

Parallel trade

SUMMARY

Parallel trade is the resale of a product by a wholesaler in a market other than that intended by the manufacturer. One of its consequences is that manufacturers may be prevented from price discriminating between markets that have different willingness to pay for the product in question. Some legal regimes give the manufacturer the right to prohibit parallel trade, but others do not. We examine the policy implications of parallel trade in a world in which manufacturers invest in product quality, and have the possibility to develop different quality variants of their goods. We also consider the possibility that the authorities may impose price caps and compulsory licensing (as commonly occurs for some pharmaceutical products). We find that taking investment incentives into account makes parallel trade much less likely to enhance overall welfare, which implies that parallel trade in products intensive in R&D, such as pharmaceuticals, is less desirable than in fields such as branded consumer products. We also find that, somewhat surprisingly, the threat of parallel trade does not induce firms to market inferior versions of their products in poor countries. However, parallel trade is less likely to be detrimental to welfare when there are price caps, since compulsory licensing can mitigate the major cost of parallel trade (namely a refusal to supply a poor country market).

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Parallel trade, price discrimination, investment and price caps

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1. INTRODUCTION

Parallel trade is the resale of a product by a wholesaler in a market other than that intended by the manufacturer. Where prices differ across countries, either because the manufacturer has segmented international markets in order to price discriminate, or because buyers have differing degrees of bargaining power, parallel trade is simply arbitrage.

Within a country, if prices differ across regional markets, manufacturers are powerless to prevent arbitrage – parallel trade is legal. However, intellectual property law in many developed countries protects the right of a producer or licensor in possession of a trade mark or a patent to prohibit parallel trade, that is, to prevent international arbitrage.

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Two examples may be helpful. First, in 2001 the European Court of Justice ruled that the UK trademark of Levi Strauss (UK) Ltd had been infringed when Tesco and Costco, two British retailers, purchased Levi jeans from US distributors for sale in the UK. Levi Strauss has persistently refused to supply Tesco and Costco directly, and had expressly prohibited their US distributors from selling Levis for export. Note, however, that it was the retailers who were guilty of the infringement, even though they had not entered into any contractual relationship with Levis. In other words, the retailer is bound to observe the trademark owner's restriction on the resale of the product, even if the product is no longer the legal property of the trademark owner.¹

Secondly, in 2004 GlaxoSmithKline (GSK) was refused summary judgment in the UK Court of Appeal against a wholesaler who had purchased a fixed dose combination HIV drug, produced under a GSK trademark, to resell in the UK, when the drugs had originally been sold to French distributors on the understanding that they were to be supplied to Africa for humanitarian purposes (at prices substantially lower than those paid in developed country markets) – see Box 1. Note that GSK's motivation for supplying the products in the first place was in part a consequence of intense pressure from aid agencies to make their products available to less developed countries (LDCs) at discounted prices.

These examples illustrate an interesting conflict between competition law and intellectual property law. Under competition law, a manufacturer that attempted to contractually restrain rival distributors from competing with a wholesaler who had been granted an exclusive territory would be likely to be challenged in court. Even if licensed distributors were granted exclusive territories and restrained from competing in another's territory, it is unlikely that a competition authority would sanction the restraint being placed on a third party that attempted to engage in parallel trade. Competition authorities are not sympathetic to the use of exclusive territories to maintain a system of price discrimination. Intellectual property law permits trademark and patent holders to prohibit arbitrage.

The right of owners of intellectual property to prohibit parallel trade is of some antiquity, having been recognized in the UK as early as 1871.² Since then, however, the obvious conflict with competition law, and indeed, contract law, has led to challenges and erosion of the right. Under standard contract law, the seller of a good loses all rights to dictate terms in relation to the subsequent resale of the product, the seller's rights being said to be 'exhausted' upon first sale. There is a strong consumer lobby which argues that a rule of exhaustion should also be applied to products protected under intellectual property law.

In this paper we consider the costs and benefits associated with parallel trade, and by implication the law which allows owners of intellectual property to prohibit it. It is well known, to economists at least, that the welfare effects of third degree price

¹ European Court of Justice, C-415/99, <http://oami.eu.int/en/mark/aspects/pdf/JJ990415.pdf>

² *Bells v. Willmott* (1871) L.R. 6 Ch. App. 239, 245.

Box 1. Parallel trade and pharmaceuticals supplied on humanitarian grounds

The UK Court of Appeal has refused an attempt by GlaxoSmithKline (GSK) for a summary judgment against a pharmaceutical wholesaler which purchased products originally destined for humanitarian use in Africa, but subsequently distributed them in the UK.

GSK sold, at cost price, three HIV products (Combivir, Trizivir and Eпивir) and an asthma therapy (Serevent) (collectively referred to as the 'products') to four buyers (the 'buyers') in France: Keren, Uniworld, Intermed, and L'Afrique aide L'Afrique on the understanding that the drugs would be used for humanitarian purposes. However, the products were sold by the buyers to a Swiss firm, Horne et Cie, which in turn sold them to a UK wholesaler, Dowelhurst, which subsequently distributed the products to UK hospitals.

GSK claimed that Dowelhurst infringed GSK's trademarks by the unauthorized selling of products intended for Africa. Dowelhurst counter-argued that the products bore a European licence number, the packaging was appropriate for the European market and there was no labelling advising traders that the products were destined for Africa and not for sale on the European market. Dowelhurst also claimed that GSK made no objections when it provided them of notice to repackage and relabel the products. The Court of Appeal ordered a full trial to assess the evidence against Dowelhurst.

The central issue in this case was whether GSK's rights were exhausted once it sold the products to the buyers. It is a well-established principle that where goods are put on the market in the European Economic Area (EEA) by a proprietor, or with his consent, he is taken to have exhausted all of his intellectual property rights, including trademarks. GSK argued that it merely sold its products and did not actually put them on the market.

Lord Justice Jacob, disagreeing with GSK, stated 'Normally when one buys goods one can resell them. The sale conveys the right of onward disposal to the buyer. A buyer who initially buys goods in the EEA with one intention (e.g., export to Africa) is free to change his mind (sell within EEA). They are his goods. And it is not only buyers who can change their minds – sellers may do so also. It seems unlikely that 'put on the market' can depend purely on the vagaries of an unenforceable and a freely changeable intention of either side.'

Source: Downloaded from CMS Cameron Webber website. Article dated 1 April 2004.

discrimination are ambiguous (see Varian, 1985), and this issue was addressed in the context of parallel trade by Malueg and Schwartz (1994). Such models rest on the extent to which arbitrage will cause a producer to cut off supply to markets which it would supply in the absence of arbitrage. We extend this analysis to consider the effect that arbitrage will have on the *ex ante* incentive of the producer to invest in supplying high quality products, which is, after all, the rationale for intellectual property law in the first place.³

We develop a model of vertical product differentiation in a two-country model, where in the domestic country (where the producer seeks protection from parallel trade) consumers have a higher willingness to pay. The producer decides on the appropriate level of investment in product quality given the expected trading regime *ex post*. By diminishing the incentive to invest, arbitrage is even more likely to diminish welfare than in the conventional third degree price discrimination story. We emphasize that the important effect to consider is not the size of expected rent accruing to the producer conditional on the trading regime, but the effect on the marginal incentive to invest.

We also consider the possibility of a more sophisticated reaction by a producer to the threat of parallel trade. Faced with arbitrage the conventional approach is to consider whether the producer will or will not supply the product to low willingness-to-pay markets. We also consider whether there is an incentive to supply an inferior version of the product for sale at a lower price. We show that in general the incentive to supply a low quality version is limited by the threat that this product would pose to the market share of the high quality product at the lower end of the high willingness-to-pay market (cannibalization). Thus even in the face of a richer strategy set the producer seems to face a simple choice between selling a single quality at a uniform price or refusing to supply low willingness-to-pay markets.

This analysis may be relevant to the investigation of trade in branded goods protected by trademarks, such as jeans, perfumes, etc. However, in the case of pharmaceutical products protected by patents, refusal to supply is seldom a credible policy. Under the rules of the World Trade Organization (WTO), national governments are permitted to issue compulsory licences for the supply of pharmaceutical products in cases where the supply of medicines is deemed essential. Moreover, in many countries the government negotiates fixed prices well below those that are offered in unconstrained markets (see Box 2).

We show that a regime of compulsory licensing and price caps in some countries has radical implications for the desirability of parallel trade. In the most extreme case, if the government of the foreign market takes out a compulsory licence, chooses to fix prices at marginal cost and then parallel trade is permitted, all incentives to invest in product development are destroyed. In such a world, parallel trade is clearly welfare

³ This is certainly the case for patent law. The motivation for trademark law is presented, at least by lawyers, as the need to prevent confusion among consumers as to the origin of the product; to economists, however, such protection mainly makes sense in a context where there is an intention to encourage the supply of high quality branded goods.

Box 2. Intellectual property, trade and the WTO

Ideas and knowledge are an increasingly important part of trade. Most of the value of new medicines and other high technology products lies in the amount of invention, innovation, research, design and testing involved. Films, music recordings, books, computer software and online services are bought and sold because of the information and creativity they contain, not usually because of the plastic, metal or paper used to make them. Many products that used to be traded as low-technology goods or commodities now contain a higher proportion of invention and design in their value – for example branded clothing or new varieties of plants.

Creators can be given the right to prevent others from using their inventions, designs or other creations – and to use that right to negotiate payment in return for others using them. These are ‘intellectual property rights’. They take a number of forms. For example books, paintings and films come under copyright; inventions can be patented; brand names and product logos can be registered as trademarks; and so on. Governments and parliaments have given creators these rights as an incentive to produce ideas that will benefit society as a whole.

The extent of protection and enforcement of these rights varied widely around the world; and as intellectual property became more important in trade, these differences became a source of tension in international economic relations. New internationally agreed trade rules for intellectual property rights were seen as a way to introduce more order and predictability, and for disputes to be settled more systematically.

The Uruguay Round achieved that. The WTO’s TRIPs Agreement is an attempt to narrow the gaps in the way these rights are protected around the world, and to bring them under common international rules. It establishes minimum levels of protection that each government has to give to the intellectual property of fellow WTO members. In doing so, it strikes a balance between the long-term benefits and possible short-term costs to society. Society benefits in the long term when intellectual property protection encourages creation and invention, especially when the period of protection expires and the creations and inventions enter the public domain. Governments are allowed to reduce any short-term costs through various exceptions, for example to tackle public health problems. And, when there are trade disputes over intellectual property rights, the WTO’s dispute settlement system is now available.

The agreement covers five broad issues:

- how basic principles of the trading system and other international intellectual property agreements should be applied;
- how to give adequate protection to intellectual property rights;
- how countries should enforce those rights adequately in their own territories;
- how to settle disputes on intellectual property between members of the WTO;
- special transitional arrangements during the period when the new system is being introduced.

Source: <http://www.wto.org>

reducing. We also develop an analysis of a somewhat more complex case, where the producer can supply either one or two versions of the product, and where the foreign government can commit to only using compulsory licences for the inferior product (when two versions are supplied). We then find that in most cases parallel trade is welfare enhancing because compulsory licensing allows supply to be maintained to poor markets, while the limited commitment to capping only the price of the inferior variant is used to preserve investment incentives to supply the high-quality version. However, we find that when the willingness to pay of the foreign country is very low, there is an indeterminacy of the quality level of the inferior product, which is likely to depend upon negotiation between the producer, the foreign country government and possibly the domestic country government (since domestic welfare is also affected by this negotiation). This analysis suggests it is desirable to adopt parallel trade when this can be done in a way that enhances welfare through negotiation.

The paper is organised as follows. In the next section we set out the policy debate and the existing economic literature. In Section 3 we develop our model. Section 4 examines the policy implications.

2. THE POLICY DEBATE AND THE ECONOMIC LITERATURE

The issue of parallel trade has created huge controversy in recent years. Historically, owners of intellectual property (IP) in Europe and North America have been able to maintain international price discrimination by writing contracts with distributors prohibiting them from parallel trading goods from low price to high price markets. For example, a pharmaceutical company based in the UK could sell a drug under patent or trademark at low prices to India while charging a high price in the UK and prevent arbitrage simply by marking the export product ‘not for resale in the UK’.⁴

⁴ Indeed, recent case law suggests that, in the European Union at least, parallel trade from outside the EU is not permitted unless there is explicit consent from the manufacturer; and that mere failure to indicate that parallel trade is prohibited is not enough to allow a wholesaler to engage in such trade (again, see European Court of Justice, C-415/99).

