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# **Pricing and Welfare Implications of Parallel Imports in the Pharmaceutical Industry<sup>\*</sup>**

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**Abstract:** In this paper we investigate the implications of permitting parallel imports of pharmaceuticals produced by a monopoly, from one country to another. We use a model where countries differ in the patients' level of co-payment for buying pharmaceuticals, and patients differ in the utility obtained from the consumption of pharmaceuticals. We show that the effects of parallel imports on total welfare are as follows: On the one hand, when countries differ in their health system only, parallel imports decrease total welfare; On the other hand, when countries differ in the health needs of their patients only, parallel imports enhance total welfare.

**Keywords:** Parallel Imports, Welfare.

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## 1. Introduction

With this paper, we participate to the ongoing debate over the benefits and drawbacks from permitting parallel imports among countries. In particular, we investigate the pricing and welfare implications of parallel trade of pharmaceuticals between two countries. Parallel imports are goods produced genuinely under intellectual property right (IPR) protection, placed into circulation in one market, and then imported into a second market without the authorization of the IPR owner. They are identical to the legitimate products, except that they may be packaged differently and may not carry the original manufacturer's warranty (Maskus, 2000).

One important reason why parallel imports might arise, if they are permitted, is to arbitrage away international price discrimination, which is widely observed for pharmaceutical products (see Maskus, 2000). One expected effect of permitting parallel imports is a convergence in prices between countries. Ganslandt and Maskus (2001) provide evidence on price convergence resulting from parallel trade of pharmaceuticals in EU countries.

The expected effect of parallel trade in terms of social welfare is not so clear-cut. Welfare is shown to either increase or decrease with parallel imports, depending on whether authors consider any of the following aspects: different drug prices regulations across countries (Pecorino, 2002); efforts of IPR owners to exert vertical price control (Maskus and Chen, 2002); the level of demand dispersion across markets (Malueg and Schwartz,

1994); and the need for manufacturers to recoup their global research and development costs (Danzon, 1998).

The main contribution of our paper is that it stresses the importance of identifying the main determinants of international price discrimination to understand the welfare effects associated with parallel trade. We use a model that accounts for the differences between countries in terms of health insurance reimbursement policies and in terms of drug needs reflected in the patients' valuation for a drug. We neglect the effects associated with different income levels across countries, even though this difference is likely to be an important determinant of international price discrimination. When we consider differences in income only, the parallel imports are expected to flow from low-income countries towards high-income countries. Since parallel imports generate price convergence between countries, richer countries might benefit from parallel imports while poorer countries might be worse off (see Danzon, 1998). However, international price discrimination is likely to be caused not only by differences in income across countries, but also differences in other relevant characteristics of the demand. Otherwise, how could we answer the question raised by Maskus (2001): Why might prices be higher in poor countries?<sup>1</sup>

Characteristics of the demand that are especially relevant for pharmaceuticals rely both on insurance and on drug needs. Both can be specific to countries. On the one hand, the huge variations among national health systems can influence the pricing strategies of pharmaceutical firms. In particular, the level of insurance reimbursement influences the pricing of drugs, since it directly affects the price elasticity of the demand for drugs. If there

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<sup>1</sup> Maskus (2001) reports the finding that prices are elevated in such countries as South Africa, Mexico and Brazil relative to those in Canada, Spain and Italy.

is no other regulation on drug prices as it is the case in Germany and in Denmark among other countries, the pharmaceutical manufacturers would charge higher prices in countries where insurance is more generous, taking advantage of a lower price elasticity of demand.<sup>2</sup> Pavcnik (2002) provides evidence on this relationship between the patients' co-payment for buying drugs and drug prices in Germany. On the other hand, pharmaceutical firms might also take advantage of differences in needs for a given drug among countries, charging higher prices where some endemic illness makes the need for the appropriate drug higher than in countries where this illness is not active, for example.

We tackle these issues using a model with the following timing. In the first stage, a multinational monopoly producer sets the price of a patented drug to be sold in two countries. If the prices are different between the two countries, parallel traders can buy, in the second stage of the game, drugs in the low-price country and re-sell them in the high-price country at a price depending on whether the market for parallel imports is monopolistic or competitive. In the third stage of the game, the individuals in both countries choose to consume either one unit of the drug supplied by the monopolist, or one unit of the parallel imported drug, or nothing, so as to maximize their utility.

We first confirm a result already reported in the literature: Parallel trade makes the prices converge between countries. As a reaction to the possible entry of parallel traders in the market, the pharmaceutical monopoly producer trades-off the benefits from price discrimination with the losses of facing competition from parallel imports in the high-price country. Therefore, the monopolist increases the price in the low-price country, and

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<sup>2</sup> In the presence of additional price regulations, which is not the focus of our paper, this relationship may not hold anymore. See Jelovac (2002) for the effect of item-by-item negotiation on this relationship.

decreases the price in the high-price country so as to deter some amount of parallel imports. This does not mean that permitting parallel trade results in global uniform pricing. Contrary to other papers (Malueg and Schwartz, 1994, and Richardson, 2002) in which parallel imports are assumed to imply *de facto* global uniform pricing, we obtain global uniform pricing only if consumers value the original drug and the parallel imported drug equally. However, as noted by Maskus (2001), goods that are parallel imported may not be perceived to be of the same quality between markets, even if the manufacturer placed them on the market originally, because of differences in packaging or guarantees. This difference in perception leads in our model to the persistence of some level of price discrimination between countries, even when parallel imports are permitted.

