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Parallel trade, product quality, and welfare

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HIGHLIGHTS

- We study the welfare effects of parallel trade (PT) considering R&D investment.
- Quality may be higher under PT, depending on consumers' preferences for quality.
- Consumer surplus may rise (fall) in the PT-source (PT-recipient) country.
- *Ex post* welfare is lower with than without PT, but total consumer surplus rises.
- Improving quality is a necessary condition for PT to increase welfare *ex ante*.

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ABSTRACT

We study the welfare effects of parallel trade (PT) considering investment in quality. We thus revisit the case for PT in research-intensive industries. We find that PT may raise quality, depending on how preferences for quality differ across countries. Conditional on quality, consumer surplus may rise (fall) in the PT-source (PT-recipient) country. While PT reduces *ex post* welfare, improving quality is a necessary condition for PT to increase welfare *ex ante*.

1. Introduction

Parallel trade (PT) refers to the purchase of patented or trademarked products in one country, and the subsequent export of those products to another country, without the consent of the intellectual property rights (IPR) owner.[1]

The question whether PT should be permitted or banned has received growing attention in the public debate and in the academic literature. This policy issue is particularly relevant in research-intensive industries, such as pharmaceuticals. It is widely held that PT entails a trade-off between static and dynamic efficiency: the supposed positive *ex post* (i.e. when R&D investment is sunk) welfare effects of allowing free circulation of goods should be weighed against the alleged negative *ex ante* impact on investment incentives.

In this paper, we revisit the impact of PT on product quality, and thereby on consumer and social welfare. We consider a vertical pricing model of PT with endogenous quality choice where the IPR owner sells directly at home, and abroad through an independent firm.

While most theoretical models assume that the mere threat of PT leads to global uniform pricing, our model exhibits both parallel imports and third-degree retail price discrimination at equilibrium (even with no arbitrage cost). Indeed, there is evidence that PT has gained large market shares but has not yet resulted in price convergence across relevant countries.[2]

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[1] The exercise of PT hinges on the territorial exhaustion of IPR. The European Union (EU) has adopted a regime of regional exhaustion where IPR are ended upon first sale in Member States, thereby allowing free trade among them, but still hold outside the region. United States have chosen national exhaustion, where IPR owners may prevent imports. Developing countries have chosen international exhaustion, with complete trade liberalization.

[2] For the case of pharmaceuticals in the EU, see e.g. EFPIA—European Federation of Pharmaceutical Industries and Associations, *The pharmaceutical industry in figures*, 2013, available at: http://www.efpia.eu.

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We find some results that run counter to the prevailing wisdom. First, product quality may be higher with than without PT, depending on how consumers' preferences for quality differ across countries. Second, with endogenous quality consumer surplus may rise in the PT-source country, or fall in the PT-recipient country. Third, PT reduces *ex post* global welfare. We show that improving quality is a necessary condition for PT to raise welfare *ex ante* (we provide a sufficient condition in an example with linear demand and quadratic R&D cost).

Much of the literature agrees that PT has positive *ex post* welfare effects when all markets are served (Malueg and Schwartz, 1994), but reduces investment *ex ante* (Li and Maskus, 2006; Alexandrov and Deb, 2012). Valletti (2006) finds that investment in quality can be higher under international exhaustion when differential pricing between countries is cost-based (rather than demand-based), but higher investment never yields higher global welfare. Matteucci and Reverberi (2013) find that quality investment may rise when parallel imports are inferior substitutes for the original product. In a regulated setting, Grossman and Lai (2008) find that international exhaustion may boost innovation and local consumer surplus.

The paper is organized as follows. Section 2 presents the model. Section 3 assesses the product quality under PT. Section 4 analyzes welfare. Section 5 discusses an example. Section 6 concludes.

2. The model

We set up a two-country model where a manufacturer (firm M) sells a product in country 1 through a controlled subsidiary, and in country 2 through an independent distributor (firm D). The latter may parallel export the product to country 1 at no cost (qualitative results hold if the arbitrage cost is sufficiently low: see footnote 7). Retailing costs are normalized to zero.

We consider a three-stage game. At stage one, firm M carries out R&D and sets product quality $x > 0$ at cost $C(x)$, where $C'(x) > 0$ and $C''(x) > 0$. At stage two, firm M manufactures the product (without loss of generality, marginal costs are normalized to zero) and sets the unit wholesale price w to firm D. At stage three, firm D sets the retail quantity (or price) in country 2. In country 1, should PT take place, firms compete in quantities.[3]

Consumers in the two countries differ in their willingness to pay (wtp) for the product and in their marginal valuation of quality, because of cross-country differences in income and/or product needs. Let $U_j(z, x) = z + v_j(x)$ be the utility of a consumer of type z that buys a product of quality x in country j ($j = 1, 2$). We assume that z is uniformly distributed between $-\infty$ and $\alpha_j > 0$, thus avoiding that all types buy. Consumers in country j are homogeneous in their preference for quality $v_j(x) > 0$.[4] We assume that $v_j'(x) > 0$[5]—for convenience, we sometimes use primes to denote derivatives of functions with respect to (wrt) their arguments.