Even in the USA, where the ‘first sale doctrine’ holds that a producer loses all rights to the subsequent control of that good once it has been sold on the market, parallel trade has been prevented in trademark goods by the Tariff Act (1930)⁵ and in pharmaceutical products by restrictions imposed by the Food and Drug Administration (FDA).

This position has come under growing challenge due to a number of recent developments. First, in the European Union, the exercise of these rights under trademark and patent law has been deemed incompatible with the goal of creating a single European market. In the 1990s the EU adopted a policy known as ‘community exhaustion’, whereby a good once placed on the market inside the EU can be resold anywhere without restraint (hence the rights of the producer are said to be ‘exhausted’ upon first sale). Although the empirical evidence is lacking, it is likely that this rule has caused prices of goods formerly protected from parallel trade to converge, at least in some markets. Parallel trade has also become very important in product areas where prices have not converged, notably in pharmaceutical products. Medicines within the EU are priced at very different levels and there has been a considerable amount of arbitrage. For example, in the UK where pharmaceutical prices are among the highest in the EU, it is now said that as much as 20% of all pharmaceutical products sold in the UK are parallel traded (see Kanavos *et al.*, 2004, and the paper by Kanavos and Costa-Font in this issue). At the same time, parallel importing from outside the EU remains prohibited, a position that has been clearly established in a number of court cases.⁶ Sweden has found this state of affairs objectionable, since prior to entering the EU in 1995 the country applied a regime of international exhaustion (parallel trade was permitted from any country in the world), but since then holders of IP rights in Sweden have been able to prevent parallel trade from outside the EU. According to a study by the Swedish Competition Authority (1999) this has raised the prices of some products by as much as 30%.

Second, in the United States the issue of parallel trade in pharmaceuticals has become significant because of the large differences in prices between the US and Canada. Prices of some pharmaceuticals can differ by as much as 100% depending on where they are purchased (see, e.g., Graham and Robson, 2000), leading to a substantial amount of cross-border shopping by US citizens. According to one survey, re-imports of pharmaceuticals by US citizens from Canada amounted to around US \$1.1 billion in 2004, about 0.5% of total US expenditure.⁷ The size of the price differences became a political issue in both the 2000 and 2004 US presidential elections. Both candidates in 2004 supported legislation in Congress to make it easier

⁵ See Gallini and Hollis (1999, p. 8).

⁶ Notably, *Silhouette v. Hartlauer* (Case C-335/96). Silhouette, an Austrian company that sold spectacles under its trademark, sold an outdated batch to a Bulgarian company for resale in the former Soviet Union. However, the distributor then tried to put them on the market in Austria, and the court upheld Silhouette’s right to prevent this under its trademark. This ruling was an application of Community Exhaustion – the key was that the goods had been placed on the market outside the EU and the trademark owner had the right to prohibit their re-entry into the single market.

⁷ http://open.imshealth.com/IMSinclude/i_article_20040726.asp

Box 3. A typology of parallel trade cases1. *Rich country to poor country:*

a) Poor countries want the right to produce patented or trademark goods under licence and then re-export at low prices to rich countries because of the perceived boost to economic development.

b) In some cases, poor country producers want to produce under licence in order to sell to other poor countries, e.g., pharmaceutical products from India to Africa.

2. *Rich country to rich country:*

a) Retailers in high price markets want to buy from distributors in more competitive low price markets (Tesco wants to buy Levis from US distributors).

b) Patients want to buy pharmaceuticals from countries where prices are lower thanks to the purchasing power of national health system buyers (US patients buying pharmaceuticals in Canada).

to buy pharmaceuticals from Canada, while several Canadian observers noted that the growth of this arbitrage trade would lead to price equalization between the two countries, to the detriment of Canadian welfare.⁸

Third, parallel trade was a contentious issue in the negotiations which led to the creation of the WTO. In order to bring intellectual property within the framework of the world trading system an agreement on Trade-Related aspects of Intellectual Property (TRIPs) was negotiated. This agreement was silent on the issue of exhaustion of rights (i.e., the right to prohibit parallel trade). Article 6 in Part I – General Provision and Basic Principles recites: ‘nothing in this agreement shall be used to address the issue of exhaustion of intellectual property rights’. This Article is indicative of the lack of consensus and it effectively meant that countries which wanted to prohibit such trade could continue to do so.

During the negotiations many developing countries argued that parallel trade should be permitted since it would allow developing country licensees to acquire export markets in high-tech products such as pharmaceuticals. In this they were supported by influential intellectual property lawyers such as Abbott (1998), who argued that restricting parallel trade was an unjustified limitation on free trade. This issue came to a head in relation to compulsory licensing, which was sanctioned under TRIPs to deal with national health crises such as the AIDS epidemic. In August 2003 it was agreed at the WTO that while compulsory licences were intended primarily to

⁸ <http://www.canadaka.net/modules.php?name=News&file=article&sid=608>

Box 4. Three theories of parallel trade*Price discrimination*

Third degree price discrimination raises welfare when it causes a significant increase in the number of consumers served. Parallel trade can cause low willingness-to-pay markets to be shut down and is likely to reduce welfare in such cases (Malueg and Schwartz, 1994).

Investment and Ramsey pricing

Development of innovations protected by intellectual property (such as pharmaceuticals) is a case of competition *for* the market rather than *in* the market. In order to recover the fixed costs of participating in innovation contests sellers must recover revenues well in excess of variable and marginal cost. Second best fixed cost recovery entails a Ramsey pricing scheme which will not be feasible if arbitrage is permitted (Danzon, 1997).

Exclusive territories and vertical price control

Exclusive distribution schemes may be justified on the grounds that competition in distribution and retailing will lead to free-riding and under-investment in marketing and after-sales service. However, parallel trade can act as a competitive discipline to ensure that monopoly is not abused and that such arrangements are not exploited to relax inter-brand competition (Gallini and Hollis, 1999).

satisfy domestic needs, it would be permitted for countries producing at low cost under such compulsory licenses to export to other countries. As part of the agreement 23 of the wealthier nations agreed to deny themselves the right to purchase low cost imports of this kind, which would effectively be a kind of parallel trade.⁹

2.1. Economic analysis

The economic literature on parallel trade can be split into two streams. First, there are a number of less formal policy-oriented reviews.¹⁰ Second, more technical papers have considered parallel trade in the context of price discrimination (mainly third-degree price discrimination, but also second-degree price discrimination, as we discuss in Section 3) and in the context of vertical price control (see Box 4). The welfare effect

⁹ http://www.wto.org/english/tratop_c/trips_c/implem_para6_e.htm.

¹⁰ See e.g., Tarr (1985), Danzon (1998), NZIER (1999), Swedish Competition Authority (1999), NERA (1999), Commission on IP Rights (2002), OECD (2002), West and Mahon (2003).

of third-degree price discrimination is an issue which is well known in the economic literature, and Varian (1985) provides necessary and sufficient conditions for price uniformity to result in a loss of welfare. The issue was analysed in the case of parallel trade by Malueg and Schwartz (1994) who showed that parallel trade could reduce welfare if the willingness to pay of consumers in different countries is sufficiently dispersed. The reason is that when dispersion is high, some markets are dropped since the monopolist prefers to concentrate only on the richer markets.¹¹ This would seem to fit with the case of parallel trade in essential medicines between rich countries and the LDCs, although it is less clear in the case of parallel trade within a region such as the EU, or for the trade in branded goods protected by trademark between the EU and the USA. Malueg and Schwartz discuss how a 'mixed system' generates a higher welfare than either banning or permitting parallel trade everywhere. In other words, it is efficient to try to sort countries into 'blocks' (e.g., on an income per capita basis) and permit parallel trade within but not between blocks.

Danzon (1997) and Danzon and Towse (2003) offer a robust defence of international price discrimination for pharmaceuticals. They argue that this amounts to a form of Ramsey pricing that, if properly structured, would ensure that advanced drugs were available in low income countries, those with high elasticity of demand, while preserving investment incentives in the high income countries, those with the lowest price elasticity.

The decision as to whether to allow parallel trade rests with the national government of the country that could import parallel traded goods. Richardson (2002) demonstrates, in a world where governments care only about consumer surplus (and have no interest in R&D issues) that it is a global Nash equilibrium for all countries to adopt parallel trade (on the assumption that parallel traded prices will always be in between prices set under international price discrimination). The intuition behind this result is simple: the countries that would like to permit parallel imports are those that are discriminated against in its absence. As a result, high-price countries can 'undo' price discrimination.¹² Since this is not observed in practice, he examines other reasons that dilute the result, e.g., tariffs and lobbying by producers.

Bordoy and Jelovac (2005) propose a model where government health policies may differ internationally according to the level of patient co-payments for buying pharmaceuticals, and patients may differ in the utility obtained from the consumption of pharmaceuticals. Their model is thus one where price discrimination is dictated by differences in the regulatory regimes rather than in demand elasticities. When countries differ in their health systems only, parallel imports decrease total welfare

¹¹ In the presence of increasing returns to scale, price uniformity induced by parallel trade can negatively affect everybody (Hausman and MacKie-Mason, 1988).

¹² For instance, imagine the EU enforces only 'community exhaustion' in a world where the other countries apply international exhaustion, thus in the EU there is a ban on parallel imports but not on parallel exports. In this scenario EU consumers are harmed by the ban on parallel imports. If Europe were a potential importer of goods, the ban on parallel trade would raise the price of these goods. If Europe started out as a low-cost country relative to other countries for some other goods, then parallel exporters gain by exporting the good to these other countries and in doing so raise the price to EU consumers. Thus a unilateral ban on parallel imports in a world of global exhaustion does not make sense.

since consumption is reallocated from individuals with greater needs to individuals with smaller needs. When countries differ in the health needs only (but share the same health system), parallel imports enhance total welfare because it reallocates consumption efficiently. Their model, however, takes no account of dynamic impacts on R&D.

A recent study by Rey (2003) takes this analysis a step further by considering the role of government in setting prices. In most countries pharmaceuticals are not directly purchased by consumers but are supplied at prices negotiated between the government (or national health authorities) and the producer. He argues that parallel trade reduces the ability of a government to make a conscious choice to invest in R&D by paying high prices while permitting foreign governments to negotiate lower prices. In this view parallel trade limits the ability of government to make its own policy choices. In a model with two countries, one with a high willingness to pay (H) and one with a low willingness to pay (L), with different willingness to pay for R&D and where R&D has a public good feature since it applies to both countries, there is typically under-investment even in the absence of parallel trade. Rey (2003) shows that, once parallel trade is permitted, the H country reduces its R&D contribution, while the L country may not change its contribution (but it is nevertheless hurt since less R&D is supplied overall).¹³ According to this analysis, parallel trade does not lead to 'market integration' but to a uniform alignment on the lowest level of R&D.¹⁴

These welfare analyses adopt a reduced form approach to modelling economic institutions, considering at its simplest whether international price discrimination is welfare enhancing. An alternative approach, considered by Gallini and Hollis (1999), is to examine the nature of the contractual relationships between manufacturers and authorized distributors that are permitted under a rule of reason in competition law. They argue forcefully that the beneficial effects of restricting parallel trade could be achieved through the application of contract law, the law of torts and competition law, thus eliminating the detrimental effects of use of intellectual property law to achieve these ends. This argument rests on the claim that the exclusion of gray goods (parallel imports) is equivalent to the imposition of an exclusive territory (ET). ETs are desirable in so far as they prevent free-riding on a distributor's investment in goodwill and intangibles, and they prevent confusion over the nature of the product (assuming differing tastes require different packaging, etc.), and undesirable in so far as they promote collusion between manufacturers (Rey and Stiglitz, 1995). Their conclusion is that the desirable effects can be achieved through contracting with distributors, while any free-riding or confusion associated with parallel trade can be

¹³ This is not the only equilibrium. The L country may also contribute more since it recognizes that its price will *de facto* affect the other country's contribution.

