rangle\). Under this outcome, firm \(i\) chooses its global price \(p_i\) to solve

\[
Max_{p_i} \sum_j \pi_{ij}(p_i) = Max_{p_i} \sum_j p_i x_{ij}(p_i) = Max_{p_i} \sum_j \frac{p_i}{\mu_j} \left( \mu_j - \frac{p_i}{q} \right) \tag{4}
\]

Solving this problem gives firm \(i\)'s optimal price under global integration \(\langle \overline{ABC} \rangle\) as follows:

\[
p_i(\langle \overline{ABC} \rangle) = \frac{3q \Pi_j \mu_j}{2 \sigma} \text{ where } \sigma = \sum_{j \neq k} \mu_j \mu_k \tag{5}
\]

It is straightforward to show that firm \(i\)'s optimal uniform price \(p_i(\langle \overline{ABC} \rangle)\) is increasing in all of its arguments (i.e. in \(q_i\) and \(\mu_j\) where \(j = A, B,\) or \(C\)). Firm \(i\)'s profit under \(\langle \overline{ABC} \rangle\) equals

\[
\pi_i(\langle \overline{ABC} \rangle) = p_i(\langle \overline{ABC} \rangle) \sum_j \frac{1}{\mu_j} \left( \mu_j - \frac{p_i(\langle \overline{ABC} \rangle)}{q} \right) \tag{6}
\]

Now suppose each firm decides to sell only in the two larger markets at a common price, a market outcome that is referred to as \textit{regional integration} or \(\langle \overline{AB} \rangle\). Under this outcome, firm \(i\) chooses its common price in the large countries to solve

\[
Max_{p_i} \sum_j \pi_{i,j}(p_i) = \sum_j p_i x_{ij}(p_i) = \sum_j \frac{p_i}{\mu_j} \left( \mu_j - \frac{p_i}{q} \right)
\]

Solving which gives firm \(i\)'s optimal price under regional integration \(\langle \overline{AB} \rangle\):

\[
p_i(\langle \overline{AB} \rangle) = \frac{q \Pi_{j \neq C} \mu_j}{\sum_{j \neq C} \mu_j} \tag{7}
\]

\(^6\)The superscript \(\leftrightarrow\) in \(\langle \overline{AB} \rangle\) indicates that exports flow in both directions between countries \(A\) and \(B\).
Firm $i$’s total profit under regional integration $\langle AB \rangle$ is given by

$$\pi_i(\langle AB \rangle) = \sum_j \frac{p_i(\langle AB \rangle)}{\mu_j} (\mu_j - \frac{p_i(\langle AB \rangle)}{q})$$

If firm $i$ sells in both large markets (i.e. in its home market and in country $j$) while firm $j$ sells only in market $j$, then we get partial regional integration $\langle ij \rangle$. We have $p_{i,j}(\langle AB \rangle) = p_i(\langle AB \rangle)$ whereas $p_{j,i}(\langle AB \rangle) = p_j^*$. Finally, firm $i$’s profit when it only serves its domestic market under $\langle IE, IE \rangle$ is given by $\pi_{i,d}^* = \mu_{i,d}/4$.

We can now state:

**Lemma 1:** Since $\mu_A \geq \mu_B \geq \mu_C$ we have:

(i) $p_{i,A}^* > p_i(\langle AB \rangle) > p_{i,B}^* > p_{i,C}^*$.

(ii) $p_i(\langle AB \rangle) = \sum_{j \neq C} \lambda_j(\langle AB \rangle)p_{i,j}^*$ and $p_i(\langle ABC \rangle) = \sum_j \lambda_j(\langle ABC \rangle)p_{i,j}^*$ where $0 < \lambda_A(\langle ABC \rangle) < \lambda_B(\langle ABC \rangle) < \lambda_A(\langle AB \rangle) < \lambda_B(\langle AB \rangle) < 1$.

Lemma 1 has four main messages. First, when free to price discriminate internationally, each firm charges its highest price in the largest market and its lowest price in the smallest market. This pricing behavior simply reflects the differing willingness to pay on the part of consumers in different countries. Second, if price discrimination is not possible so that a firm must charge a common price in markets it serves, then its common price $p_i(\langle AB \rangle)$ when it serves only the two large countries (i.e. $A$ and $B$) is higher than its globally optimal price $p_i(\langle ABC \rangle)$ when it serves all markets. The intuition is straightforward: if the smallest market is also served, then the firm lowers its common price to take account of demand conditions in that market. Third, the first two equalities in part (ii) simply say that the common price a firm charges in markets that it serves is a weighted average of its optimal market specific prices for those markets. Note that $\lambda_A(\langle AB \rangle) < \lambda_B(\langle ABC \rangle)$ and $\lambda_A(\langle AB \rangle) < \lambda_B(\langle AB \rangle)$: in other words, the weights determining the common price are inversely proportional to market size. This simply reflects the optimization involved in setting a single price that maximizes a firm’s joint profit in all markets that it serves. Fourth, the inequalities $\lambda_A(\langle ABC \rangle) < \lambda_A(\langle AB \rangle)$ and $\lambda_B(\langle ABC \rangle) < \lambda_B(\langle AB \rangle)$ say that the weight given to the optimal price in each large market is lower if a firm serves all three markets at a single global price relative to when it serves only the two large markets. This feature of the model is also quite intuitive: the
constraint that the inability to price discriminate puts on a firm’s pricing behavior is more binding when it serves three asymmetric markets as opposed to only the two larger markets.