Furthermore, we show that the effect of parallel imports on the total welfare is ambiguous. We identify two cases in which the effect of parallel trade in terms of total welfare can be stated unambiguously. We show that parallel trade increases the total welfare when it takes place between countries differing in their drug needs only. The rationale behind this positive effect relies on the re-allocation of consumption from individuals with relatively lower needs in the exporting country, towards individuals with relatively higher needs. The opposite re-allocation of consumption is the result of parallel trade when countries differ only in their health insurance reimbursement policies. In that case, the total welfare decreases with parallel trade.

One specific feature of our model is worth mentioning in order to contrast our results with an existing general result over the welfare effect of third-degree price discrimination. In our model, a simple utility specification results in the same total quantity of drugs purchased, no matter whether parallel imports are permitted or not. An existing general result states that

price discrimination reduces welfare if it does not increase total output (see Tirole, 1988, p. 138). Even though our aim is not to compare uniform pricing with price discrimination, our result departs from this classical result: The welfare effect of lowering price discrimination by permitting parallel imports is not necessarily positive, even though the total output remains constant. It is the presence of differentiated co-payment for buying pharmaceuticals in our model, and their influence on how the consumers' surpluses are computed, that explain this discrepancy.<sup>3</sup>

In the next section we describe the model. Section 3 discusses the equilibrium of the game. In Section 4 we analyze the welfare implications of allowing parallel trade. Finally, we conclude in Section 5.

## 2. The Model

We consider a multinational firm producing a patented drug. We assume that the variable cost of producing the drug is zero. The producer acts as a monopolist given the patent on his product. He sells the drug in two countries,  $A$  and  $B$ , at prices  $p_A$  and  $p_B$ , respectively. If parallel imports are permitted, one or more wholesalers can buy the drug in country  $i$ ,  $i = A, B$ , at price  $p_i$ , and re-sell it in the other country at price  $p_w$ , and at no cost except the price paid for the drug in the first country.<sup>4</sup>

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<sup>3</sup> See Jelovac (2003) for a more detailed analysis of the role of differentiated subsidies on the welfare effects of third-degree price discrimination versus uniform pricing, in general.

<sup>4</sup> For the role of transportation costs, see Ganslandt and Maskus (2001).

Each country has a population whose size is normalized to one. For simplicity, individuals in both countries are assumed to have a utility additively separable in the consumption of a numeraire composite good and the consumption  $x$  of the drug, with  $x = \{0,1\}$ . They have an income  $I$  at their disposal to buy the composite good, and one or zero unit of the drug. In each country, individuals differ in their valuation of the drug,  $q$ , which is uniformly distributed on the support  $[\underline{q}_i, \bar{q}_i]$  in country  $i, i = A, B$ :

$$q \sim U[\underline{q}_i, \bar{q}_i].$$

We assume, for simplicity, that  $\bar{q}_i - \underline{q}_i = 1$ . To guarantee that the equilibrium solutions are interior, we also assume that  $0 \leq \bar{q}_i \leq 2, i = A, B$ .

Moreover, we assume that individuals prefer to consume the drug supplied by the monopolist to the one supplied by the parallel importer. Therefore, their valuation of the parallel imported drug is weighted by  $r < 1$ . This assumption reflects the fact that, according to Maskus (2001) among others, “goods that are parallel imported may not be perceived to be of the same quality between markets, even if they were placed on the market originally by the manufacturer, because of differences in packaging or guarantees”.

We assume that the expenses for drug consumption of an individual,  $p_i x_i$ , are partially reimbursed by some public health insurer in both countries, so that the individuals only pay a share  $a_i$  of it in country  $i$ . Therefore, the indirect utility function of an individual with valuation  $q$  in country  $i$  can be written as:

$$U_i = I + \text{Max}\{q - a_i p_i; r q - a_i p_w; 0\},$$



if there are parallel imports available in country  $i$ . Otherwise, the utility function reduces to:

$$U_i = I + \text{Max} \{ \mathbf{q} - \mathbf{a}_i p_i; 0 \}.$$

We assume throughout the paper the following inequality:

$$\frac{\bar{\mathbf{q}}_A}{\mathbf{a}_A} < \frac{\bar{\mathbf{q}}_B}{\mathbf{a}_B},$$

to account for the differences between the countries, and to guarantee that if parallel trade takes place, it does so from country  $A$  towards country  $B$ .