¹⁴ Pecorino (2002) models the US/Canada issue more simply, assuming that in one country (the US) the seller can fix the monopoly price, while in the other market (Canada) price is bargained over with the government. He shows that for linear and constant elasticity demand the effect of parallel trade is not only to reduce prices in the US but to raise profits. The reason is that the seller bargains more aggressively when faced with parallel trade since the Canadian price also becomes the US price, and thus while profits are lost in the US, the gain in Canada exceeds this loss. While an interesting observation, the model is quite simple, and is hard to reconcile with the observed fact that pharmaceutical companies bitterly oppose parallel trade.

addressed through the law of tort (suing for damages). However, their analysis is less clear cut on the issue of price discrimination; while they recognize the arguments of Malueg and Schwartz may have some weight, they state that ‘The welfare of the country accepting gray goods is unambiguously harmed by enforcing ET if the exclusive territories are supporting a scheme of international price discrimination’. This seems to be sufficient, in their view, to neglect any potential welfare gains from international price discrimination, since under their preferred policy regime parallel trade to exploit international price differences would be legal, absent any evidence of free-riding or consumer confusion. While the Gallini and Hollis paper deals explicitly with trademarks, their argument logically extends to patents as well.

Maskus and Chen (2004) take up this approach and examine the nature of contractual relationships between a domestic manufacturer and foreign distributor to determine when parallel trade will be optimal. They show that the manufacturer will take account of the threat of parallel trade when fixing wholesale prices, and therefore reduces social welfare. Encouraging parallel trade can raise welfare, at least in part, if it reduces the incentive to create such distortions. There is no unambiguous conclusion on the effect of parallel trade on global welfare. In fact, Maskus and Chen show that total welfare is ‘U-shaped’ in the cost of re-exporting (e.g., transportation costs). If transportation costs are so high that parallel trade is not feasible, then the manufacturer can set an efficient two-part wholesale tariff. As parallel imports become a real threat, the manufacturer starts raising the wholesale price above marginal cost to deter parallel trade, thus creating vertical distortions. But when parallel trade cannot be avoided in equilibrium, it has good welfare properties as it reallocates goods between the countries: in this case a reduction in the cost of conducting parallel trade increases social welfare.

These models mainly focus on static efficiency, ignoring dynamic effects on R&D. An exception is Rey (2003) discussed above. The investment problem is also addressed by Li and Maskus (2004) and Valletti (2004). They analyse a model where a manufacturer engages in cost-reducing R&D and sells his product into another country through a distributor. Indeed, they find that parallel imports discourage investment in process innovation.

3. A MODEL OF PARALLEL TRADE AND INVESTMENT UNDER VERTICAL PRODUCT DIFFERENTIATION

Parallel trade, even if not always desirable, is a fact of life for many owners of intellectual property, and given the recent improvements in the international flow of information relating to prices and so on, it is probably increasing. In the rest of the paper we ask how firms are likely to accommodate the parallel trade. In our model we seek to clarify several issues that are dealt with in only a cursory way in the existing literature:

- The incentive to invest: opponents of parallel trade frequently claim that it undermines the incentive to invest, and here we analyse this claim carefully and

seek to balance any investment effects against the trade effects associated with the different pricing regimes. To do this we use a model of vertical product differentiation, which allows diversity in both consumer preferences over quality and investment in product quality.

- We consider a richer strategy set for the producer faced with parallel trade than that which is normally allowed. Usually the producer can choose only price and whether or not to sell. Here we allow that the producer may change investment strategy, and also that the producer may introduce different product qualities for sale in different markets. These opportunities interact in important ways with the regime of parallel trade.
- Finally, we consider the impact of a regulated price cap in one country when parallel trade is permitted, and the effect on the incentives to invest and to supply different product qualities.

Product differentiation by country is commonplace – Nescafé is sold at different strengths in different countries, the amount of sugar in Coca-Cola also varies. Companies may try to position a product to meet local tastes, but this activity can also play a role in discouraging international arbitrage. We consider this here by developing a model of vertical product differentiation in which a seller can choose to introduce a product of inferior quality to meet demand at the ‘bottom end’ of the market, which is the demand that would typically be unmet under the threat of parallel trade when the willingness to pay of consumers in different countries is sufficiently dispersed.

Clearly such a policy could have significant implications for medical treatments, but also in wide ranges of product categories. In fact, we conclude that while an inferior brand may be offered in many circumstances as a screening device, in general it never pays to offer an inferior brand purely for purposes of price discrimination as a response to the threat of parallel trade.¹⁵ This result, however, depends crucially on the presence of other constraints that the manufacturer may face. In particular, we analyse the role played by price-caps and compulsory licensing imposed on the product.

3.1. Assumptions: preferences and costs

In order to accommodate the idea that higher investment (e.g., investment in R&D) leads to ‘better’ products, we consider a model of vertical product differentiation (see Box 5). Consumers have preferences *à la* Mussa–Rosen (1978): when a consumer of type t buys a product of quality u at price p , her utility is $tu - p$. There are two markets,

¹⁵ This result contrasts with a paper by Ahmadi and Yang (2000), which suggests that a producer can benefit from parallel trade when it ‘creates’ an inferior quality good and hence can price discriminate within the same country. Their model rests on the idea the producer cannot credibly produce an inferior brand in the absence of parallel trade (e.g., because it would hurt the brand image), but that offering the inferior quality product is profit maximizing. It is not clear why the producer should face such an obstacle in general. Similarly, Anderson and Ginsburgh (1999) show that a manufacturer can use parallel imports to discriminate across customers in the home market.

Box 5. Model assumptions

Consumers are differentiated according to their willingness to pay for a product, and each consumer's willingness to pay is increasing in the quality of the product. The producer invests in developing a product of a given quality which it then places on a 'domestic' market and may or may not place on a second, 'overseas' market. There are as many consumers in the overseas market, but they have a lower willingness to pay. The decision to sell in the overseas market depends on the expected profit. The decision to sell in the overseas market also affects the incentive to invest in the quality of the product.

In the absence of parallel trade the producer price discriminates. When parallel trade is permitted the product must sell at the same price in the domestic and overseas market. In the model it makes no difference whether the producer exports to local distributors or licenses production and distribution overseas, the implications in relation to parallel trade and investment are identical.

We consider three variants:

- The standard model (Section 3.2). This formalizes the Malueg and Schwartz model with investment.
- Multiple product varieties (Section 3.3). Here we examine the incentive to introduce an inferior version of the product for sale in the overseas market.
- Price caps and compulsory licensing (Section 3.4). Here we consider how the producer would respond to the imposition of a price cap backed by the threat of a compulsory licence in the overseas market.

a domestic and a foreign market (from the standpoint of the producer). In the domestic market there is a unit mass of consumers: t is uniformly distributed between 0 and 1 with density 1. In the foreign market there is also a unit mass of consumers with t uniformly distributed between 0 and $a < 1$ with density $1/a$. This type of preference generates a linear downward-sloping demand curve in each market and allows us to deal with investments in quality. Higher investments lead to outward shifts of both demand curves.

The idea behind this specification is that the foreign market is located in a 'poor' country and the domestic market is in a 'rich' country.¹⁶ In both countries there is

¹⁶ Or alternatively, a 'high willingness to pay' and a 'low willingness to pay' market, which is a more realistic characterization of the situation where Levis jeans are parallel traded from the US to Europe. This lower willingness to pay may reflect the greater competitiveness of the market or simply differences in tastes.

always somebody not buying the product unless offered for free as the lowest type has a zero willingness to pay. The parameter a corresponding to the willingness to pay of the highest type in the poor country is used to distinguish between the case of similar countries (a close to 1) from the case of different countries ($a \ll 1$). The assumption that there is a unit mass of consumers in each country focuses the analysis purely on willingness/ability to pay, rather than market size.

The good is supplied by a monopoly firm. The firm first invests in R&D and generates a good of quality u , then it sells the product according to the pricing regime. In order to obtain closed-form solutions we make use of a simple quadratic investment function, $u^2/2$. We develop the model in several steps.

First, we solve the model for a given quality with and without parallel trade. We then endogenize quality. In this benchmark model we rehearse the arguments of the welfare impact of parallel trade, contrasting an *ex ante* analysis with the *ex post* welfare analysis.

Second, we ask whether the firm itself would react to parallel trade by introducing additional lower-quality variants in order to discourage international arbitrage. We show that this never happens.

Last, we imagine that a price cap is imposed on the firm's product. We show that there is a region of parameters that depends on a and on the level of the cap where the firm has now an incentive to change its portfolio of products. We also show that the impact on investments depends on whether the firm reacts to the cap by changing its portfolio of products or selling a single product everywhere.

3.2. A standard model of parallel trade: *ex ante* versus *ex post* analysis

3.2.1. No arbitrage. In the absence of arbitrage, the firm can sell its product at different prices in the two countries. In each country it sells to those customers with t comprised between the marginal type $\underline{t} = p/u$ and the highest type. Thus in the domestic market the firm maximizes $\pi = p(1 - p/u)$, giving:

$$\begin{cases} p = u/2 \\ \underline{t} = 1/2 \\ \pi_d = u/4 \end{cases} \tag{1}$$

Similarly, in the foreign market the firm maximizes $\pi = p(a - p/u)/a$, resulting in:

$$\begin{cases} p = au/2 \\ \underline{t} = a/2 \\ \pi_f = au/4 \end{cases} \tag{2}$$

Note that these values are simply the values for the domestic market multiplied by a . This completes the positive analysis of prices *ex post*, in the absence of arbitrage. *Ex ante*, the firm maximizes its global profit $\Pi = \pi_d + \pi_f - u^2/2$, resulting in a quality level $u = (1 + a)/4$.

3.2.2. Arbitrage. Imagine now that arbitrage cannot be avoided and is costless. Also imagine that the firm supplies only one product quality. Then solutions (1) and (2) cannot hold, as customers would buy the product from the cheapest country (in practice from arbitrageurs/resellers who buy products in the cheap country and export them in the expensive country).

As a first step, note that Equation (1) gives a reservation pay-off that the firm can ensure by excluding the foreign market when $a < 1/2$ (when $a > 1/2$ from (2) there is no consumer type willing to purchase at the price offered by the monopolist). The domestic monopoly price is sustainable and the foreign market is not served. However, such a solution may not be profit maximizing overall, as the firm might be able to do better by following alternative pricing strategies. If the firm tries to supply both markets, under the one-price constraint, it maximizes $\pi = p(1 - \underline{t}) + p(a - \underline{t})/a$, where $\underline{t} = p/u$ once again represents the ‘marginal’ customer. The solution is:

$$\begin{cases} p = \frac{a}{1+a}u \\ \underline{t} = \frac{a}{1+a} \\ \pi_{d+f} = \frac{a}{1+a}u \end{cases} \quad (3)$$

For Equation (3) to be valid, the firm must be better off by supplying both markets rather than selling only to the domestic market. Comparing Equation (1) with Equation (3) we have $\pi_{d+f} > \pi_d \Leftrightarrow a > 1/3$. This means that both countries are supplied if a is high enough (greater than $1/3$), while the foreign market is shut down otherwise. Taking this into account, *ex ante* the firm maximizes its global profit, resulting in a quality level $u = a/(1+a)$ if $a > 1/3$ and $u = 1/4$ if $a < 1/3$.

3.2.3. Welfare analysis. We distinguish between a welfare analysis *ex ante* and *ex post*.¹⁷ (See Box 6) The *ex post* analysis is conducted for a given (exogenous) quality level and the results are summarized in Table 1. Table 1 reports the effect on consumer surplus in the two countries, firm’s profit and global welfare when moving from a world of no parallel trade (when prices take the expressions given by Equations (1) and (2)) to a world where parallel trade is permitted. The *ex post* analysis is well known: if both markets are supplied (when prices take the expressions given by Equation (3)), then parallel trade is good for welfare as it achieves a better allocation of the product. Consumers in the rich country benefit from the reduction in price brought by parallel traders, while consumers in the poor country are the losers because they face higher

¹⁷ We assume utility to be transferable and compute overall welfare as the simple sum of consumer surplus in the two countries and firm’s profits. Evaluating policies through consumer surplus implicitly assumes that transfers can be made, which may be difficult across countries. Crampes and Hollander (2003) discuss various possibilities to implement pricing policies in international markets (overpricing health services and transferring resources to the laboratories in rich countries, financing pharmaceutical laboratories through taxes, and bundling the sale of health services and pharmaceuticals).