It is straightforward to show that

\[ \pi_i(\overline{AB}) \geq \pi_i^* \iff \mu_i \leq 3\mu_J. \] (8)

This inequality motivates the following assumption:

**Assumption 1**: \( \mu_A \leq 3\mu_B \) and \( \mu_B \leq 3\mu_C = 3 \).

The first part of Assumption 1 says that the degree of asymmetry between the two large markets (i.e. A and B) is not so large that the firm from the largest market (i.e. firm a) finds it profitable to serve only its home market (i.e. A) as opposed to serving both markets A and B when PLVs can flow freely between the two of them. As we will show below, when \( \mu_A > 3\mu_B \) a policy of regional exhaustion does not arise in equilibrium and nothing of interest or significance is lost by ignoring this scenario. The second part of Assumption 1 is interpreted similarly and it helps limit the number of market outcomes without affecting our analysis of regional exhaustion in any way.

**Lemma 2**: Suppose the global policy regime is \((\mathbf{1E}, \mathbf{1E})\). Then, there exist \( \mu_A^c \) and \( \mu_I^* \) such that:

(i) \[ \pi_i(\overline{ABC}) \geq \pi_i(\overline{AB}) \iff \mu_A \leq \mu_A^c = 5\mu_B\mu_C/(4\mu_B - 5\mu_C) \] \hspace{1cm} (9)

where \( \partial\mu_A^c/\partial\mu_J < 0; \partial^2\mu_A^c/\partial^2\mu_J > 0; \) and \( i = a, b \).

(ii) \[ \pi_i(\overline{ABC}) \geq \pi_i^* \iff \mu_I \leq \mu_I^* = 8\mu_J\mu_C/(\mu_J + \mu_C) \] \hspace{1cm} (10)

where \( \partial\mu_I^*/\partial\mu_J > 0 \) and \( \partial^2\mu_I^*/\partial^2\mu_J < 0 \).

Part (i) of Lemma 2 says that each firm prefers to serve all markets at a common price to serving only the two larger markets if country A’s market is smaller than the threshold \( \mu_A^c \). It is worth pointing out that the threshold \( \mu_A^c \) is common for both firms since each firm is considering the same decision: whether or not to drop market C. The fact that \( \partial\mu_A^c/\partial\mu_J < 0 \) means that from firm \( i \)'s perspective, an increase in the market
size of the other large country, makes it more attractive to serve only the two large markets as opposed to serving all markets.

Part (ii) says that if a firm’s home market is sufficiently large (i.e. exceeds the threshold $\mu^*_i$), then it prefers to sell only at home as opposed to serving all markets since the high degree of asymmetry with respect to the other markets forces it to set a price that is too far away from its optimal price in the lucrative home market. The fact that $\partial \mu^*_i/\partial \mu_J > 0$ is quite intuitive: as the market size of the other countries’ increases, firm $i$’s preference gets tilted in favor of serving all markets as opposed to only its home market.

The first major result can now be stated:

**Proposition 1:** Suppose both large countries choose $\text{IE}$. Then, the market outcome is global integration $\langle \overline{ABC} \rangle$ iff $\mu_A \leq \mu^*_A$; otherwise, the outcome is regional integration $\langle \overline{AB} \rangle$.

This result has a very simple interpretation. Since $\mu_A \leq 3\mu_B$ (Assumption 1), firm $a$ finds it profit maximizing to serve the other large market even when both large countries implement $\text{IE}$. Indeed, the only decision each firm has to make is whether or not to drop the smallest market ($c$) and not serving this market is optimal iff country $A$’s market exceeds the threshold $\mu^*_c$. When this is the case, the market outcome is $\langle \overline{AB} \rangle$.

Figure 1 illustrates the optimal pricing decisions of firms under (IE,IE) in the $(\mu_B/\mu_C, \mu_A/\mu_C)$ space. Since $\mu_B \leq \mu_A$ and $\mu_A \leq 3\mu_B$ only the region above the 45 degree line and the region below the upward sloping bold line labelled $\mu_A = 3\mu_B$ is relevant. The downward sloping curve plots $\mu^*_A$. Below this curve, the two large countries are relatively similar to each other and not much bigger than the smaller market and the market outcome is $\langle \overline{ABC} \rangle$ whereas above this curve, both firms drop the small market and the market outcome is $\langle \overline{AB} \rangle$. 
Now consider a firm’s pricing decisions under the policy regime (IE, NE). We can state:

**Corollary 1:** Given that its home country implements IE, firm a’s pricing decisions are independent of the policy regime implemented by country B.