The timing of our game is assumed to be as follows. If parallel trade is permitted, and assuming *a priori* that parallel trade takes place from country  $A$  towards country  $B$ , then the monopolist sets the prices  $p_A$  and  $p_B$  in the first stage of the game so as to maximize his profits:

$$\Pi_m = p_A(D_A + D_w) + p_B D_B,$$

where  $D_i$ ,  $i = A, B$ , stand for the demand for the drug directly supplied by the monopolist in country  $i$ , and  $D_w$  stands for the demand faced by the parallel importer in the importing country,  $B$ . Then, in the second stage of the game, the parallel importer sets the price  $p_w$ , as a Stackelberg follower. If the parallel importer is unique, he sets  $p_w$  so as to maximize his profit:

$$\Pi_w = (p_w - p_A)D_w.$$

If there are many wholesalers competing with each other in the parallel imports market, then they set a price equal to their marginal cost:  $p_w = p_A$ . In the third stage of the game, the individuals in both countries choose to consume either one unit of the drug supplied by the

monopolist, or one unit of the parallel import if it is available, or nothing, so as to maximize their utility. If parallel trade is legally forbidden, then the second stage of the game previously described vanishes, and  $D_w = 0$ .

We solve the game by backwards induction to derive the Nash sub-game perfect equilibrium.

### 3. The equilibrium of the game

#### 3.1. Benchmark: Parallel imports are forbidden legally

We first present, as a benchmark case, the equilibrium of the game when parallel imports are legally forbidden. In the last stage of the game, individuals choose to consume either one unit of the good supplied directly by the monopolist in their country, or nothing. Given the utility:

$$U_i = I + \text{Max} \{q - a_i p_i; 0\},$$

only the individuals in country  $i$  with a valuation for the drug  $q \geq a_i p_i$  are going to buy one unit of the good. Therefore, the demand faced by the monopoly in country  $i$  is:

$$D_i = \bar{q}_i - a_i p_i, \quad i = A, B.$$

Given these demands, the monopolist sets the prices  $p_A$  and  $p_B$  so as to maximize his profit:

$$\Pi_m = p_A D_A + p_B D_B = p_A (\bar{q}_A - a_A p_A) + p_B (\bar{q}_B - a_B p_B).$$

The equilibrium prices that maximize this profit ( $p_A^*$  and  $p_B^*$ ) are presented in Table 1. The corresponding equilibrium demands ( $D_A^*$  and  $D_B^*$ ), profit ( $\Pi_m^*$ ), consumers' surpluses ( $CS_A^*$  and  $CS_B^*$ ), and public expenses ( $PE_A^*$  and  $PE_B^*$ ) for paying a share  $1 - a_i$ ,  $i = A, B$ , of the expenses associated with drug consumption, are also presented in Table 1.

**Table 1**

	Country A	Country B
Price	$p_A^* = \frac{\bar{q}_A}{2a_A}$	$p_B^* = \frac{\bar{q}_B}{2a_B}$
Demand	$D_A^* = \frac{\bar{q}_A}{2}$	$D_B^* = \frac{\bar{q}_B}{2}$
Cons. surplus	$CS_A^* = I + \frac{\bar{q}_A^2}{8}$	$CS_B^* = I + \frac{\bar{q}_B^2}{8}$
Profit	$\Pi_m^* = \frac{1}{4} \left( \frac{\bar{q}_A^2}{a_A} + \frac{\bar{q}_B^2}{a_B} \right)$	
Public expenses	$PE_A^* = \frac{1-a_A}{a_A} \left( \frac{\bar{q}_A}{2} \right)^2$	$PE_B^* = \frac{1-a_B}{a_B} \left( \frac{\bar{q}_B}{2} \right)^2$

In both countries, the equilibrium monopoly prices increase with the ratio representing the maximum effective willingness to pay for the drug:<sup>5</sup>

$$\frac{\bar{q}_i}{a_i}, i = A, B.$$

<sup>5</sup> In this model, the maximum valuation for the drug is corrected by the co-payment rate to obtain the maximum effective willingness to pay for the drug.

In particular, the monopoly manufacturer can charge higher prices when the co-payment rate is lower, taking advantage of a lower price elasticity of demand when the co-payment is lower. The equilibrium demands do not depend on the level of the patients' co-payment for buying the drug, since the price faced by the individuals in both countries,  $\mathbf{a}_i p_i$ , only depends on the maximum valuation for the drug in their country. Furthermore, the price is lower in country  $A$ , which results from the assumption that the maximum effective willingness to pay is lower in country  $A$ . In this benchmark case, the monopoly producer discriminates as much as possible the prices between the two countries.

### 3.2. Parallel imports are legally permitted

When parallel imports are legally permitted, the demands for both the parallel import and the drug supplied by the producer are realized in the third stage of the game. Parallel trade, if it takes place, does so from country  $A$  towards country  $B$  by assumption. Then, in country  $A$  where the drug is not available as a parallel import, the individuals with a valuation  $\mathbf{q} \geq \mathbf{a}_A p_A$  buy one unit of the drug supplied by the monopoly producer in this country. Therefore,

$$D_A = \bar{\mathbf{q}}_A - \mathbf{a}_A p_A.$$

In country  $B$  where parallel imports are available, only the individuals with a valuation:

$$\mathbf{q} \in \left[ \frac{\mathbf{a}_B p_w}{\mathbf{r}}; \frac{\mathbf{a}_B (p_B - p_w)}{1 - \mathbf{r}} \right],$$

maximize their utility buying one unit of the parallel import:

$$r\mathbf{q} - \mathbf{a}_B p_w \geq \text{Max} \{ \mathbf{q} - \mathbf{a}_B p_B; 0 \}.$$