A consumer of type z in country j ($j = 1, 2$) buys the product at price p_j if $z + v_j(x) - p_j \geq 0$ (if the net utility is negative, z will not buy). Hence, types for which $z \geq p_j - v_j(x)$ enter the market. Given their uniform distribution, there are $\alpha_j - (p_j - v_j(x))$ active consumers and thus $Q_j = \alpha_j + v_j(x) - p_j$ is the total quantity sold in country j. Let $a_j(x) = \alpha_j + v_j(x)$ (note that $a_j'(x) > 0$). Then, $p_j = a_j(x) - Q_j$ is the inverse demand curve in country j. In country 1, when PT takes place we have $Q_1 = q_1 + q_t$, where q_1 is the quantity sold by firm M and q_t are parallel imports. In country 2, the monopolist firm D sells $Q_2 = q_2$.

We avoid corner solutions where PT is deterred or blocked, or where market 2 is closed under PT. For this purpose, we restrict the set of feasible quality levels so that the resulting demand dispersion between countries is not too high, in the sense that consumers' maximum wtp in country 1 is not too much higher than in country 2.

Assumption 1. Let $x \in X = \left\{x \in \mathbb{R}^+ : \frac{10}{29} < \frac{a_2(x)}{a_1(x)} < 1\right\}$.

Table 1 reports firms' profit functions, consumer surplus in each country and global welfare under national exhaustion (regime n) and international exhaustion (regime i) of IPR.

Table 1
Firms' profit functions, consumer surplus and global welfare in both regimes.

Regime n	Regime i
$\pi_M^n = p_1 q_1 + w q_2 - C(x)$	$\pi_M^i = p_1 q_1 + w(q_2 + q_t) - C(x)$
$\pi_D^n = (p_2 - w) q_2$	$\pi_D^i = (p_1 - w) q_t + (p_2 - w) q_2$
$CS^n = CS_1^n + CS_2^n = q_1^2/2 + q_2^2/2$	$CS^i = CS_1^i + CS_2^i = (q_1 + q_t)^2/2 + q_2^2/2$
$W^n = CS_1^n + CS_2^n + \pi_M^n + \pi_D^n$	$W^i = CS_1^i + CS_2^i + \pi_M^i + \pi_D^i$

3. Product quality

Let us analyse the impact of PT on investment incentives. Thus, we derive the product quality under regime n (Section 3.1), regime i (Section 3.2), and compare the results (Section 3.3).

3.1. National exhaustion

In regime n, firm M is a monopoly in country 1 and firm D a monopoly in country 2. At stage three, the first-order condition (FOC) on each firm's profit wrt quantity gives $q_1^n(x) = \frac{a_1(x)}{2}$, $q_2^n(x, w) = \frac{(a_2(x) - w)}{2}$. At stage two, the FOC on firm M's profit wrt the wholesale price gives $w^n(x) = \frac{a_2(x)}{2}$. Inserting for $w^n(x)$, the quantity sold in country 2 is $q_2^n(x) = \frac{a_2(x)}{4}$.[6] At stage one, quality derives from the FOC on firm M's profit wrt x (assuming an interior solution):

$$\frac{\partial \pi_M^n(x)}{\partial x} = \frac{1}{4}\left(2a_1(x)\, a_1'(x) + a_2(x)\, a_2'(x)\right) - C'(x) = 0 \qquad (1)$$

if the second-order condition (SOC) holds (i.e. $\frac{\partial^2 \pi_M^n(x)}{\partial x^2} < 0$). Let $x^n \in X$ be the solution to (1).

3.2. International exhaustion

In regime i, at stage three firm M and firm D compete *à la* Cournot in country 1, while firm D is a monopoly in country 2. Hence, the equilibrium quantities are:

$$\begin{cases} q_1^i(x, w) = \dfrac{a_1(x) + w}{3} \\ q_t(x, w) = \dfrac{a_1(x) - 2w}{3} \\ q_2^i(x, w) = \dfrac{a_2(x) - w}{2}. \end{cases} \qquad (2)$$

Let $w^i(x)$ be the price that derives from the FOC on firm M's profit at stage two:

$$w^i(x) = \frac{a_2(x)}{2} + \frac{5}{19}(a_1(x) - a_2(x)) > \frac{a_2(x)}{2} = w^n(x). \qquad (3)$$

[3] An alternative timing where firm M simultaneously sets x and w would not alter the equilibrium of the game. Following Maskus and Chen (2004), the assumption of Cournot competition in the PT-recipient country has become standard practice in vertical pricing models of PT (see e.g. Matteucci and Reverberi, 2005).

[4] If instead the marginal consumer values quality less than the average consumer, then product quality would decline at equilibrium, *ceteris paribus*.

[5] We borrow the demand structure from Katz and Shapiro (1985) and several others. Qualitative results hold for more general demand structures insofar as an increase in x implies parallel upward shifts in demands.

[6] At stages two and three, the second-order conditions are always fulfilled in both regimes.