The logic behind this result is transparent. When country A’s policy regime makes it impossible for the firm to price discriminate internationally, it has to set a common price in all markets that it chooses to serve. As a result, the choices facing firm a under (IE, NE) are exactly the same as those that it faces under (IE, IE) so that Lemma 2 continues to describe the pricing behavior of firm a under (IE, IE).

Consider now the pricing decisions of firm b under (IE, NE). As is clear, firm b will always serve at least one foreign market. To see why, simply note that firm b can serve its home market and country C’s market and earn optimal monopoly profits in these markets because country B is closed to PIs. The subtlety lies in deciding whether or not it should serve country A’s market (IE, NE) since serving this market alters its pricing behavior in other markets thereby reducing its profits in those markets.
As a result, under (IE,NE), firm b has to choose between selling in:

(a) all markets at a single global price and earning the profit $\pi_b(\bar{ABC})$.
(b) only countries A and B at a common price and earning $\pi_b(\bar{AB})$.
(c) in its home market (B) and in country C at prices that are optimal for each market and earning $\pi_{bB}^* + \pi_{bC}^*$.

Thus, relative to the scenario where both countries adopt IE, the key difference is that under the policy regime (IE,NE), firm b has the opportunity to earn higher profits in countries B and C when it does not serve country A’s market since it can price discriminate across the other two markets. As a result, the choice between serving all markets and serving only markets A and B continues to be determined by part (i) of Lemma 2. With respect to the other two alternatives facing firm b, we can show that

$$\pi_b(\bar{AB}) \geq \pi_{bB}^* + \pi_{bC}^* \iff \mu_A \geq \mu_A' = \mu_B(\mu_B + \mu_C)/(3\mu_B - \mu_C)$$  \hspace{1cm} (11)

where $\partial\mu_A' / \partial \mu_B > 0$.

This inequality motivates the following assumption:

**Assumption 2:** $\mu_A \geq \mu_A'$.

As noted above, the assumption $\mu_A \geq \mu_A'$ ensures says that it is more profitable for firm b to serve the largest market (i.e. A) and its home market even when it has to charge a common price in both markets than to serve its home market and the smallest market (i.e. country C) at optimal market specific prices. Assumption 2 is rather mild since the curve $\mu_A = \mu_A'$ actually lies below the 45 degree line in Figure 1 (along which $\mu_B = \mu_A$) for most of the parameter space.

There exists a small region (shown as Region R in Figure 2 below) where the curve $\mu_A = \mu_A'$ lies above the 45 degree line so that over region R firm b prefers to not sell in country A in order to charge its optimal market specific prices in countries B and C. As is clear, over this region the markets of countries A and B are very similar in size, making

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7 Together with $\mu_A \geq \mu_B$, Assumption 2 implies that $\mu_A \geq \max(\mu_B, \mu_A')$. 

---
it worthwhile for firm $b$ to sacrifice market $A$ in order to charge its optimal price in other two markets. Assumption 2 rules out this outcome by making region $R$ inadmissible.\footnote{If region $R$ were admissible, the market outcome in this region would be one where firm $a$ sells in countries $A$ and $B$ at a common price while firm $b$ sells in countries $B$ and $C$ at its optimal market specific prices. Under this outcome, only consumers in country $B$ obtain access to both goods; those in country $A$ are denied good $b$ while those in country $C$ are denied good $a$. For simplicity, we maintain Assumption 2 throughout the paper.}

Now consider firm $b$’s choice between serving all three markets versus serving only markets $B$ and $C$. We have

$$\pi_b(\overline{ABC}) \geq \pi^*_bC + \pi^*_bB \iff \mu_A \geq \mu^*_A$$

(12)

where $\partial \mu^*_A / \partial \mu_B > 0.\footnote{We have $\mu^*_A = \mu_B \mu_C (\mu_C + \mu_B) / (\pi_B \mu_C - \mu_B^2 - \mu_C^2)$.}$

It is straightforward to show that since $\mu_B \leq \mu_A$ we must have $\mu^*_A < \mu^*_C$. This is intuitive: firm $b$ is more willing to drop market $C$ than it is to drop market $A$. Furthermore, we have $\mu^*_A < \mu_B$ and since $\mu_B \leq \mu_A$ this immediately implies that inequality (12) necessarily holds.

Finally, from Lemma 2 we already know that

$$\pi_b(\overline{ABC}) \geq \pi_b(\overline{AB}) \text{ iff } \mu_A \leq \mu^*_A$$

The market outcomes under $(ie,ne)$ can now be stated.

**Proposition 2:** Suppose the global policy regime is $(ie,ne)$. Then (i) firm $b$ charges the same price in every market it sells and it sells in all markets if $\mu_A \leq \mu^*_A$; otherwise, it sells in only countries $A$ and $B$ and (ii) equilibrium outcomes under $(ie,ne)$ are the same as that under $(ie,ie)$.

Part (i) reflects the fact that the ability to price discriminate internationally is determined by the exhaustion policy of the larger country. Given that country $A$ is open to PIs, even if country $B$ opts for NE, firm $b$ is unable to price discriminate internationally. By ruling out region $R$ in Figure 2, assumption 2 helps deliver part (ii) of Proposition 2.