Therefore,

$$D_w = \text{Max} \left\{ \frac{\mathbf{a}_B (p_B - p_w)}{1 - r} - \frac{\mathbf{a}_B p_w}{r}; 0 \right\},$$

which is equivalent to:

$$D_w = \begin{cases} 0 & \text{if } p_w \geq r p_B, \\ \frac{\mathbf{a}_B (r p_B - p_w)}{r(1 - r)} & \text{if } p_w \leq r p_B. \end{cases}$$

For parallel trade to be attractive to the individuals in country  $B$ , we need a price  $p_w$  not only lower than  $p_B$ , but lower than  $r p_B$ , to account for the fact that, *ceteris paribus*, individuals prefer the drug supplied by the monopolist to the parallel import.

Individuals in country  $B$  with a valuation:

$$\mathbf{q} \geq \frac{\mathbf{a}_B (p_B - p_w)}{1 - r},$$

are better off buying one unit of the good supplied by the monopolist, if the parallel import attracts some individuals in country  $B$ , i.e. if  $p_w \leq r p_B$ . Otherwise, individuals with a valuation  $\mathbf{q} \geq \mathbf{a}_B p_B$  buy one unit of the good supplied by the monopolist in country  $B$ .

Therefore, the demand for the drug supplied directly by the monopolist in country  $B$  is:

$$D_B = \begin{cases} \bar{\mathbf{q}}_B - \mathbf{a}_B p_B & \text{if } p_w \geq r p_B, \\ \bar{\mathbf{q}}_B - \frac{\mathbf{a}_B (p_B - p_w)}{1 - r} & \text{if } p_w \leq r p_B. \end{cases}$$

In the second stage of the game, the parallel importer(s) can buy drugs in country  $A$ , and decide upon the price  $p_w$ , anticipating the demands  $D_A$ ,  $D_B$  and  $D_w$  previously derived. If the parallel imports market is a competitive one, then the equilibrium parallel import price is:

$$p_w = p_A.$$

This price attracts consumers in country  $B$  only if  $p_w = p_A \leq rp_B$ . That is, only if the difference in the prices charged by the monopolist in both countries is big enough. Otherwise, i.e. if prices  $p_A$  and  $p_B$  are too similar, there would be no room for the parallel importers to enter the market in country  $B$ .

If there is only one monopolistic parallel importer, then the equilibrium price is the one that maximizes his profit:

$$\Pi_w = (p_w - p_A)D_w = \begin{cases} 0 & \text{if } p_w \geq rp_B, \\ (p_w - p_A) \frac{a_B(rp_B - p_w)}{r(1-r)} & \text{if } p_w \leq rp_B. \end{cases}$$

If the difference between  $p_A$  and  $p_B$  is high enough:  $p_A \leq rp_B$ , then the parallel importer enters the market with the following equilibrium price :

$$p_w = \frac{p_A + rp_B}{2}.$$

Otherwise, i.e. if  $p_A > rp_B$ , there would be no parallel imports available in country  $B$ .

In stage 1, the monopoly producer sets the prices  $p_A$  and  $p_B$  to maximize his profit, anticipating the parallel import price and the demands  $D_A$ ,  $D_B$  and  $D_w$ . The demand for the drug supplied by the monopoly producer in country  $A$  is unaffected by the decision of the parallel importer in stage 2. Therefore, the demand  $D_A$  that is anticipated in stage 1 is:

$$D_A = \bar{q}_A - a_A p_A.$$

Given the sub-game perfect equilibrium in stage 2, the demand for parallel imports in country  $B$  that is anticipated in stage 1 is:

$$D_w = \begin{cases} 0 & \text{if } p_A \geq r p_B, \\ \frac{a_B(r p_B - p_A)}{r(1-r)} & \text{if } p_A < r p_B, \end{cases}$$

whenever the market for parallel imports is competitive or monopolistic.

The demand  $D_B$  that is anticipated in stage 1 depends on the market for parallel imports. If it is a competitive market, then:

$$D_B = \begin{cases} \bar{q}_B - a_B p_B & \text{if } p_A \geq r p_B, \\ \bar{q}_B - \frac{a_B(p_B - p_A)}{1-r} & \text{if } p_A < r p_B. \end{cases}$$

If it is a monopolistic market, then:

$$D_B = \begin{cases} \bar{q}_B - a_B p_B & \text{if } p_A \geq r p_B, \\ \bar{q}_B - \frac{a_B((2-r)p_B - p_A)}{2(1-r)} & \text{if } p_A < r p_B. \end{cases}$$

Given these demands, the equilibrium prices  $p_A$  and  $p_B$  that maximize the producer's profit:

$$\Pi_m = p_A(D_A + D_w) + p_B D_B,$$

are presented in Table 2. The corresponding equilibrium demands ( $D_A$ ,  $D_B$  and  $D_w$ ), profits ( $\Pi_A$  and  $\Pi_B$ ), consumers' surpluses ( $CS_A$  and  $CS_B$ ), and public expenses ( $PE_A$  and  $PE_B$ ), are also presented in Table 2.