Box 6. Results of the simple model

Ex post (i.e., ignoring investment decisions) parallel trade raises welfare for domestic consumers, reduces welfare for overseas consumers (since they will pay higher prices) and reduces profits. Note that when the producers anticipate parallel trade, overseas consumers cannot expect to gain by engaging in arbitrage, since the producer will simply set a uniform price in all markets. Net welfare increases with parallel trade so long as overseas markets are not closed. However, the lower the willingness to pay (e.g., the poorer the consumers) in the overseas market, the more likely it is that shutdown will occur. This is the Malueg and Schwartz result.

Ex ante (i.e., endogenizing the investment decision) parallel trade reduces welfare. There is no longer such a simple trade-off between domestic and overseas consumers. The overseas market enlarges the potential sales of the producer and hence generates an increase in investment in quality. Since parallel trade always reduces sales in the overseas market, it also reduces investment in product quality, which adversely affects domestic customers. While domestic consumers are still better off with parallel trade (because the domestic price effect outweighs the quality effect), their net gain is no longer large enough to outweigh the losses of the overseas consumers and the producer.

Table 1. *Ex post* welfare analysis of parallel trade

The effect of introducing parallel trade when willingness to pay in the foreign market is:	Consumer surplus in the domestic market	Consumer surplus in the foreign market	Profit	Welfare
High ($a > 1/3$)	Higher	Lower	Lower	Higher
Low ($a < 1/3$)	No change	Lower	Lower	Lower

prices. However, if the maximum willingness to pay in the foreign market is low ($a < 1/3$) then this market is shut down, even consumers in the domestic market do not gain as they are offered the same price as without parallel trade, and therefore total welfare must be strictly lower with parallel trade (and prices take the expressions given by (1)). The equations underlying Table 1 are given in the Appendix.

Once investments are taken into account (the *ex ante* analysis), the welfare analysis changes quite dramatically as is shown in Table 2 (see the Appendix for the precise formulae). The constraint on price implies that the firm has lower revenues from

Table 2. *Ex ante* welfare analysis of parallel trade

The effect of introducing parallel trade when willingness to pay in the foreign market is:	Quality	Consumer surplus in the domestic market	Consumer surplus in the foreign market	Profit	Welfare
High ($a > 1/3$)	Lower	Higher	Lower	Lower	Lower
Low ($a < 1/3$)	Lower	Lower	Lower	Lower	Lower

investments at the margin. Thus it always reduces the amount of investment made in a regime with parallel trade. This has a negative impact on the quality supplied, and thus reduces both consumer and total welfare. In the specific example reported in Table 2, consumers in the rich country still benefit overall from parallel trade (as long as both countries are supplied, i.e., $a > 1/3$) as the *ex post* reduction in price more than compensates for the reduction in quality. If one takes global consumer surplus as a test of benefits, then parallel trade still benefits consumers overall as long as the poor country is still served. However, if total welfare is used, then parallel trade has a negative impact for any value of a . This result depends on the quadratic investment function that we have used. More generally, the *ex ante* reduction in investment depends on the elasticity of the investment cost function: the more elastic the bigger the reduction.

This completes the ‘standard’ story of parallel trade. Parallel imports improve welfare *ex post* when they reduce the price in inelastic markets (with higher willingness-to-pay types), thus leading to an increase in consumption and welfare that more than compensates the loss arising from those markets with lower elasticity (lower willingness-to-pay types) that consume less under parallel trade. However, parallel imports also reduce the manufacturer’s investment. The simple model we have developed here captures this important tension between *ex ante* versus *ex post* incentives that has been the subject of many informal analyses.

3.3. Introducing variants

We now consider the question of whether it is profitable to sell more than one variant in either market (leaving open the possibility that each market is supplied with a dedicated product). Under what circumstances will the producer be willing to introduce a second product, of lower quality? Exploring this possibility seems natural given that we have shown that when the foreign country is very poor ($a < 1/3$) the monopolist would otherwise abandon the market altogether. Perhaps, if the monopolist could sell a second variant, it would sell the lower-quality product to the foreign market earning some profits there.

As a natural benchmark, we begin by asking whether it would ever be optimal to introduce an inferior variant in the absence of parallel trade. We assume that once a certain quality u has been produced at the investment stage, the producer is also able

to supply a lower-quality product of quality u_i at a zero extra cost, as a by-product of the first innovation.

This is a plausible assumption to make in relation to a number of products supplied internationally under trademark. For example, it is frequently the case that manufacturers sell their outdated machinery to developing countries, enabling them to supply an old version of the product. In such a case the manufacturer would generally intend that the old machinery were used to supply the developing country market only, rather than to compete in its home market. The threat of this kind of parallel trade may not be the only factor in a decision to sell old plant, but it could reasonably be a contributory one.

In the case of a pharmaceutical product, it seems unlikely that a research lab would seriously contemplate developing an inferior version (at least with respect to therapeutic properties) for the purpose of restricting parallel trade. Nonetheless, pharmaceutical companies may also license older products (perhaps where the patent has expired but the trademark remains valuable) for production in LDCs, creating the possibility that two products of different qualities originating from a single producer may exist on the market at the same. When this is possible, the licensing decision may be affected by the threat of parallel trade. Alternatively, quality in the model can be understood here as ‘perceived’ quality, so that two products with identical therapeutic properties have different quality levels if marketing expenditure on the two products is different. The restrictions we impose on u_1 imply that the firm has some flexibility to determine the quality of the low-quality variant. It is never as good as its premium product, but also it is not a fictitious product that no one would ever buy.¹⁸

3.3.1. No arbitrage. Imagine there is no international exhaustion (no arbitrage) and the monopolist decides to offer two products of different quality. The firm may try to sell the two products in each market at different prices. Imagine that in each market i the higher-quality product u is sold at a price p_i and the lower-quality product $u_i < u$ is sold at a price $p_{ii} < p_i$. The high-quality product is bought by the high end of the market (those customers between $\tilde{t}_i = (p_i - p_{ii}) / (u - u_i)$ – defined as the type indifferent between the two variants – and $T_i = \{a, 1\}$), while the low-quality product is sold to the low-end (those customers between $\underline{t}_i = p_{ii} / u_i$ – defined as the type indifferent buying the inferior version and not buying – and \tilde{t}_i). The expression for profit in market i with two products then is:

$$\pi_i^2 = (T_i - \tilde{t}_i)p_i + (\tilde{t}_i - \underline{t}_i)p_{ii}.$$

On the other hand, if the monopolist decides to offer only one product of high-quality in this market it would sell to all customers with t above $\underline{t}_i = p_i / u$ and it would get:

$$\pi_i^1 = (T_i - \underline{t}_i)p_i.$$

¹⁸ We assume $u_i \in [\underline{u}, \bar{u}]$, with $\underline{u} > 0$, $\bar{u} < u$.

Noting that $\tilde{t}_i - \underline{t}_i = (\underline{t}_i - \underline{t}_i)u_i/(u - u_i)$ and that $\tilde{t}_i - \underline{t}_i = (\underline{t}_i - \underline{t}_i)u/(u - u_i)$, it can immediately be shown that:

$$\pi_i^1 - \pi_i^2 = (\tilde{t}_i - \underline{t}_i)p - (\tilde{t}_i - \underline{t}_i)p_i = \frac{\underline{t}_i - \underline{t}_i}{u - u_i} (pu_i - p_i u) = \frac{u_i u (\underline{t}_i - \underline{t}_i)^2}{u - u_i} > 0.$$

Result: with no arbitrage the monopolist strictly prefers to sell a single product in each market.

Notice that the result does not make use of first-order conditions. Thus it is a very general finding, holding for any combination of the two prices of the high- and low-quality good. The intuition is that, although by introducing a second product of lower quality the monopolist can enlarge the market, the availability of such a product also induces some customers that were previously buying the high-quality product to purchase the low-quality product at a cheaper price. The loss of revenue from customers who ‘switch’ in this way will always prevail over the increased revenues from the expanding bottom end of the market. Hence the monopolist should never offer a lower-quality variant of its product, even when it is costless to do so.

3.3.2. The choice of quality under arbitrage: never introduce a second variant to fight parallel trade.

In Section 3.2 we showed that the firm renounces all sales in the foreign market when $a < 1/3$ and there is parallel trade. We also know from Section 3.3.1 above that it would not be profitable to introduce a lower-quality product in the domestic market when it is protected from parallel trade. However, in the presence of arbitrage it may be the case that the firm would want to introduce a low quality variant in order to have some sales in the foreign market without fearing that such a product is bought in the domestic/ richer market. We now examine whether this is a profitable strategy for dealing with parallel trade.

Imagine the firm introduces, next to its original high quality product u sold at a price p , a lower-quality product $u_i < u$ sold at a price $p_i < p$. The high-quality product is bought by consumers whose type is greater than or equal to $\tilde{t} = (p - p_i)/(u - u_i)$. The low-quality product is sold to customer types between $\underline{t} = p_i/u_i$ and \tilde{t} . Two cases have to be examined:

- The firm offers to sell two products in both markets.
- The firm offers to supply both goods in the domestic market, and only the low quality good in the foreign market.¹⁹

We consider each of these in turn.

¹⁹ The lowest willingness to pay in both markets is equal to zero, thus it can never be the case that consumers in the rich country consume only the high-quality good if the low-quality good is available for sale in the poor country.

Case 1. *The firm offers to sell two products in both markets.* Imagine there is an ‘interior’ solution, which can arise if $a > \tilde{t} > \underline{t} \geq 0$. The firm then maximizes with respect to the two prices

$$\pi = [p(1 - \tilde{t}) + p_t(\tilde{t} - \underline{t})] + [p(a - \tilde{t}) + p_t(\tilde{t} - \underline{t})]/a.$$

Optimal prices, indifferent and marginal types are:

$$\left\{ \begin{array}{l} p = \frac{a}{1+a}u \\ p_t = \frac{a}{1+a}u_t \\ \underline{t} \equiv \tilde{t} = \frac{a}{1+a} \end{array} \right.$$

In other words, it is optimal to ‘price out’ the lower-quality good: this is not going to be bought by anybody and the firm adopts the same solution described by (3) – with only one product sold in both countries – assuming $a > 1/3$. If $a < 1/3$ then only a single product is sold in the domestic market and nothing in the foreign market.

Case 2. *The firm offers to supply both goods in the domestic market, and only the low quality good in the foreign market.* Imagine now $\tilde{t} > a > \underline{t} > 0$. The profit is $\pi = [p(1 - \tilde{t}) + p_t(\tilde{t} - \underline{t})] + p_t(a - \underline{t})/a$ and optimal prices, marginal/indifferent types and corresponding profits are:

$$\left\{ \begin{array}{l} p = \frac{u - u_t}{2} + p_t \\ p_t = \frac{a}{1+a}u_t \\ \tilde{t} = 1/2 \\ \underline{t} = \frac{a}{1+a} < \tilde{t} \\ \pi^2 = \frac{1}{4}u - \frac{1 - 3a}{4(1+a)}u_t \end{array} \right. \tag{4}$$

While there is a local optimum in this case, this is not necessarily a global optimum since the firm may have at its disposal other strategies as well. First of all, notice that Equation (4) is a candidate solution where we have assumed that $a > \underline{t} = a/(1 + a)$, which is always satisfied, and $\tilde{t} > a$, implying $a < 1/2$. If $a > 1/2$ then we return to Case 1 where we have already shown that the monopolist is better off by selling only the high-quality good.

When $a < 1/2$ the candidate solution given by Equation (4) then overlaps with Equation (3) when $a > 1/3$ and with Equation (1) when $a < 1/3$. Denoting by π^2 the profit with ‘two products’ in Equation (4), it turns out that:

$$\begin{aligned}\pi_{t+f} &> \pi^2 \text{ if } a > 1/3 \\ \pi_d &> \pi^2 \text{ if } a < 1/3 .\end{aligned}$$

In other words, our candidate solution is never a global optimum: while the firm makes money by selling the low quality good abroad and both goods domestically, it could make even more money by the following strategy:

- when $a > 1/3$, concentrating only on the high-quality good in both markets if the foreign consumers are rich enough (the solution described by (3)), or
- when $a < 1/3$, abandoning the foreign market and selling only the high quality good in the domestic market if the foreign consumers are very poor (the solution described by (1)). Also in this case, only one variant is sold.

Result: with arbitrage the monopolist strictly prefers to sell a single product in each market.