However, even in the absence of Assumption 2 only over region $R$ do market outcomes under $(ie,ne)$ differ from those under $(ie,ie)$. Whereas regional integration $\overline{AB}$ obtains
over region $R$ under (IE,IE), the market outcome in this region under (IE,NE) is that firm $a$ sells in countries $A$ and $B$ at a common price while firm $b$ sells in countries $B$ and $C$ at its optimal market specific prices. Thus, when the policy regime is (IE,NE), over region $R$ only consumers in country $B$ obtain access to both goods; those in country $A$ are denied good $b$ while those in country $C$ are denied good $a$. For simplicity, we maintain Assumption 2 throughout the paper – it ensures that when only non-discriminatory exhaustion policies are used, the openness to PIs on the part of the largest country (i.e. $A$) makes the exhaustion policy of country $B$ inconsequential.

Figure 2 illustrates the optimal pricing decisions of firms under (IE,NE) in the ($\mu_B/\mu_C$, $\mu_A/\mu_C$) space.

Figure 2: Market outcomes under (IE, NE)

The only remaining task with respect to the effects of non-discriminatory exhaustion policies is to consider market outcomes when one or both countries adopt NE. In this regard, it is obvious that under (NE,NE) the market outcome is global segmentation $\langle A;B;C \rangle$ wherein both firms sell in all markets at their optimal market specific prices.

Next consider (NE,IE). Under this regime, if a firm serves both markets $B$ and $C$ it must charge a common price in both. Since market $A$ is closed to PIs, each firm will
necessarily sell there at its optimal price $p_{iA}^*$ earning $\pi_{iA}^*$. Thus, one of two outcomes can potentially happen:

(i) firm $i$ serves all markets charging its optimal price $p_{iA}^*$ in country $A$ and the common price $p_i(b;C)$ in countries $B$ and $C$, an outcome which we refer to as partial integration $\langle A;B;C \rangle$ in the other two countries or

(ii) it serves only the two larger markets at the optimal prices $p_{iA}^*$ and $p_{iB}^*$ yielding partial segmentation $\langle A;B \rangle$.

Option (i) is is chosen by firm $i$ iff

$$\pi_{iA}^* + \pi_i(b;C) \geq \pi_{iA}^* + \pi_{iB}^* \iff \pi_i(b;C) \geq \pi_{iB}^* \iff \mu_B \leq 3$$

which holds due to Assumption 1. Thus, we have:

**Proposition 3:** The equilibrium outcome under $(NE,IE)$ is partial integration $\langle A;B;C \rangle$ whereas that under $(NE,NE)$ is global segmentation $\langle A;B;C \rangle$.$^{10}$

We now derive optimal pricing behavior of firms when at least one country implements regional exhaustion.

### 4 Analysis of regional exhaustion

It is worth emphasizing at the outset that RE is a unilateral policy choice. In other words, regardless of the exhaustion policy of other countries, a country can implement RE by simply discriminating across its trading partners by allowing PIs from only of them. In what follows, we examine the implications of such a policy for the country that adopts it as well as for its trading partners.

#### 4.1 Possible market outcomes

We begin by noting that when RE is an option, the set of market outcomes increases. In addition to the four types of market outcomes described under non-discriminatory exhaustion policies, the following two market outcomes also need to be considered:

$^{10}$Clearly, if the second inequality in Assumption 2 does not hold (i.e. if $\mu_B > 3\mu_C$) then the market outcome under $(NE,IE)$ is partial global segmentation $\langle A;B \rangle$. 

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(1) Partial integration \( (\overrightarrow{AB};C) \): When each firm sells in countries A and B at a uniform price and in country C at its optimal monopoly price for that market. The market outcome \( (\overrightarrow{AB};C) \) can be interpreted similarly.

(2) Partial regional integration \( (\overrightarrow{ij}) \): Firm i sells in countries i and j at a common price but firm j does not sell in country i and neither firm sells in country c. The superscript \( \rightarrow \) in the notation \( (\overrightarrow{ij}) \) indicates that exports flow only from country i to j.\(^{11}\)

Market prices and profits under these outcomes can be recovered using the preceding derivations. For example, we have \( p_{iJ}(\overrightarrow{AB}) = p_i(\overrightarrow{AB}) \) whereas \( p_{jJ}(\overrightarrow{AB}) = p_j^* \). Similarly, \( p_{iJ}(\overrightarrow{ABC}) = p_i(\overrightarrow{ABC}) \) whereas \( p_{iC}(\overrightarrow{ABC}) = p_i^* \).

4.2 Equilibrium outcomes under regional exhaustion

Suppose country i opts for RE with country j (who implements IE) and consider firm decisions under \( (RE,IE) \). Consider firm i first. Since the policy regime of country j is IE, if firm i sells in both foreign markets it must do so at a common price. But due to country i’s policy of RE with country j, firm i cannot charge a lower price in country j than it charges at home. Furthermore, firm i cannot charge a lower price at home than it charges in country j since its policy is IE. As a result, if firm i sells in both large countries (i and j), it must do so at the common price \( p_i(\overrightarrow{AB}) \). Furthermore, if it sells in all three markets it must do so at the common price \( p_i(\overrightarrow{ABC}) \).