For the sake of clarity, we use the following notation:

$$\Delta \in \{\Delta_0, \Delta_m, \Delta_c\},$$

with:

-  $\Delta = \Delta_0 = 0$ , if  $\mathbf{ra}_A \bar{\mathbf{q}}_B \leq \mathbf{a}_B \bar{\mathbf{q}}_A$ , and/ or if parallel imports are legally forbidden.

-  $\Delta_m = \frac{\mathbf{ra}_A \bar{\mathbf{q}}_B - \mathbf{a}_B \bar{\mathbf{q}}_A}{2(\mathbf{r}(2 - \mathbf{r})\mathbf{a}_A + \mathbf{a}_B)}$ , if  $\mathbf{ra}_A \bar{\mathbf{q}}_B > \mathbf{a}_B \bar{\mathbf{q}}_A$ , parallel imports are permitted, and

their market is monopolistic.

-  $\Delta_c = \frac{\mathbf{ra}_A \bar{\mathbf{q}}_B - \mathbf{a}_B \bar{\mathbf{q}}_A}{2(\mathbf{ra}_A + \mathbf{a}_B)}$ , if  $\mathbf{ra}_A \bar{\mathbf{q}}_B > \mathbf{a}_B \bar{\mathbf{q}}_A$ , parallel imports are permitted, and

their market is competitive.

The term  $\Delta$  allows us to present the equilibrium solution in Table 2 in an uniform way, independently on the situation considered: either no market for parallel imports, or monopolistic parallel imports market, or competitive parallel imports market. Thus, in order to compare these three situations, it is enough to focus on  $\Delta$ , with  $\Delta_0 < \Delta_m < \Delta_c$ .



**Table 2**

	Country A	Country B	Parallel importer
Price	$p_A = \frac{1}{a_A} \left( \frac{\bar{q}_A}{2} + \Delta \right)$	$p_B = \frac{1}{a_B} \left( \frac{\bar{q}_B}{2} - r\Delta \right)$	$p_w = \frac{r}{a_B} \left( \frac{\bar{q}_B}{2} - \Delta \right)$
Demand	$D_A = \frac{\bar{q}_A}{2} - \Delta$	$D_B = \frac{\bar{q}_B}{2}$	$D_w = \Delta$
Cons. surplus	$CS_A = CS_A^* - \frac{\Delta}{2} (\bar{q}_A - \Delta)$	$CS_B = CS_B^* + \frac{r\Delta}{2} (\bar{q}_B + \Delta)$	
Profit	$\Pi_m = \Pi_m^* - \frac{\Delta}{2a_A a_B} (ra_A \bar{q}_B - a_B \bar{q}_A)$		$\Pi_w = \Delta \left\{ \frac{r}{a_B} \left( \frac{\bar{q}_B}{2} - \Delta \right) - \frac{1}{a_A} \left( \frac{\bar{q}_A}{2} + \Delta \right) \right\}$
Public expenses	$PE_A = \frac{1-a_A}{a_A} \left\{ \left( \frac{\bar{q}_A}{2} \right)^2 - (\Delta)^2 \right\}$	$PE_B = \frac{1-a_B}{a_B} \left\{ \left( \frac{\bar{q}_B}{2} \right)^2 - r(\Delta)^2 \right\}$	

If  $ra_A \bar{q}_B \leq a_B \bar{q}_A$ , then allowing parallel imports or not does not make any difference, since  $\Delta = \Delta_0 = 0$ . In that case, the market conditions in both countries are very similar. That can be seen adding our assumption on the market asymmetry:

$$\frac{\bar{q}_A}{a_A} < \frac{\bar{q}_B}{a_B},$$

to the condition characterizing the situation discussed now:

$$ra_A \bar{q}_B \leq a_B \bar{q}_A < a_A \bar{q}_B.$$

With such a similarity between the market conditions of both countries, the room for the monopoly producer to price discriminate is very limited, no matter whether parallel imports

are tolerated or not. Therefore, no parallel importer could take advantage of this price difference to attract clients in country  $B$ .

If  $ra_A \bar{q}_B > a_B \bar{q}_A$ , market conditions in both countries are different enough, so that parallel trade occurs if it is allowed. We can discuss the effects of allowing parallel imports, independently on whether the parallel imports market is competitive or monopolistic. In both cases,  $\Delta > 0$ , which can be compared to the benchmark situation where parallel imports are forbidden and  $\Delta = 0$ .

In Table 2, we see that allowing parallel imports makes the prices in both countries converge :  $p_A$  increases and  $p_B$  decreases. This is an intuitive result, and it is explained by the following trade-off faced by the monopoly producer. The latter would like to enjoy the benefits associated with the price discrimination, and limit the competition associated with the parallel trade in country  $B$ . The trade-off arises because the stronger the price discrimination, the bigger the room for parallel imports.