From this we can draw the following conclusions:

- Firms recognize the risk of cannibalization. Under arbitrage they are ‘forced’ to get a global brand. If two local brands are kept, then the firm is damaging its overall profitability.
- Even when firms have more variants at their disposal (e.g., more ‘local’ brands), they should not use all of them as a response to parallel imports.
- The welfare analysis conducted in Section 3.2. remains valid and the same conclusions apply when multiple variants are a possibility.

3.3.3. What matters for the ‘single product’ result (see also Box 7). We have shown that a monopolist does not react to parallel trade by introducing low-quality variants. The intuition comes from the fact that preferences are linear in quality and quality is costless to produce. Hence the monopolist’s objective function is also linear and there is always a corner solution where the monopolist supplies only one product. Although introducing a second product of lower quality can enlarge the market, the availability of such a product also induces some customers that were previously buying the high-quality product to purchase the low-quality product at a cheaper price. The reduced revenues from these ‘switching’ customers always prevail over the increased revenues from the expanded bottom end of the market, hence the monopolist should never downgrade its own quality. This result does not depend on the uniform distribution of willingness to pay in the various countries.²⁰

²⁰ To see this, imagine the extreme case where a mass m of customers is concentrated in a ‘high’ country where everybody is of type t_h , and a mass $(1 - m)$ is concentrated in a ‘low’ country where everybody is of type $t_l < t_h$. If the monopolist sells only the high quality good, his profit is $\pi^1 = \max\{t_l u, m t_h u\}$, according to whether both markets are served or only the ‘high’ country. On the other hand, if it offers two products, by solving the standard screening problem that satisfies incentive compatibility for the high types and individual rationality for the low types, the equilibrium profit is: $\pi^2 = t_l u_l + m t_h (u - u_l) < \pi^1$.

Box 7. Results of the model with the potential for product variety

If parallel trade cannot be prevented in the simple model, the producer is faced with a stark choice – either shut down the overseas market or allow the product to move freely at a uniform price. We imagined it might be possible to follow an intermediate strategy – offer an inferior version of the product in the overseas market and reserve the high-quality version for the domestic market. This might seem to accord with company policies in relation to branded goods in overseas markets, where companies often offer old versions of the product, often produced using old machinery that has been exported from the domestic market. However, our model shows that this strategy would not make sense, given our assumptions about costs. Introducing an inferior product into the overseas market creates competition from arbitrageurs in the domestic market, and even if this means that wealthy consumers still purchase the high-quality version, there is enough cannibalization of the domestic market to make the strategy unprofitable.

Note that this result depends on our assumption that the costs of supplying product quality are entirely fixed. If higher quality entailed a higher variable cost then it would pay to supply different varieties in different markets, as in the Mussa–Rosen model of product variety and second-degree price discrimination. This would be true with and without parallel trade: thus the threat of arbitrage does not cause *additional* products to be introduced.

There are of course many situations where a portfolio of products of different qualities will be offered. The main point that should be taken from our analysis is that, if such reasons exist, they seem not to be affected by parallel trade. In other words, if a firm – in the absence of parallel trade – offers a single product, then it will continue offering a single product even in the presence of parallel trade.

What matters for the single product result is that variable costs of production, if they are present, are either constant or increasing at a decreasing rate with quality. If, on the contrary, variable costs increase at an increasing rate, then the firm may want to introduce two variants to discriminate among heterogeneous customers. This would be a classic Mussa–Rosen story where the firm engages in second-degree price discrimination. In contrast, when there are increasing returns to quality, the monopolist will sell a single product at the highest feasible quality level.

A monopolist would also want to introduce a second variant if one part of the market is captive (e.g., some customers are not prepared to switch to the inferior variant, no matter how cheap it is). Also in this case, however, parallel trade *per se* does not cause the introduction of additional varieties: the best strategy for the

monopolist would be to supply the superior product to the captive market and the inferior version to the more elastic segment of the market in any case, with and without parallel trade.

Another reason for introducing lower-quality variants could be competition. As shown by Johnson and Myatt (2003) a monopolist with a certain quality portfolio adjusts its product line in response to competition in different ways, according to the behaviour of its marginal revenue. In particular, if the incumbent's supply increases with entry, then a lower-quality variant will be introduced. Valletti and Szymanski (2004) elaborate on this idea in the context of a pharmaceutical firm that faces the presence of a 'generic' product. Indeed, the incumbent firm will introduce a 'fighting brand' to compete with the generic, both with and without parallel trade.

While the degree of convexity of variable costs and competition are both reasons that may induce an incumbent to offer multiple products, neither of them is associated with parallel trade *per se*. Lower quality products do not arise in our model when the firm is unconstrained in its pricing strategies. Parallel trade imposes a constraint on pricing strategies, and quite naturally we have found that the firm would not add products when constrained to offering a single price everywhere. However, this may not be a general result. What we investigate next is whether the imposition of different types of constraints on its pricing ability can change the outcome. In particular we study the effect of having price caps.

3.4. Introducing price caps: they do matter

Parallel trade is commonly treated by economists as an issue of third-degree price discrimination driven by the profit maximizing strategy of a monopolist. However, in the case of healthcare products protected by patents and trademarks, the monopolist frequently faces a monopsonist, usually in the form of the state negotiating on behalf of the national healthcare system. Pharmaceutical companies argue that, faced with these market conditions, parallel trade amounts to the global imposition of the lowest price that any government can negotiate. Moreover, national governments can impose compulsory licences on products protected by patent, and fix the remuneration, if any, to be paid to the licensor.²¹ Hence refusal to supply may not be an option for the monopolist, severely curtailing its bargaining power.

In this section we model the effects of bilateral monopoly backed by the threat of compulsory licensing in the overseas market. We suppose that there is a price cap which is imposed on the good sold in the foreign market. We also suppose that the price cap is fixed to maximize the welfare of consumers in the foreign market, which is how we might expect a benevolent foreign government to act. In fixing the cap the foreign government must consider the effect on the quality of the good supplied as

²¹ Article 31 of the TRIPs agreement imposes some restrictions on the exercise of this right. Article 21, however, states that WTO members may not issue a compulsory licence for trademarks.

Box 8. Compulsory licensing

Compulsory licensing is when a government allows someone else to produce the patented product or process without the consent of the patent owner. In current public discussion, this is usually associated with pharmaceuticals, but it could also apply to patents in any field. The agreement allows compulsory licensing as part of the agreement's overall attempt to strike a balance between promoting access to existing drugs and promoting research and development into new drugs. But the term 'compulsory licensing' does not appear in the TRIPs Agreement. Instead, the phrase 'other use without authorization of the right holder' appears in the title of Article 31. Compulsory licensing is only part of this since 'other use' includes use by governments for their own purposes.

Compulsory licensing and government use of a patent without the authorization of its owner can only be done under a number of conditions aimed at protecting the legitimate interests of the patent holder. For example: Normally, the person or company applying for a licence must have first attempted, unsuccessfully, to obtain a voluntary licence from the right holder on reasonable commercial terms – Article 31b. If a compulsory licence is issued, adequate remuneration must still be paid to the patent holder – Article 31h.

However, for 'national emergencies', 'other circumstances of extreme urgency' or 'public non-commercial use' (or 'government use') or anti-competitive practices, there is no need to try for a voluntary licence – Article 31b.

Compulsory licensing must meet certain additional requirements. In particular, it cannot be given exclusively to licensees (e.g., the patent-holder can continue to produce), and usually it must be granted mainly to supply the domestic market. Compulsory licensing cannot be arbitrary.

The TRIPs Agreement does not specifically list the reasons that might be used to justify compulsory licensing. In Article 31, it does mention national emergencies, other circumstances of extreme urgency and anti-competitive practices – but only as grounds when some of the normal requirements for compulsory licensing do not apply, such as the need to try for a voluntary licence first.

Source: www.wto.org

well as the price. This requires us to specify carefully the timing of events. The most extreme model, given that the WTO recognizes the right of governments to impose compulsory licences (see Box 8), would assume that governments were unable to precommit not to invoke a compulsory licence, and hence any product would be

licensed. Whether or not there is parallel trade, the optimal price cap for the foreign country is zero. This case produces a stark result: if there is no parallel trade the producer invests as if it were serving the domestic market alone, and makes monopoly profits in the domestic market and zero abroad. If there is parallel trade, then there will be no private investment, since the global price is always zero.

This is an extreme result, and one which the negotiations at the WTO mentioned in Section 2 seem intended to avoid. In specifying the conditions under which a compulsory licence can be issued, Article 31 of the TRIPs requires the foreign government to seek agreement with the owner of the patent and to ensure reasonable compensation is paid (see Box 9).²² To model this more conciliatory approach we suppose that the foreign country negotiates with the producer to sell an inferior version of the product at a capped price if the producer prefers this option to selling the high quality version in the foreign market. If this is the preferred option of the producer, we assume that the foreign government commits to not using a compulsory license to acquire the high quality version. At the same time, there is a danger for the foreign government that, in a world with parallel trade, the producer would exploit this commitment by supplying a ‘phantom’ product in the foreign market. By this we mean a product with zero quality for which there will be zero demand, which would benefit the producer by eliminating any competition for the high quality product in the domestic market.

In Section 3.3 we assumed that the inferior product must have some positive quality, and we found that the firm would never choose to supply this product. When the price is regulated in the foreign market we will see that it can be optimal to supply the low quality variant, in which case we have to discuss the mechanism by which the quality level of the inferior product is set. Thus we envisage the following sequence of events:

- The producer decides quality/investment levels. There is an agreement over minimum quality standard for the inferior product if two qualities are supplied (where the parties to the agreement may include the producer, the foreign government and possibly the representatives of the domestic consumers).
- The foreign government imposes a price cap in the foreign market. It also commits not to compulsorily licence the high quality product if two varieties are supplied.
- The producer sets the price of the unregulated product (if there is one).
- Trade takes place.

²² For example, paragraph (b) states ‘such use may only be permitted if, prior to such use, the proposed user has made efforts to obtain authorization from the right holder on reasonable commercial terms and conditions and that such efforts have not been successful within a reasonable period of time. This requirement may be waived by a Member in the case of a national emergency or other circumstances of extreme urgency or in cases of public non-commercial use. In situations of national emergency or other circumstances of extreme urgency, the right holder shall, nevertheless, be notified as soon as reasonably practicable. In the case of public non-commercial use, where the government or contractor, without making a patent search, knows or has demonstrable grounds to know that a valid patent is or will be used by or for the government, the right holder shall be informed promptly’, while paragraph (h) states ‘the right holder shall be paid adequate remuneration in the circumstances of each case, taking into account the economic value of the authorization’.

Box 9. Importing under compulsory licensing

Article 31(f) of the TRIPs Agreement says products made under compulsory licensing must be ‘predominantly for the supply of the domestic market’. This applies to countries that can manufacture drugs – it limits the amount they can export when the drug is made under compulsory licence. And it has an impact on countries unable to make medicines and therefore wanting to import generics. They would find it difficult to find countries that can supply them with drugs made under compulsory licensing.

The problem was resolved on 30 August 2003 when WTO members agreed on legal changes to make it easier for countries to import cheaper generics made under compulsory licensing if they are unable to manufacture the medicines themselves. The decision waives exporting countries’ obligations under Article 31(f) – any member country can export generic pharmaceutical products made under compulsory licences to meet the needs of importing countries, provided certain conditions are met. The waiver is interim, the ultimate goal is to amend the TRIPs Agreement itself.

Carefully negotiated, these conditions aim to ensure the beneficiary countries can import the generics without undermining patent systems, particularly in rich countries. They include measures to prevent the medicines from being diverted to the wrong markets. And they require governments using the system to keep all other members informed, although WTO approval is not required. At the same time phrases such as ‘reasonable measures within their means’ and ‘proportionate to their administrative capacities’ are included to prevent the conditions becoming burdensome and impractical for the importing countries.

All WTO member countries are eligible to import under this decision, but 23 developed countries are listed in the decision as announcing voluntarily that they will not use the system to import: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the US.

Another 10 countries about to join the EU said they would only use the system to import in national emergencies or other circumstances of extreme urgency, and would not import once they had joined the EU: Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia.

And 11 more said they would only do so in national emergencies or other circumstances of extreme urgency: Hong Kong China, Israel, Korea, Kuwait, Macao China, Mexico, Qatar, Singapore, Chinese Taipei, Turkey, United Arab Emirates.