What about firm j’s pricing decisions? Since the exhaustion policy of its home country (i.e. j) is IE, firm j cannot charge a lower price in any foreign market it serves relative to the price it charges at home. Also, it cannot charge a higher price at home than it charges in country i since the latter’s policy is RE. Thus, if firm j sells in both markets i and j, it must do so at the common price \( p_j(\overrightarrow{AB}) \) and if it sells in all three, it must charge the uniform price \( p_j(\overrightarrow{ABC}) \). Therefore, we can state:

**Lemma 3:** If one large country implements RE while the other implements IE then market outcomes are the same as that when both countries implement IE.

\(^{11}\)Since \( \mu_A \geq \mu_B \) a scenario where both firms sell in country B at a common price with only firm a selling in country A and no firm selling in country C need not be considered because it is not an equilibrium outcome in the product market.
This result has a powerful implication:

**Corollary 2:** While the decision to implement RE is unilateral, given that country J’s policy is NE, country I cannot unilaterally induce partial integration \((\overrightarrow{AB};C)\) by implementing RE with country J.

This raises the following question: does the effective implementation of a policy of RE between two countries require policy coordination between them? Before this question can be addressed, we need to derive market outcomes under alternative policies as well as Nash equilibrium policies.

Consider the regime \((RE,RE)\). It is immediate that under this regime, both firms necessarily sell in country C. This is because each firm is free to earn \(\pi_{iC}\) in country C without affecting its profit in other markets since PIs cannot flow into those markets from country C. Thus, the only question is whether to serve all markets or only the home market and country C. Firm i prefers selling in all markets to selling in only countries I and C iff

\[
\pi_i(\overrightarrow{AB};C) \geq \pi_{II}^* + \pi_{IC}^* \iff \pi_i(\overrightarrow{AB}) + \pi_{iC}^* \geq \pi_{II}^* + \pi_{IC}^* \iff \pi_i(\overrightarrow{AB}) \geq \pi_{II}^* \iff \mu_I \leq 3\mu_J \quad (13)
\]

Since \(\mu_B \leq \mu_A\), it must be that \(\pi_b(\overrightarrow{AB}) \geq \pi_{bI}^*\) so it follows that under \((RE,RE)\), firm b sells in all markets (i.e. A and B) as opposed to only its home market (i.e. B). On the other hand, under \((RE,RE)\), firm a prefers to sell in all markets as opposed to selling in only countries A and C iff \(\mu_A \leq 3\mu_B\), which is guaranteed by Assumption 1.\(^{12}\) Thus, the market outcome under \((RE,RE)\) is partial integration \((\overrightarrow{AB};C)\).

Now consider the regime \((RE,NE)\) where country I implements RE and country J, NE. There are two key points to note. First, under this regime, firm i is free to charge a higher price in country J than the price it charges at home but not a lower price since its home market is open to PIs from country J. Second, under \((RE,NE)\), since PIs from country C cannot flow into the other two markets, both firms necessarily sell in country C at their optimal market prices for that market.

To derive firms’ optimal decisions, consider firm b first. Since \(\mu_B \leq \mu_A\) it is clear that firm b can sustain its optimal monopoly price in each market and will therefore serve all

\(^{12}\)If Assumption 1 does not hold (so that \(\mu_A > 3\mu_B\)), firm a will sell in only countries A and C at its optimal prices and the market outcome is no longer \((\overrightarrow{AB};C)\).
markets and earn maximal profit $\pi^*_b$. However, since $\mu_B \leq \mu_A$ we have $p^*_aB < p^*_aA$, so that firm $a$ must charge a common price in markets A and B if it chooses to sell in both of them. Thus, firm $a$ sells in all markets iff $\pi_a(\overline{AB}) \geq \pi^*_aA \iff \mu_A \leq 3\mu_B$, which holds due to Assumption 1.

Thus, optimal pricing decisions when one country chooses RE can now be stated:

**Proposition 4**: The following hold with respect to market outcomes under regional exhaustion policies:

(i) Suppose country $A$ implements RE with respect to country $B$. Then (a) market outcomes under the mixed policy regime (RE,IE), are the same as that under (IE,IE) (described in Proposition 1 and shown in Figure 1) and (b) the market outcome under both (RE,RE) and (RE,NE) is partial integration $(\overline{AB};C)$.

(ii) Suppose country $B$ implements RE with respect to country $A$ while country $A$ opts for NE. Then the market outcome is partial integration $(\overline{AB};C)$.

In other words, as long as one large country implements RE and the other one does not implement IE, the outcome is the same as that when both countries implement RE, i.e., partial integration $(\overline{AB};C)$

5 **Equilibrium exhaustion policies**

To derive equilibrium policies, we assume that the objective of each government is to maximize aggregate national welfare. Therefore, while choosing exhaustion policy, the government of each country has to take into account consumer surplus over both goods as well as the aggregate global profit of its firm.