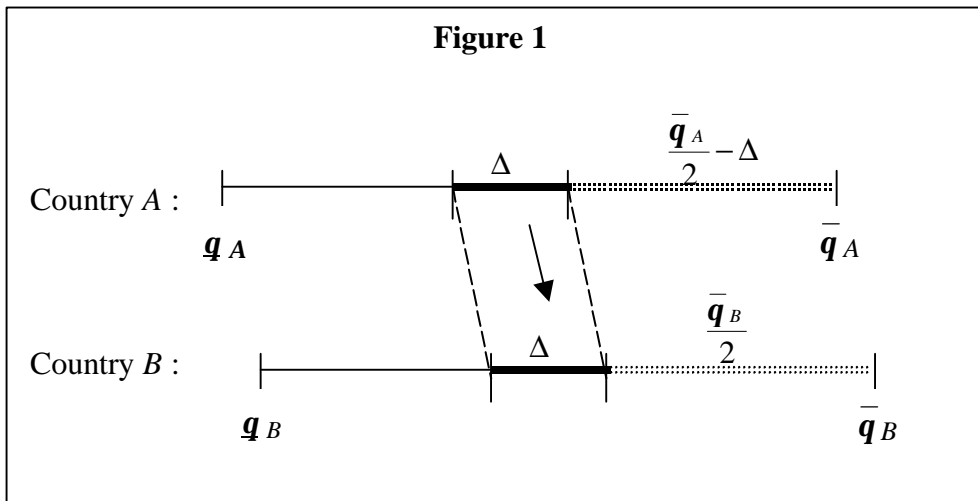
The main difference between a competitive parallel imports market and a monopolistic one can be understood when realizing that  $\Delta_m < \Delta_c$ . This implies that the price convergence due to parallel imports is stronger when the parallel import market is competitive. This happens because the afore-mentioned trade-off and its resulting price effect are stronger when the threat of competition from parallel importers is stronger, thus when the parallel imports market is competitive. Consequently, all the remaining effects associated with parallel imports are stronger when the parallel import market is competitive.

The price set by the parallel importer is naturally higher or equal than the price paid in country  $A$ , and it is lower than the price of the competing drug supplied by the producer in country  $B$ . Given the convergence in price, we have that:

$$p_A^* < p_A \leq p_w < p_B < p_B^*$$

Therefore, individuals in country  $B$  enjoy lower prices when parallel imports are permitted, while individuals in country  $A$  face a higher price.

Analyzing the demands in Table 2, we depict a re-allocation of the drug consumption from country  $A$  to country  $B$ , the total output remaining unchanged. This can be seen graphically in Figure 1:



Clearly, the consumers in country  $B$  are better off, enjoying more consumption at lower prices. The opposite happens in country  $A$ . This explains why  $CS_A$  is lower and  $CS_B$  is higher when  $\Delta > 0$  than when  $\Delta = 0$ .

The monopoly producer profit is reduced due to both the competition from parallel imports in country  $B$ , and the lower price discrimination. The profit of the parallel importer(s) is obviously at least as high as when they do not operate on the market.

Last, the public expenses are lower in both countries when parallel imports are permitted.

#### 4. The welfare analysis

We now analyze how the changes induced by the parallel imports affect the total welfare. We define the total welfare as the sum of consumers' surpluses net of the public expenses in both countries, and profits of both the monopoly producer and the parallel importer(s):

$$TW = CS_A + CS_B - PE_A - PE_B + \Pi_m + \Pi_w.$$

We already know that, on the one hand, parallel imports, when they take place, cause a positive effect on the total welfare through  $CS_B$ ,  $PE_A$ ,  $PE_B$ , and eventually  $\Pi_w$  (if the parallel importer is a monopoly; otherwise,  $\Pi_w = 0$ ). On the other hand, they have a negative effect on the total welfare through  $CS_A$  and  $\Pi_m$ . In order to determine the circumstances under which the positive effect out-weights the negative one, it is useful to compare the total welfare when parallel imports are allowed,  $TW$ , with the one characterizing the benchmark case,  $TW^*$ :

$$TW = TW^* + \frac{\Delta}{2}(\mathbf{r}\bar{\mathbf{q}}_B - \bar{\mathbf{q}}_A - (1 + \mathbf{r})\Delta),$$

where:

$$TW^* = CS_A^* + CS_B^* - PE_A^* - PE_B^* + \Pi_m^*.$$

Therefore, the necessary and sufficient condition for parallel imports to increase total welfare is:

$$r\bar{q}_B - \bar{q}_A > (1+r)\Delta. \quad [\text{NSC}]$$

Given our assumptions, and the condition for the parallel imports to take place ( $ra_A\bar{q}_B > a_B\bar{q}_A$ ), parallel trade can result either in an increase or in a decrease of the total welfare. The sum of the profits net of the public expenses always decreases as a result of parallel trade:

$$\sum_{j=m,w} \Pi_j - \sum_{i=A,B} PE_i = \sum_{j=m,w} \Pi_j^* - \sum_{i=A,B} PE_i^* - (1+r)\Delta^2.$$