Source: www.wto.org

In equilibrium, the producer will anticipate the price set by the foreign government and will then be able to optimize its choice of product variety and its *ex ante* investment choice conditional on this expectation.

3.4.1. Results with compulsory licensing and price caps. The formal derivation of the results in our model is relegated to the Appendix. Below we state the principal conclusions of the modelling.

1. If all product varieties can be subject to unrestrained compulsory licensing and the licensor in the overseas country can unilaterally set the price cap, then the producer anticipates all products will be compulsorily licensed and capped at marginal cost. In this world parallel trade thus destroys all investment incentives since the free-riding behaviour of the overseas country extends everywhere.
2. If the government of the overseas country could instead fully commit to an appropriate remuneration, then free-riding would not arise and investment would take place. This obvious result is not realistic. Thus we study a weaker form of commitment, where the foreign country offers the producer the following contract: the foreign government compulsory licenses at a capped price only the low-quality product in case the producer decides to supply two variants.
3. The producer keeps the option whether or not to offer an inferior version. Contrary to Section 3.3, there is now a combination of price cap/willingness to pay in the foreign country that induces the monopolist to offer two variants under parallel trade. This is because, if the price cap is low enough, the monopolist prefers to sell two variants (the superior version in the domestic market only and the inferior version in both countries) to selling a single product everywhere at a low (capped) price that applies in all places because of parallel trade.
4. Given that the final choice whether or not to supply one or two variants is left with the producer, our mechanism also gives some limited commitment to the government of the overseas country when setting a specific price cap. In fact, the foreign government anticipates that now it has two options:
 - (a) to cap the version supplied there at a price equal to marginal cost: this will induce the monopolist to introduce an inferior version and offer it to the overseas government;
 - (b) to commit to capping the superior version of the product at a price which ensures that it is not worthwhile for the producer to introduce the inferior version.
5. An interesting property of this mechanism is that parallel trade has no effect on investment incentives. Clearly, investment incentives are reduced by the existence of compulsory licensing, but in this regime where limited commitment by the foreign government is possible the incentives are the same at the margin, with and without parallel trade. Without parallel trade, the overseas government sets the cap at the marginal cost: investment incentives are thus dictated only by the

domestic market. With parallel trade, either the cap is very low and the producer prefers to sell two variants (but the marginal revenues from investment are zero in the foreign country where the inferior variant is sold, thus marginal revenues are made only in the domestic market, as in the case without parallel trade), or the cap is set at a reasonably high level in order to induce the producer to offer the high-quality good everywhere: in this latter case the marginal returns from investment are also the same as without parallel trade since a lower margin applies to a bigger market (both countries instead of the domestic market alone). With and without parallel trade the monopolist supplies the same investment level.

The *ex ante* welfare properties of parallel trade change quite dramatically with compulsory licensing and price caps. Under parallel trade we show that:

1. As long as the willingness to pay in the overseas market is large enough, it is preferable for the foreign government to fix the cap high enough so that the superior product is introduced. In this range parallel trade is always welfare enhancing *ex ante*: there is no investment dilution effect and everybody is supplied.
2. If willingness to pay is very low (e.g., consumers are very poor) then the producer will always want to sell an inferior product despite it being capped at marginal cost. The foreign consumers lose from parallel trade (in the absence of parallel trade they would still pay only the marginal cost but consume the high-quality product), while domestic consumers always gain. The overall *ex ante* impact of parallel trade is welfare enhancing only if the quality of the inferior quality is not 'too' low.
3. When the inferior product is introduced there is a tension between the producer and the overseas government over its quality. The producer wants to select 'zero' quality – what we have called a 'phantom' product, while the government wants an 'effective' product whose price is set at marginal cost. We suggest that this problem needs to be fixed by bargaining between the overseas government, the producer and the domestic government, whose consumers will also be affected by the quality of the inferior product.

4. POLICY DISCUSSION AND CONCLUSIONS

On the face of it, the principal arguments in relation to parallel trade have long been understood by economists in the general context of third-degree price discrimination: price discrimination reduces welfare when the number of consumers served is not much affected by the selling regime, but raises welfare if uniform prices cause a significant segment of the market to go unserved. This paper has taken this observation as the starting point for analysing a richer set of interactions between producers and markets.

We draw three broad policy conclusions. First, we think it is important to analyse parallel trade not just in terms of price discrimination, but also investment. Where investment arguments are absent, there is probably little merit to prohibiting parallel

trade. Intellectual property laws exist to encourage investment, and while the appropriate extent of the incentives that should be provided is open to debate, ignoring investment effects seems to miss the point. Second, we think it is important to bear in mind the effect on consumers who receive low prices under price discrimination rather than just those who pay high prices. Canadian citizens have already recognized that the pressure to permit parallel trade with the US will probably lead them to pay higher prices: their welfare loss will clearly not be negligible. Third, the most important adverse effects of parallel trade tend to occur when the foreign country is very poor, causing the market to be shut down in a world of parallel trade. This may not be of much significance in the luxury branded goods market, but in the case of essential medicines and related products this effect is important.

Our first, and fairly straightforward, result is that while parallel trade may have positive welfare implications (so long as distribution of willingness to pay is not too widely dispersed), this is no longer true once the incentive to invest in quality is accounted for. If investment matters then parallel trade reduces investment. This is a view which is consistently advocated by firms that wish to use patents or trademarks to price discriminate in international markets. This implies that the policy prescription will depend on how seriously the investment argument is taken. The investment argument is that the function of intellectual property is to stimulate investment in (welfare enhancing) R&D. Note that even under parallel trade, there can remain an incentive to invest encouraged by intellectual property rights, but this incentive will be weaker than in a world where parallel trade is permitted.

There has been much controversy in the legal profession over the relevance of the investment argument in relation to trademarks. For example Justice Laddie, one of the leading authorities in Europe on the issue of trademarks, has asserted that the purpose of a trademark is essentially 'to tell the truth about the origin of goods' and that by permitting trademark owners to prohibit parallel trade the law had conferred upon trademark owners the 'parasitic right to interfere with the distribution of goods which bears little or no relationship to the proper function of the trademark right'.²³ This view of trademarks gives no weight to the investment argument and therefore questions the value of protecting price discrimination. A similar position is taken by Gallini and Hollis (1999), for different reasons. They see restrictions on parallel trade as an inappropriate mechanism for creating exclusive territories and argue that the ordinary rules of antitrust should be applied to the analysis of contractual arrangements to create exclusive territories. They argue that parallel trade is an essential discipline in these arrangements. Prohibiting parallel imports is analogous to the creation of exclusive territories since both restraints minimize the amount of intra-brand competition and can be used to dampen inter-brand competition. By creating market power for the retailer, the producer perceives less elastic demand curves, causing in turn a dampening

²³ *Zino Davidoff SA v A&G Imports Limited*, CH-1998 D No.4517, paragraph 36.

of competition among producers, which then translates into price rises.²⁴ What these two views (one legal, one economic) have in common is a desire to enable consumers in high price countries to obtain products that are available more cheaply elsewhere.

These arguments give no weight to the interests of consumers in markets where price discrimination leads to low prices and who will therefore lose from parallel trade. Nor do they take account of the negative impact that parallel trade will have on investment incentives. However, our model focuses purely on intra-brand competition and takes no account of the impact of inter-brand competition or any interaction between the two. There are a wide range of branded consumer products protected by trademarks where inter-brand competition is significant and hence the welfare effects that we have identified may be moot.

It seems plausible to us to advocate parallel trade on the grounds cited above for products such as jeans and perfume. If parallel trade undermined R&D in branded textiles and fine fragrances, it seems hard to argue that the impact on global welfare would be significant, whereas the *ex post* welfare effects of uniform prices could be quite large. Moreover, our analysis in Section 3.3 suggests that there is little likelihood of introducing an inferior product in foreign markets subject to parallel trade. This is important since the incentive to supply inferior products could undermine the perceived benefits of parallel trade.

Thus we agree with those critics who have questioned the relevance of the investment argument for branded goods protected by trade marks. However, we believe that patents play a significant role in stimulating R&D in a number of industries, most notably in the pharmaceutical industry and particularly in relation to clinical testing, which is a lengthy and expensive process unlikely to be commercially worthwhile unless the product that emerges is protected from competition for a limited period of time.

Even if we accept the investment argument, that acceptance needs to be qualified depending on the types of markets that are being considered. From a welfare standpoint, we think that the biggest concern that arises with parallel trade involves the consumers in the 'poorer' markets, who will benefit from lower prices when parallel trade is prohibited and are likely to see prices increase if parallel trade is permitted. This in turn suggests that we should be concerned with just how poor these consumers are. For example, when we compare parallel trade in pharmaceuticals between the USA and Canada or within the European Union, the consumers in the 'poor' country are often better off than a significant fraction of consumers in the 'rich' country. This gives some reason to question the value of prohibiting parallel trade when trade is between countries with little difference either in average wealth or the variability of wealth. However, when we consider trade between the rich and the very poor then the issue seems rather different to us. For example, it is widely held to be ethically

²⁴ This occurs as retail prices are strategic complements, see Rey and Stiglitz (1995). Firms can then use parallel trade/exclusive territories to collude implicitly: by endowing retailers with market power, the producer can induce an outcome whereby the retailer will increase prices in response to a rise in a competitor's prices and conversely lower prices as a response to entry.

desirable to supply cheap pharmaceuticals to poorer countries, notably AIDs drugs to Africa. Yet there is evidence that drugs supplied for humanitarian purposes are simply being parallel traded back to developed countries (see the GlaxoSmithKline case mentioned in Box 1). Prohibiting this kind of parallel trade seems likely to ease the flow of life-saving products to the poorer countries and is therefore a desirable policy.

In addition, our analysis of price caps in Section 3.4 suggests that a degree of caution is required when analysing products subject to price caps and compulsory licensing. First, it is important to recognize that compulsory licensing exists because certain products, mostly pharmaceuticals, are deemed essential to public health and that therefore a refusal to supply, because the willingness to pay of consumers in some markets is not high enough, cannot be accepted. As we noted earlier, parallel trade is likely to be detrimental to welfare when it causes the producer to shut down the foreign market. The WTO rules on compulsory licensing were introduced to deal precisely with such cases. Clearly a compulsory license requires a price cap as well. While the WTO requires that the government attempts to negotiate a voluntary agreement before imposing a compulsory licence, and that compensation should be set at a reasonable level subject to judicial review in that country, and that the products be intended primarily for the citizens of that country, there remains a significant likelihood that a price cap will be set at a low level, rendering parallel trade extremely profitable. Thus in this case the compulsory licence has the effect of keeping open a market that would be shut down under a regime of parallel trade (but would not have been shut down if parallel trade were illegal).

If parallel trade is permitted under such an arrangement, the compulsory licence will have the effect not only of denying the licensor a profit in the foreign market (which, in any event, would probably have been very small) but also of denying it a profit in its home market (i.e., where it enjoys patent protection). Whether such a policy is considered fair or not, the practical consequence will be to kill off investment in research into products that might become subject to compulsory licence, unless some other form of compensation is agreed. It is, of course, open to governments in wealthier countries to permit parallel trade and then directly reimburse companies for losses if this is deemed essential to maintaining investment in R&D. Moreover, alternative mechanisms exist for compensating innovation, such as research prizes. We investigated a more subtle mechanism whereby it is the overseas government that commits to compulsorily license only the inferior variant in the case where the producer decides to offer more than one product. We showed how the foreign government can then either accept the inferior variant (and cap it at the lowest possible price) or set a price cap high enough to induce the producer to deliver the high-quality variant everywhere. We demonstrated that under this particular incentive mechanism the presence of parallel trade does not have any impact on investments.

We showed that when the willingness to pay of the poorer country is not too low, the compulsory licensing scheme will cause the producer to supply only a product of a single quality in both markets, and while investment incentives are lower than they

would be in the absence of price caps, parallel trade does not reduce investment and improves welfare. The reason for this is that the foreign government will choose to set the price cap high enough to ensure that the producer does not want to sell an inferior product, and in doing so ensures that the producer has the incentive to supply the same quality product as if there were no parallel trade. Note that in this case the profits of the producer fall, but the marginal incentive to invest does not.