5.1 **Welfare**

Aggregate welfare of country 1 where 1=A,B under market outcome $M$ is given by

$$w_1(M) = \sum_i cs_i(M) + \sum_j \pi_{ij}(M)$$

where $i = a, b$; $j = A, B$, or C; $i, j = A, B$, and $M = (\overline{AB}), (\overline{AB};C), (\overline{ABC}), (\overline{A}),$ or $(A;B;C)$ whereas welfare of country C equals

$$w_C(M) = \sum_i cs_iC(M)$$
where
\[
\begin{align*}
 cs_{ij}(M) &= \frac{1}{\mu_j} \int_{\frac{p_{ij}(m)}{q_j}}^{\mu_j} (q\theta - p_{ij}(M)) d\theta = \frac{1}{2} \frac{(q\mu_j - p_{ij}(M))^2}{q_j} \tag{14}
\end{align*}
\]

Plugging in the relevant price into the above formula yields consumer surplus in any country under a particular market outcome. Using the relevant expressions for consumer surplus and firm profits under alternative outcomes, the following can be shown by direct calculations:

**Proposition 5:** The following hold with respect to each country’s welfare under alternative market outcomes:

(i) \( w_A(\overline{ABC}) > w_A(\overline{AB};C) > w_A(A;B;C) \).

(ii) \( w_I(\overline{IJ};C) = w_I(\overline{IJ}) + \pi_C > w_I(\overline{IM}) = w_I(\overline{IM}) + cs_{ij}(\overline{IM}) > w_I(\overline{IM}) \) for \( i,j = A,B \).

(iii) \( w_B(A;B;C) > w_B(\overline{AB};C) \Leftrightarrow \mu_A > \mu_B \) and \( w_B(A;B;C) > w_B(\overline{AB};C) > w_B(\overline{AB}) > w_B(\overline{IJ}) = 0 \) for \( i,j = A,B \).

Part (i) of Proposition 5 simply reflects the fact that prices are lowest in country A’s market under global integration \( \langle ABC \rangle \) whereas they are highest under global segmentation \( \langle A;B;C \rangle \). Part (ii) clarifies that from the viewpoint of countries A and B, welfare of each large country under partial integration is the sum of its welfare under regional integration and the local firm’s optimal monopoly profit in country C. Indeed, partial integration is jointly optimal for countries A and B in the sense that it maximizes their joint welfare subject to the constraint that country A does not allow PIs from country C (i.e. it practices regional exhaustion with country B). The threat of PIs from country B to A ensures that firms charge the same prices in both markets while a ban on PIs from country C ensures that both firms export to country C because each firm is free to charge its optimal (low) price in country C without having to lower its price in countries A and B.

Part (iii) says that, unlike country A, country B’s most preferred regime is not necessarily global integration. However, country B does prefer global segmentation \( \langle A;B;C \rangle \) to regional integration \( \langle AB \rangle \). The intuition for this is clear. Freeing parallel trade with
country A has two consequences for country B, both of which are negative. First, it raises prices in country B’s market and therefore lowers the welfare of its consumers. Second, it reduces the total profit of firm b since it is unable to charge its optimal prices in all markets, as it does under global segmentation. Therefore, country B loses from having free parallel trade only with country A. The intuition for the comparison of \(\langle A;B;C \rangle\) and \(\langle \overline{ABC} \rangle\) is now easy to see. While firm profits decline if global segmentation is replaced by global integration, consumer surplus in country B can now increase provided that country A is not so large (i.e. \(\mu_A > \mu_A^w\)) that the downward pressure on local prices that results from permitting parallel trade with country C is swamped by the upward pressure caused by integration with country A.

The intuition for why country C’s most preferred outcome is global segmentation is clear: local prices are the lowest under this outcome whereas they are the highest under global integration \(\langle \overline{ABC} \rangle\). Finally, the worst outcome for country C arises when its market is simply not served by firms, as is the case under \(\langle \overline{AB} \rangle\) and \(\langle \overline{IJ} \rangle\) for \(i,j=A,B\).

We are now ready to derive equilibrium policies.

### 5.2 Equilibrium policies

We already know from Lemma 2 and Proposition 3 that if country A implements IE, the policy choices of country B become irrelevant for determining the market outcome. Furthermore, we know from part (i) of Proposition 6 that country A’s most preferred market outcome is global market integration \(\langle \overline{ABC} \rangle\). This implies that whenever a policy of IE on its part leads to \(\langle \overline{ABC} \rangle\), country A will indeed choose IE as its policy rendering country B’s policy decision inconsequential. Thus from Proposition 1 it follows that when \(\mu \leq \min\{3\mu_B, \mu_A^e\}\) country A chooses IE and global integration \(\langle \overline{ABC} \rangle\) obtains.