Therefore, the total welfare can increase with parallel trade only when the gain for the consumers in country  $B$  is sufficiently large to compensate the loss for the consumers in country  $A$ . A necessary but not sufficient condition for  $TW > TW^*$  is thus:

$$\sum_{i=A,B} CS_i = \sum_{i=A,B} CS_i^* + \frac{\Delta}{2} (r\bar{q}_B - \bar{q}_A + (1+r)\Delta) > \sum_{i=A,B} CS_i^*,$$

which is equivalent to:

$$r\bar{q}_B - \bar{q}_A + (1+r)\Delta > 0. \quad [\text{NC}]$$

Both conditions [NC] and [NSC] hold when countries only differ in the distribution of valuations for the drug, reflected in  $\bar{q}_i$ ,  $i = A, B$ . This happens when we consider countries with a similar health system, but with different valuations for the drug due to

differences in the endemic illnesses suffered by their populations, for example. In that case, the condition under which parallel imports take place reduces to  $r\bar{q}_B > \bar{q}_A$ . Therefore, in this situation, the increase in the consumers' surplus in country  $B$  more than compensates the decrease in the one of country  $A$ . One explanation for that relies on the re-allocation of the drug consumption from country  $A$  towards country  $B$ . The parallel imports would make the individuals in country  $A$  with a valuation:

$$\mathbf{q} \in \left[ \frac{\bar{q}_A}{2}, \frac{\bar{q}_A}{2} + \Delta \right],$$

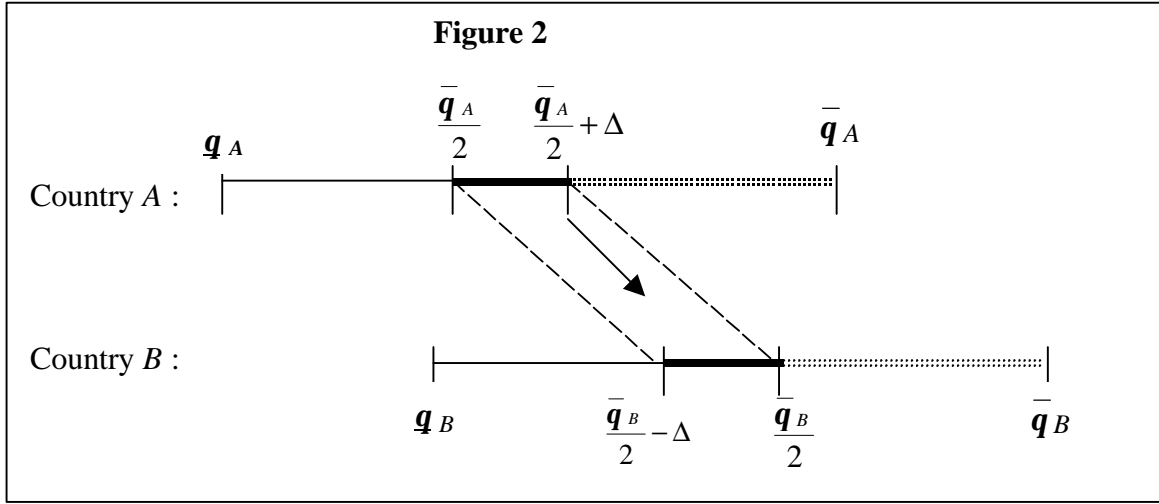
give up consuming the drug. While in country  $B$ , individuals with a valuation:

$$\mathbf{q} \in \left[ \frac{\bar{q}_B}{2} - \Delta, \frac{\bar{q}_B}{2} \right],$$

start consuming the drug thanks to the parallel trade. Therefore, we have a re-allocation from individuals valuing the drug less towards individuals valuing the drug more, since:

$$\frac{\bar{q}_A}{2} + \Delta < \frac{\bar{q}_B}{2} - \Delta,$$

whenever  $\Delta \in \{\Delta_m, \Delta_c\}$ . This intuition can be seen graphically in Figure 2, while Proposition 1 summarizes this case.



**Proposition 1.** *Parallel imports increase the total welfare when they take place between countries differing only in the distribution of the valuations for the drug among their population:*

$$\mathbf{a}_A = \mathbf{a}_B \quad \text{and} \quad \bar{q}_A < \bar{q}_B \Rightarrow TW \geq TW^* .$$

Another interesting case considers two countries differing only in their health care system, reflected in the co-payment for buying the drug. We can think of countries with similar health needs and different social security systems. Some countries in the European Union satisfy these characteristics. In this case,  $\bar{q}_A = \bar{q}_B = \bar{q}$ , and the condition for parallel trade to take place is  $\mathbf{r}a_A > a_B$ . The total welfare can be rewritten as:

$$TW = TW^* - \frac{\Delta}{2} \left( (1 - r)\bar{q} + (1 + r)\Delta \right).$$

Therefore, parallel imports decrease the total welfare in this case, even when the sum of the consumers' surpluses is positive, which occurs only when:

$$r > \frac{\bar{q} - \Delta}{\bar{q} + \Delta}.$$

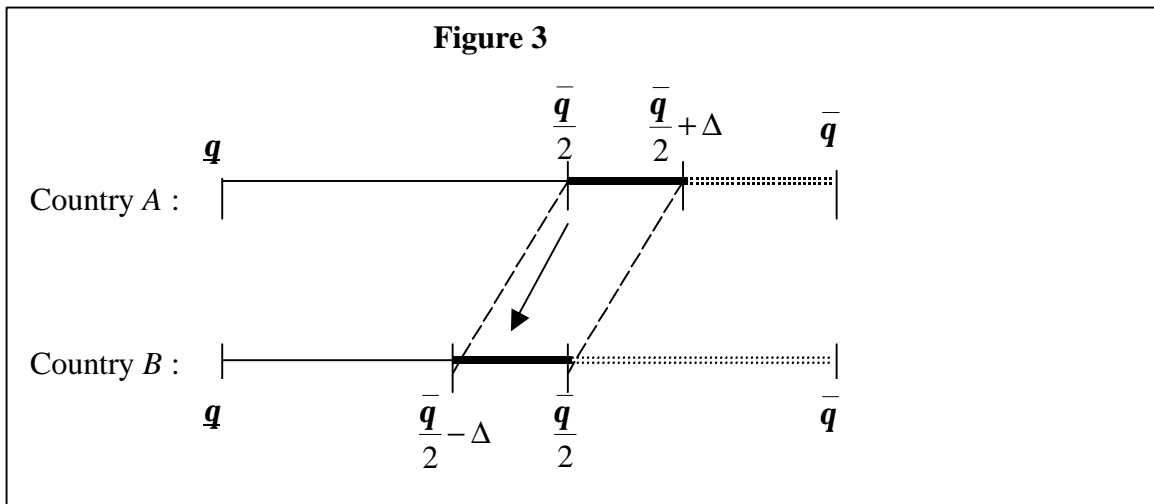
We have now a re-allocation of the drug consumption from individuals in country  $A$  with a higher valuation:

$$q \in \left[ \frac{\bar{q}}{2}, \frac{\bar{q}}{2} + \Delta \right],$$

towards individuals in country  $B$  with a lower valuation:

$$q \in \left[ \frac{\bar{q}}{2} - \Delta, \frac{\bar{q}}{2} \right].$$

This can be seen graphically in Figure 3, while Proposition 2 summarizes this case.



**Proposition 2.** *Parallel imports decrease the total welfare when they take place between countries differing only in their health insurance reimbursement policies:*

$$\mathbf{a}_A > \mathbf{a}_B \quad \text{and} \quad \bar{\mathbf{q}}_A = \bar{\mathbf{q}}_B \quad \Rightarrow \quad TW \leq TW^*.$$



## 5. Conclusions

With this paper, we participate to the ongoing debate over the benefits and drawbacks from allowing parallel trade among countries. We use a model that accounts for the differences between countries in terms of health system (reflected in the level of patients co-payments), and in terms of drug needs (reflected in the patients valuation for the drug). Our main findings are the following.

First, we confirm some results already discussed in the ongoing debate: Parallel trade makes the prices converge between countries, it makes the individuals of the importing country better off, while making the ones of the exporting country worse off, and they decrease the profit of the monopoly producer. Moreover, we show that the public expenses in both the importing and the exporting countries are reduced with parallel trade.

Second, we show that the effect of parallel imports on the total welfare is ambiguous, even though the total output remains unchanged. This certainly contrasts with the classical result over the negative effect associated with price discrimination when total output is unchanged. This discrepancy relies on the presence of differentiated co-payments in our model.

We identify two cases where the effect of allowing parallel trade on the total welfare can be stated unambiguously. On the one hand, we show that parallel trade increases the total welfare when it takes place between two countries differing in their health needs only. The rationale behind this positive effect relies on the re-allocation of the drug consumption

from individuals with relatively less drug needs in the exporting country, towards individuals with relatively higher drug needs.

On the other hand, we show that parallel trade decreases the total welfare when it takes place between countries differing in their health system only. In that case, the drug consumption is re-allocated from individuals with relatively more drug needs to individuals with relatively less drug needs.

Our analysis is made maintaining the level of income equal between the countries. Therefore, our results are applicable to trade taking place between countries of similar income levels. A direct interpretation of our results would be the following: On the one hand, parallel trade would increase the total welfare when it takes place between two developing countries with the same level of income and patients co-payments, and different drug needs, to account for the higher needs for malaria or AIDS treatment in some developing countries than in other ones. On the other hand, parallel trade between industrialized countries, characterized by similar levels of (high) income and similar epidemiological conditions, and different drug reimbursement levels, would decrease the total welfare.

When we consider parallel trade between countries with different income levels, such as the trade between developing countries and developed ones, we should carefully add the well known effects of parallel trade between a poor country and a rich country (re-allocation of the consumption from the poor country towards the rich one) to the effects identified in the present paper.

Given the results obtained in this paper, it would be interesting to explore the optimal decision of governments about whether to permit parallel imports or not, together with an endogenous decision about the optimal health insurance reimbursement policy. This additional step is left for further research. In that sense, it is worth acknowledging the contribution of Richardson (2002) who demonstrates that, when countries individually choose whether or not to prohibit parallel imports, a global Nash equilibrium involves the permitting of parallel importing into all relevant foreign markets.

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