When the willingness to pay in the poorer country is very low is precisely when the two variant solution – a lower quality variant for the poor market sold at marginal cost – becomes an attractive strategy. Recalling that this was never an attractive option when there was no compulsory licensing, it now becomes attractive to the producer to minimize the effect of parallel trade. Moreover, when the foreign country is very poor, it would be better off having a low quality product at a low price than the high quality product at a higher price. In these circumstances parallel trade will tend to raise welfare, as long as it is possible to agree an adequate quality level for the inferior product. This is likely to involve a bargain between the foreign government and the producer. It may also involve the domestic government, which also benefits from a higher quality product being parallel traded. However, if the quality of the inferior product is too low, then parallel trade is likely to be detrimental to welfare.

In our model we have analysed the interaction between rules on parallel trade, compulsory licensing and the incentive to provide different product varieties. Our results suggest that if governments cannot pre-commit to licensing products under some cases, a regime of parallel trade will in fact eliminate all investment. If some pre-commitment is possible the potential benefits of parallel trade can be restored, but the situation is complex and may require careful bargaining between producers and governments.

Discussion

Gabrielle Demange

DELTA and CEPR

Stefan Szymanski and Tommaso Valletti provide a very elegant analysis of various regulations (price cap, compulsory license, parallel trade) that limit the monopoly power of a firm over products with high R&D costs and low marginal costs of production. Pharmaceutical products such as HIV drugs and vaccines are leading examples that the authors have in mind. The analysis takes a short-term perspective, by studying how prices and welfare are affected by regulations once the product is developed and a long-term perspective, by appraising the impact of these regulations on the incentive to invest in innovation. A main insight from the analysis is that the impact of a policy depends a great deal on whether parallel trade is allowed or not.

Two main issues underlie the paper. First, the trade-off between monopoly distortions and incentives to innovate is at the heart of the problem. This trade-off is usually

appraised through efficiency welfare gains. The optimal ‘solution’ of the trade-off depends on the situation at hand. However, since each case cannot be regulated separately, a common rule is most often used, usually a patent that gives monopoly power for a certain number of years. Under what conditions should an exception be made? There are well-known exceptions – mathematical theorems for instance. The crucial question is whether an exception should be made for some pharmaceutical products. While the paper does not directly raise this question, it should be kept in mind.

More generally, the range of policies available could be more fully discussed. For example, allowing poor countries to produce the good and resell it in conjunction with parallel trade could be studied in more detail. This is actually a policy that some poor countries are asking for. It would change the distribution of welfare gains associated with parallel trade through the distribution of profits. Also, what about other policies than patents, such as public sponsorship, or prizes?

Secondly, the affordability of the product to poor countries and distributional issues across countries are crucial elements to address. To appraise policies, the paper assumes utility to be transferable and computes consumers’ surplus or overall welfare by including profits. A delicate point is whether utility can indeed be considered as transferable in the leading case of vital medicine. But, even assuming transferable utility, appraising policies through consumers’ surplus makes sense only if transfers can be implemented, and without cost. This problem may be very important.

Consider, for example, the analysis of parallel trade in the simplest model. Parallel trade is followed either by an increase of the price in the poor country or by a shut down. The first case occurs if the willingness to pay for the product does not differ too much between the poor and the rich countries (say Canada/US) while the second holds if the markets differ widely (say African countries/US). Whichever case occurs, parallel trade hurts the consumers in the poor country. However, if the overall surplus criteria are used, adding the gains of the US consumers and losses of the Canadian ones, parallel trade is beneficial. The question is how transfers could be implemented so as to compensate Canadians for the increase in the price of medicines. More generally, what kinds of institution should be established?

A final point that may be worth mentioning is that the analysis relies on a perfect equalization of prices followed by parallel trade. Some studies suggest that this is far from being true, at least in the short run (see for example the paper by Kanavos and Costa-Font in this issue).

Panel discussion

Pierre Pestieau kicked off the panel discussion by asking about the first best solution to the problem; Stefan Szymanski responded that a social planner would set price to

zero (marginal cost) and research would be funded by lump sum taxation. Pestieau was also interested in an extension to piracy and the creation of illegal products. He explained that these (for example in the eyes of some Chinese manufacturers) might not be a bad thing for total world welfare. Georges de M enil pursued the idea of piracy and asked how this was economically distinct from compulsory licensing – whereby the government allows production of a patented product without the consent of the patent holder. In response, Stefan Szymanski first clarified the distinction between pirated goods (which are a different product from the original) and parallel imports (which are both identical and not counterfeits of the original product). He then continued to explain that piracy in China, for example, may indeed have a similar effect as a compulsory licence; it will benefit local consumers, and the good will be sold at a price that suits the local market.

Szymanski also addressed a point made in the discussion by Ernst-Ludwig von Thadden, who had suggested the model might be limited in application to situations where parallel imports occur between countries with distinct willingness to pay. The author explained that the willingness to pay may instead be interpreted more broadly and this would allow the model to be applied, for example, to the case of parallel imports of drugs from Canada to the USA. Canadian purchases at a low price do not reflect low willingness to pay on behalf of Canadians, but rather the Canadian government has been able to negotiate a low price for its consumers.

APPENDIX

Expressions for consumer surplus, profits, welfare and quality referred to in Tables 1 and 2

Table A1. *Ex post* welfare analysis of parallel trade

	CS_d	CS_f	π	Welfare
No parallel trade	$u/8$	$au/8$	$(1 + a)u/4$	$3(1 + a)u/8$
Parallel trade				
If $a \geq \frac{1}{3}$	$\frac{u}{2(1 + a)^2}$	$\frac{a^3}{2(1 + a)^2}u$	$\frac{a}{1 + a}u$	$\frac{1 + a + a^2}{2(1 + a)}u$
If $a < 1/3$	$u/8$	0	$u/4$	$3u/8$

Technical analysis of the case with price caps

For notational simplicity, we suppose that the cap regulates the ‘hedonic’ price of the good for sale in the foreign market, i.e., the quality-adjusted price of the good cannot exceed some

Table A2. Ex ante welfare analysis of parallel trade

	Quality ^a	CS _d	CS _f	$\pi - u^2/2$	Welfare
No parallel trade	$(1 + a)/4$	$(1 + a)/32$	$a(1 + a)/32$	$(1 + a)^2/32$	$(1 + a)^2/16$
Parallel trade					
If $a \geq \frac{1}{3}$	$\frac{a}{1 + a}$	$\frac{a^4}{2(1 + a)^3}$	$\frac{a^4}{2(1 + a)^3}$	$\frac{a^2}{2(1 + a)^2}$	$\frac{a(1 + a^2)}{2(1 + a)^2}$
If $a < 1/3$	1/4	1/32	0	1/32	1/16

^a Given the quadratic specification of the investment function, the level of quality coincides with the marginal incentives to invest.

capped level denoted by k : $p_f/u_f \leq k$, where the subscript f denotes the price/quality pair sold in the foreign market. In other words, this form of cap effectively fixes the lowest type to be supplied in the poor country (coverage), while it leaves some flexibility to the firm on the precise price/quality combination (if the firm supplies a very low-quality good, it has to set a very cheap price as well).

If there is no parallel trade then the producer offers the same product in each market and the following prices and profits obtain:

$$\begin{cases} p_f = ku \\ p_d = u/2 \\ \pi_{noPT} = [1/4 + (a - k)k/a]u \end{cases} \quad (5)$$

Without parallel trade the producer extracts monopoly profits in the domestic market and sells at the capped price in the foreign market. Now, if parallel trade is permitted, we consider if the monopolist wants to introduce a lower quality good that will be sold to the foreign market. Whatever good is sold on the foreign market, some of it ends up being re-imported into the domestic market.²⁵

Imagine first the monopolist sells only one good in both countries, thus $u_f = u$ and $p_f = p$. The same good is sold everywhere and the cap decided in the foreign market effectively determines the quantity sold in the domestic market. The solution is simply:

$$\begin{cases} p = ku \\ \underline{t} = k \\ \pi_{cap}^1 = k(2 - k - k/a)u \end{cases} \quad (6)$$

where π_{cap}^1 means profit under the cap when a single quality is supplied. Comparing Equation (6) with Equation (3) it is clear that the firm, under an effective cap ($k < a/(1 + a)$), makes lower profits than if it could sell a single product at an unconstrained common price.

Now consider the case where the firm offers two products, so now $u_f = u_i$ and $p_f = p_i$. The profit to be maximized is $\pi = [p(1 - \tilde{t}) + p_i(\tilde{t} - \underline{t})] + p_i(a - \underline{t})/a$ subject to $p_i \leq ku_i$, where

²⁵ We also assume that *any* product sold in the foreign market would be subject to the same cap. This ensures that, in case the monopolist decides to offer two products of different qualities, only the low-quality product would be offered for sale in the foreign market, as re-importers would be strictly making losses by buying the high-quality good in the domestic market at a price above the cap, and re-selling it in the foreign market at the capped price.

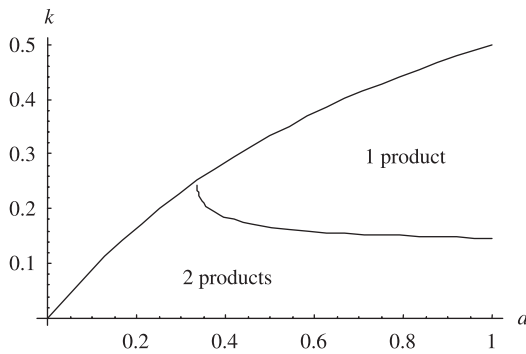


Figure A1. When two variants are introduced

the cap is binding ($k < a/(1 + a)$). Optimal prices, marginal, indifferent types and corresponding profits are:

$$\left\{ \begin{array}{l} p = \frac{u - u_l}{2} + p_l \\ p_l = ku_l \\ \tilde{t} = 1/2 \\ \underline{t} = k \\ \pi_{cap}^2 = \frac{1}{4}u - u_l \underbrace{[1/4 - k(2 - k - k/a)]}_A \end{array} \right. \tag{7}$$

where π_{cap}^2 means profit under the cap when two quality levels are supplied. The firm sets the price of the low-quality good at the capped level, while it prices the high-quality good at a premium. Comparing the expression of the capped profit with two products (Equation (7)) with the expression of the capped profit with only one product (Equation (6)) we get:

$$\pi_{cap}^2 - \pi_{cap}^1 = (u - u_l)A.$$

Thus the firm’s decision depends on the sign of the expression A in Equation (7). It is optimal for the producer to introduce two variants if and only if $sign[A] = sign[1/4 - k(2 - k - k/a)] > 0$. The sign of the expression A is affected by the cap k chosen and by the characteristic a of the foreign market. A closer inspection reveals that the sign of A is always positive for $a < 1/3$, while when $a > 1/3$ it is always possible to find a range of k such that the whole expression A is negative.²⁶ The solution is drawn in Figure A1.

The upward sloping line represents the condition needed for having a binding cap, $k < a/(1 + a)$, so it is only below this line that it makes sense to discuss the introduction of price caps. When the cap is not too binding or markets are sufficiently similar, then $sign[A] < 0$ and the firm is better off by selling a single product everywhere. However, if either k or a are sufficiently low, then the reverse is true and the firm is better off by introducing a second lower-quality variant.

²⁶ In particular, when $a > 1/3$ then $sign[A] < 0$ iff $k \in \left(\frac{a}{1+a} - \frac{\sqrt{a(3a-1)}}{2(a+1)}, \frac{a}{1+a} \right)$; notice that this interval is always compatible with a binding cap.

The welfare properties of these outcomes depend crucially on the quality of the inferior product when two goods are supplied. We have assumed (as in Section 3.3) that the low-quality good can be introduced costlessly, with $u_l \in [\underline{u}, \bar{u}]$, $\underline{u} > 0$, $\bar{u} < u$, i.e., the low-quality good is neither a phantom product nor as good as the high quality variant. But notice from Equation (7) that when two variants are introduced (i.e., $sign[A] > 0$) the expression for the capped profit is decreasing in u_l (before taking into account the investment costs). Thus the producer offers the lowest possible quality (so as to minimize the impact of parallel trade on its home market) and unless a minimum quality standard is specified the producer will supply a phantom product. We discuss below the setting of this minimum quality standard, but first we consider the *ex post* welfare analysis, for a given quality standard of the inferior product, the fixing of the price cap and the effect of the *ex ante* incentive to invest.