But when \(\mu_A^e \leq \mu \leq 3\mu_B\) if country A chooses IE then regional integration \(\langle \overline{AB} \rangle\) obtains and this market outcome is dominated by partial integration \(\langle \overline{AB};C \rangle\) from its perspective since its firm collects export profits in market C under the latter outcome but not the former whereas its consumers fare no different under the two outcomes. However, we know from Corollary 2 that country A cannot induce \(\langle \overline{AB};C \rangle\) unilaterally by choosing RE if country B implements IE. To see that country B has no incentive to choose IE when country A chooses RE, simply note from part (iii) of Proposition 5 that
country B is strictly better off under \( \langle \overline{AB};C \rangle \) relative to \( \langle \overline{AB} \rangle \) for the same reason that country A prefers \( \langle \overline{AB};C \rangle \) to \( \langle \overline{AB} \rangle \): local consumers are indifferent between the two while the local firm’s profits are strictly higher under the former outcome. Further, since either RE or NE on country B’s part leads to \( \langle \overline{AB};C \rangle \), it is indifferent between these two options but strictly prefers them both to IE over the range \( \mu_A^c \leq \mu \leq 3\mu_B \).

By analogous reasoning, it is easy to see that if country A cannot induce \( \langle \overline{ABC} \rangle \) by implementing IE (which is the case when \( \mu_A^c \leq \mu \leq 3\mu_B \)) any pair of policies that lead to \( \langle \overline{AB};C \rangle \) constitutes a Nash equilibrium. It follows from part (i) of Proposition 4 that both (RE,RE) and (RE,NE) are also Nash equilibria when \( \mu_A^c \leq \mu \leq 3\mu_B \) since these policy pairs lead to partial integration \( \langle \overline{AB};C \rangle \) as the market outcome.

**Proposition 6:** In equilibrium, policy choices of the two large countries and the resulting market outcomes are as follows:

(i) When \( \mu \leq \min\{3\mu_B,\mu_A^c\} \) country A implements IE, country B is indifferent between its three policy options, and the market outcome is global integration \( \langle \overline{ABC} \rangle \).

(ii) When \( \mu_A^c < \mu \leq 3\mu_B \) there exist two types of policy equilibria both of which lead to partial integration \( \langle \overline{AB};C \rangle \) as the market outcome. In one type of equilibrium, country A’s policy is RE while country B is indifferent between RE and NE while in the second type of equilibrium, country B chooses RE while country A is indifferent between RE and NE.

An important implication of Propositions 5 and 6 is that policy coordination between countries A and B does not yield any welfare gains. To see this clearly, first note that from the perspective of joint welfare of countries A and B, we have

\[
\sum_J w_J(\overline{AB};C) > \sum_J w_J(\overline{AB};C) > \sum_J w_J(A;B;C)
\]

However, since governments cannot force firms to serve all markets at a uniform price, they are unable to improve upon the Nash equilibrium outcome by coordinating their exhaustion policies (so long as international transfers cannot be used). Even under policy cooperation, governments of countries A and B would pick \((IE,IE)\) or \((IE,NE)\) whenever these policy pairs lead to global integration \( \langle \overline{ABC} \rangle \) and any pair of policies that lead to \( \langle \overline{AB};C \rangle \) when it is not possible to induce \( \langle \overline{ABC} \rangle \) as the market outcome. But this is
exactly what happens in the absence of cooperation: Nash equilibrium policies are such that they induce \( \langle \overline{ABC} \rangle \) whenever firms are willing to serve all markets at common prices and \( \langle \overline{AB};C \rangle \) when they are not.

6 What if regional exhaustion were infeasible?

To clarify the implications of RE for market outcomes and welfare, in this section, we describe equilibrium exhaustion policies under a scenario where countries must choose between the two non-discriminatory exhaustion policies of NE or IE so that they cannot implement RE. We state:

**Proposition 7**: When RE is not a feasible policy option, equilibrium policy choices are the same as before except when \( \mu_A^* < \mu \leq 3\mu_B^* \): over this region, when RE is not feasible country A implements IE while country B is indifferent between IE and NE and regional integration \( \langle \overline{AB} \rangle \) replaces partial integration \( \langle \overline{AB};C \rangle \) as the market outcome.

Thus, when the discriminatory exhaustion policy RE is unavailable or simply infeasible to implement, an outcome where global markets are more integrated is less likely to obtain. Furthermore, and more importantly, note that aggregate world welfare under partial integration \( \langle \overline{AB};C \rangle \) is higher than that under regional integration \( \langle \overline{AB} \rangle \):

\[
ww(\overline{AB};C) = ww(\overline{AB}) + w_C(A;B;C) > ww(\overline{AB})
\]

Indeed, recall from Proposition 5 that partial integration \( \langle \overline{AB};C \rangle \) is strictly Pareto-improving over regional integration \( \langle \overline{AB} \rangle \). Intuitively, countries A and B are strictly better off under \( \langle \overline{AB};C \rangle \) relative to \( \langle \overline{AB} \rangle \) because their consumers face the same prices under the two regimes whereas their firms fare strictly better (since each earns its optimal monopoly profit in country C’s market). Note, however, that country C is also strictly better off because its consumers are supplied both goods under \( \langle \overline{AB};C \rangle \) whereas they are supplied neither good under \( \langle \overline{AB} \rangle \): consumer access at monopoly prices is better than no access at all.

7 Concluding remarks

This paper develops a simple model to shed light on the economics of regional exhaustion, a discriminatory policy that permits parallel imports from some trading partners but
not others. The analysis is motivated by the experience of the European Union that practises this policy and of the United States, where discussions regarding the merits of permitting PIs from neighboring countries such as Canada and Mexico seem to resurface in Congressional debates at regular intervals.

One of the few, and perhaps the only, exception to non-discrimination available to WTO members with regard to their IPR policies is that they can pursue discriminatory exhaustion policies. This exception appears to conflict with the widely held view among policy-makers and researchers that the principle of non-discrimination underlying the multilateral trading system is generally a good idea. This paper has shown that, contrary to what common intuition might suggest, the freedom to discriminate with respect to exhaustion policies does not lead to beggar-thy-neighbor outcomes. In fact, an important result of this paper is that if countries were required to adopt only non-discriminatory exhaustion policies, the resulting outcomes would be (weakly) Pareto inferior: either the welfare of each country would be unaffected or all countries would be made worse off. This result argues in favor of the wide latitude available to WTO members with respect to their national exhaustion policies.

While the analysis provides several interesting insights about regional exhaustion, it abstracts from the effects of this policy on incentives for innovation. In this context, it is worth noting that whether national or international exhaustion provides stronger incentives for innovation is far from a settled question: while Li and Maskus (2006) find that national exhaustion encourages incentives for cost reductions by a monopolist, Grossman and Lai (2008) argue that incentives for product innovation can be higher under international exhaustion when the market is subject to endogenously determined price controls.\(^{13}\) The relationship between regional exhaustion and innovation is a topic worthy of future research.

\(^{13}\)Valletti (2006) shows that whether the incentive for quality improvement is higher or lower under international exhaustion depends upon whether price discrimination in international markets is cost or demand based. See also Valletti and Szymanski (2006) for related welfare analysis.
8 Appendix

Proof of Lemma 1

Part (i): We have \( \lambda_A(\bar{A}B\bar{C}) = \frac{\mu_B\mu_C}{\sigma_A}; \lambda_B(\bar{A}B\bar{C}) = \frac{\mu_A\mu_C}{\sigma_B}; \lambda_A(\bar{A}B) = \frac{\mu_B}{\mu_A+\mu_B} \); and 
\[ \lambda_B(\bar{A}B) = \frac{\mu_A}{\mu_A+\mu_B}. \]

Part (ii): Since \( \mu_A \geq \mu_B \geq \mu_C \), part (ii) of Lemma 1 follows immediately.

Sketch of proof of Proposition 5

Part (i): \( w_A(\bar{A}B\bar{C}) > w_A(\bar{A}B;C) > w_A(A;B;C) \). First note that 
\[ w_A(\bar{A}B;C) - w_A(A;B;C) = \frac{(\mu_A - \mu_B)(\mu_B^2 + \mu_A\mu_B + 2\mu_A^2)}{4(\mu_A + \mu_B)^2} \geq 0 \text{ since } \mu_A \geq \mu_B. \]
It is straightforward to show that \( w_A(\bar{A}B\bar{C}) - w_A(\bar{A}B;C) > 0 \) iff 
\[ 2\mu_A\mu_B - \mu_A\mu_C - \mu_B\mu_C > 0 \Leftrightarrow \mu_A(\mu_B - \mu_C) + \mu_B(\mu_A - \mu_C) \geq 0 \]
which always holds.

Part (ii). We have 
\[ w_B(\bar{A}B;C) - w_B(A;B;C) = \frac{(\mu_A - \mu_B)(\mu_B^2 + \mu_A\mu_B + 2\mu_A^2)}{4(\mu_A + \mu_B)^2} \geq 0 \text{ since } \mu_A \geq \mu_B \]
We can show \( w_B(A;B;C) > w_B(\bar{A}B\bar{C}) \) iff \( \mu_A > \mu_A^w \) where \( \partial \mu_A^w / \partial \mu_B > 0 \) as follows. Let \( \mu_A^w \) be defined by \( \Delta w_B \equiv w_B(\bar{A}B\bar{C}) - w_B(A;B;C) = 0 \). Differentiation establishes that \( \frac{\partial \Delta w_B}{\partial \mu_A} > 0 \) and \( \frac{\partial \Delta w_B}{\partial \mu_B} < 0 \). This implies that \( \mu_A^w \) increases in \( \mu_B \) since 
\[ \frac{\partial \mu_A^w}{\partial \mu_B} = -\frac{\partial \Delta w_B}{\partial \mu_A} > 0 \]

Part (iii): Since country \( C \) is a pure importer, part (iv) of Proposition 5 follows from part (i) of Lemma 1 which says that \( p_i(\bar{A}B\bar{C}) > p_i^* > p_i^* \).

References