Ex post welfare analysis of parallel trade

Table A3 compares the *ex post* welfare properties of parallel trade when there is a price cap. We compare the regimes with and without parallel trade for given (exogenous) quality levels and price caps.

If regime $sign[A] < 0$ applies then $\Delta Welfare = W_{PT}^1 - W_{noPT} = u(1 - 4k^2)/8$ which is always positive since for sure $k < 1/2$ in order for the cap to be binding. The properties of parallel trade do not depend on demand dispersion anymore, contrary to the ‘standard’ analysis of Section 3.2. The reason is simple: the cap and compulsory licensing ensure coverage in the foreign market at a price lower than the monopoly price. As the same good is supplied everywhere, parallel trade ensures that the monopolist’s price is reduced, which has good allocative properties for any value of a .

If regime $sign[A] > 0$ applies then
$$\Delta Welfare = W_{PT}^2 - W_{noPT} = \frac{au_l(1 - 4k^2) - 4(u - u_l)(a^2 - k^2)}{8a}.$$

The effect of parallel trade is clear: domestic customers gain quite a lot from parallel trade (those buying the high-quality product pay a cheaper price, those buying the low-quality variant would not be supplied in the absence of parallel trade). Customers in the foreign country must lose since they now consume a lower quality variant. The overall impact depends on whether the domestic or foreign consumer effect prevails. However, if u_l is sufficiently close to u then the overall effect is positive for any value of a , while if u_l approaches zero the overall effect is negative for any value of a .

Table A3. Ex post welfare analysis of parallel trade with a price cap

	CS _d	CS _f	π	Welfare
No parallel trade	$\frac{u}{8}$	$\frac{(a - k)^2}{2a}u$	Eq. (5)	$\frac{3a + 4(a^2 - k^2)}{8a}u$
Parallel trade				
2 variants ($A > 0$)	$\frac{u + 2(1 - 2k)u_l + (1 - 2k)^2u_l}{8}$	$\frac{(a - k)^2}{2a}u_l$	Eq. (7)	$\frac{4(a^2 - k^2)u_l + a[3u + (1 - 4k^2)u_l]}{8a}$
1 variant ($A < 0$)	$\frac{(1 - k)^2}{2}u$	$\frac{(a - k)^2}{2a}u$	Eq. (6)	$\frac{a - ak^2 + a^2 - k^2}{2a}u$

Fixing the price cap

The cap is chosen by the foreign government. Recall that we imagine a situation where the foreign government cannot commit to setting the cap prior to investment and that the timing of the game is the following:

- First the firm chooses the investment (the quality of the high-quality good) and decides on the quality of the lower-quality variant,
- then the foreign government sets the cap (as said earlier the foreign regulator commits to not using a compulsory licence to acquire the high quality version if it prefers the inferior version at a lower price),
- finally the producer sets prices according to the price regime, with or without parallel trade.

The last stage is described by Equations (5)–(7). In the second stage, the foreign government sets the cap to maximize foreign consumer surplus. Since foreign consumer surplus is decreasing in the price cap k (see third column of Table 3), the foreign government will always want to set the lowest possible cap compatible with each regime:

- When there is no parallel trade the optimal cap is $k = 0$.
- With parallel trade, in the case of two product qualities offered ($A > 0$) then also $k = 0$.
- With parallel trade, if the foreign government wants the producer to choose to sell only a single variant of the product then it must set k so as to ensure the constraint $A \leq 0$ is satisfied.

Thus it sets the lowest cap that makes the expression binding, $k^* = \frac{a}{1+a} - \frac{\sqrt{a(3a-1)}}{2(a+1)}$ as long as $a > 1/3$.

With parallel trade, the foreign government can affect the ‘variant’ regime by setting the cap. Given its inability to commit prior to investments, either it sets the lowest cap (but then it accepts that the lower quality is supplied) or it sets k^* and gets the higher quality good. The foreign government’s choice therefore depends on the comparison between $au_l/2$ and $(a - k^*)^2u/2a$. This comparison in turn depends on the quality level of the low quality variant:

$$k = k^* \text{ (1 variant) if } u_l < xu$$

$$k = 0 \text{ (2 variants) if } u_l > xu$$

where the factor $x = x(a)$ is an increasing function of a ($x = 1/16$ if $a = 1/3$; $x = 0.73$ if $a = 1$). In other words, if the low-quality good is not ‘too’ distant from the high-quality good, then the foreign regulator caps it at zero, effectively providing the producer with an incentive to supply two variants in order to minimize the damage to the producer’s profit in the domestic market from parallel trade. Alternatively, if the low-quality good is not of a very high standard, then the foreign government induces the producer to supply only the high-quality variant, by providing a more lenient cap, and therefore offering some protection to the producer in its domestic market.

Ex ante welfare analysis of parallel trade

Having analysed the endogenous choice of the cap in the various regimes, we now consider the *ex ante* incentives to invest in quality in the first stage, given the price cap set by the foreign government.

Table A4. *Ex ante* impact of parallel trade on investments

	Quality = marginal incentive to invest
No parallel trade ($k = 0$)	1/4
Parallel trade	
$a < 1/3$ ($k = 0$, 2 variants)	1/4
$a > 1/3$ and $u_i > xu$ ($k = 0$, 2 variants)	1/4
$a > 1/3$ and $u_i < xu$ ($k = k^*$, 1 variant)	$k^*(2 - k^* - k^*/a) = 1/4$

The introduction of a price cap in the foreign market, unsurprisingly, diminishes the incentive to invest in the high-quality good. The incentive to invest is simply the derivative of the profit function under each case (one product, no parallel trade – Equation (5), one product with parallel trade – Equation (6), and parallel trade with two products – Equation (7)). These incentives are then compared with the investment incentives in Table A2.

The most interesting result is that, under the price cap regime, the marginal incentive to invest is identical, whether there is parallel trade or not and whether there are two goods supplied or not. Thus parallel trade has no impact on the quality level of the high quality product any more since it does not change incentives at the margin. This result does not depend on the quadratic cost function used. Intuitively, when the firm supplies two variants it uses its pricing ability in the unregulated market to keep the same marginal impact on revenues of an increase in quality. When the firm offers a single product, it is the foreign government that sets the price cap in a way such that investment incentives are unaffected. Parallel trade, however, impacts on the choice of the cap level and on the variant regime.

We can now turn to the final analysis of the welfare properties of parallel trade, using global welfare to conduct comparisons.

Two products are supplied

If $a < 1/3$ then the producer would prefer to shut down the foreign market in the absence of compulsory licensing, but since the presence of compulsory licensing removes this option the producer now has an incentive to ensure that the foreign market is supplied with an inferior good of appropriate quality (otherwise it will face a compulsory licence on the high quality version). If $a > 1/3$ and $u_i > xu$, the choice is now dictated by the foreign regulator, who wants to induce the producer to supply the inferior product and caps it at zero. When two variants are supplied with parallel trade, the foreign consumers lose from parallel trade (they are supplied a lower quality good, while without parallel trade they would pay zero for the best product), while the domestic users unambiguously gain. The change in welfare is

$$\Delta Welfare = W_{PT}^2 - W_{noPT} = \frac{u_i - a(1 - 4u_i)}{8} \text{ which is positive if } u_i > a/(1 + 4a).$$

One product is supplied

If $a > 1/3$ and $u_i < xu$, then only one variant is supplied with parallel trade and it is capped at k^* . The effect of parallel trade is then to benefit the domestic market (consumers pay less for the same

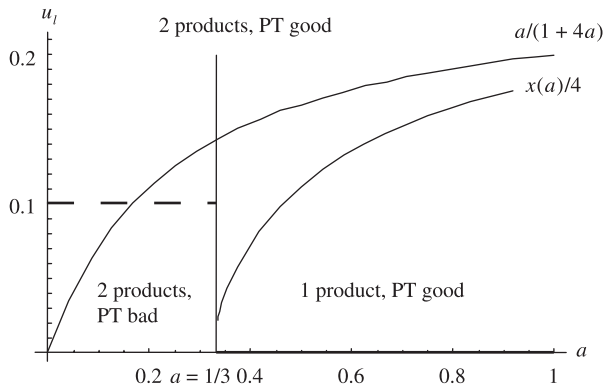


Figure A2. Ex ante effects of parallel trade

good), while foreign customers lose (in the absence of parallel trade they would have paid zero). The overall effect is always positive: $\Delta Welfare = W_{PT}^1 - W_{noPT} = \frac{3a - 1 - 2\sqrt{a(3a - 1)}}{(1 + a)} > 0$.

Therefore we find that parallel trade is always welfare enhancing if a single product is sold, for any value of a and from an *ex ante* perspective. However, if it is optimal to supply an inferior version, then parallel trade can be welfare reducing if the quality of the inferior product is too low relative to the willingness to pay of consumers in the foreign market.

Figure A2 summarizes the *ex ante* welfare analysis of parallel trade. On the vertical axis we have put the quality u_l of the lower quality variant, while the parameter a of demand dispersion is on the horizontal axis. The lowest curve in the figure is the factor $x(a)u = x/4$: below this curve a second product would never be delivered, even if available, as the producer supplies everywhere the high-quality product. In this region parallel trade has always overall positive welfare properties: without parallel trade the foreign market would be supplied at zero cost but the monopoly market would be monopolized, on the contrary with parallel trade everybody is supplied at $k^* > 0$ which preserves the investment incentives and produces a better allocation. In the region where two variants are supplied, then parallel trade always benefits the domestic market but foreign consumers lose as they are supplied an inferior product. Overall parallel trade has good welfare properties when $u_l > a/(1 + 4a)$, which is the highest curve in Figure A2.

The last choice that remains to be endogenized is the quality of the lower quality variant. When $a > 1/3$ the firm anticipates that if it offers $u_l < xu$ then the foreign government will prefer the high quality product which will be capped at $k = k^*$, while if it offers $u_l > xu$ the foreign government will prefer a low quality product capped at $k = 0$.

Since investment is the same in both cases ($u = 1/4$), the more profitable option results from comparing Equation (6) with k^* (resulting in $\pi_{cap}^1 = u/4$) and Equation (7) with $k = 0$ (resulting in $\pi_{cap}^2 = (u - u_l)/4$). Hence it is clear that the profit from selling a single variant everywhere dominates for any positive value of u_l . Thus if $a > 1/3$, u_l is not introduced²⁷ and the firm offers

²⁷ Or even if it is introduced, it is effectively a phantom product; in terms of Figure 2 any quality u_l could be supplied in principle in the region below $x(a)$ as it is costless to do so, but no one would buy it.

its high quality product at a single price k^* . But recall that parallel trade always enhances welfare when a single product is offered, and so for any value of $a > 1/3$ parallel trade has always good welfare properties *ex ante*.

If $a < 1/3$ the foreign government cannot choose the high quality product as it is not offered there by the firm in the last stage of the game (see Figure A1). This would cause no problem if the quality level of the inferior product is positive (the foreign government would respond by capping it at zero). However, since the profit of the firm is decreasing in u_i , it has an incentive to offer $u_i = 0$ (the phantom product). We have ruled out this case on *a priori* grounds since it would break the ‘regulatory compact’ that gives commitment power to the foreign regulator (positive quality in exchange for a commitment not to compulsorily license the top quality). We are no longer able within this framework to determine what u_i will be, but we can identify some important possibilities:

- If the foreign country goes back to a regime where it does not commit to anything, then the whole system collapses: no investment is ever made, and everybody gets zero.
- If some deal can be reached on u_i , and the foreign country keeps its commitment power that we have used so far, then it sets $k = 0$. Consumer surplus in the foreign market, in the domestic market and firm’s profits are respectively: $CS_f = au_i/2$, $CS_d = (u + 3u_i)/8$, $\pi = (u - u_i)/4$.

In this second case, as all these expressions are linear in u_i , some simple bargaining between the parties would possibly produce a negotiated quality at one of the extremes of the possible quality spectrum $u_i \in [\underline{u}, \bar{u}]$. We note here that the highest end of the spectrum is more likely to arise if the domestic country is also allowed to negotiate alongside the foreign country and the manufacturer. While we do not solve this bargaining fully, we notice from Figure A2 that the higher the negotiated u_i , the more likely that parallel trade has good overall welfare properties also in the case $a < 1/3$ (see the dashed line in the figure).

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