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An economic approach to parallel imports effects and competition policy

Yannis Katsoulacos [a,*], Kalliopi Benetatou [b]

[a] *Athens University of Economics and Business, Athens, Greece*
[b] *Hellenic Competition Commission, Athens, Greece*

Abstract

Parallel imports have been treated very differently in different countries. In the EU, competition law's very strong (*per se*) prohibition of restrictions to parallel imports (PI) can be justified by traditional "public interest" concerns related to the EU's objective to promote free trade and market integration. At the opposite extreme, we have had Russia's *Per Se* prohibitions of PI, which can be potentially justified by the country's industrial policy objectives of protecting its domestic industries. While there is no evidence of a shift in policy by the European Commission (EC) and the EU, there is evidence of a shift in policy in Russia away from the *per se* prohibition of PI and a recognition that "in some cases" PI should be considered legal. We consider this shift in Russian policy as a shift in the right direction, while we consider unjustified the continuation of EC policy of *per se* prohibition of restrictions to PI. Our analysis points towards a middle ground in which any question of whether restrictions of PI must be prohibited or not should be the subject of rule-of-reason investigations of the specific economic facts of each case and what these imply for welfare (and, specifically, consumer welfare).

Keywords: parallel trade, parallel imports, competition law, economic approach, consumer welfare.
JEL classification: K21, L4, L12.

1. Introduction

"Parallel trade" takes place when there is trade in the products of a firm outside (and in parallel with) the distribution network that the firm has established for its products (COM, 2003, p. 6). Parallel Imports (PI) affect a wide range of industries, spreading from traditional luxury and branded consumer products (detergents, cosmetics, wines, cameras, and watches) to industrial (such as automotive parts) and, very importantly, pharmaceutical products. In the latter

* Corresponding author, E-mail address: yanniskatsoulacos@gmail.com

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case, parallel trade often involves goods that are produced under the protection of a copyright, trademark, or patent that are placed into circulation in one country and then imported into a second country without the permission of the owner of the intellectual property rights attached to the product in the second country (Müller-Langer, 2008).

Thus, parallel imported products are very often not counterfeited or pirated but are legitimate products. However, they may not carry the original producer's warranty and may be packaged differently. Moreover, parallel importing firms ordinarily purchase a product in one country at a price that is lower than the price at which the product is sold in the second country (arbitrage between markets).

PI have been treated very differently in different countries. In EU competition law there is a strong (*per se*) prohibition of restrictions to parallel trade, which is firmly rooted in the traditional public interest concern with free trade and market integration in Europe.[1] While this is often recognized as a specific "public interest" concern[2] that is incorporated in EU competition law, it is important to enquire whether this can be justified on the basis of standard antitrust arguments: specifically, to ask whether this prohibition would result in the promotion of consumer welfare in one or more countries.

At the opposite extreme to that of the EU policy, we have Russia's *per se* prohibitions of PI which can be potentially justified by the country's industrial policy objectives of protecting its domestic industries. While there is no evidence of a shift in policy by the European Commission in its *per se* prohibition of restrictions to PI, there is evidence that the policy in Russia shifts away from the *per se* prohibition of PI and a recognition that "in some cases" PI should be considered legal. Specifically, at the end of 2018, the Federal Antimonopoly Service of the Russian Federation (FAS) presented a draft law to the Ministry of Economic Development aimed at partially legalizing PI of goods in Russia (imports of original goods without the trademark owner's consent). According

[1] The protection of parallel trade is also incorporated in EU member states' competition law. See for example cases of Hellenic Competition Commission: 434/V/2009 (HCC vs Nestlé), 441/V/2009 (HCC vs Unilever), 453/V/2009 & 610/2015 (HCC vs Colgate-Palmolive). In these cases, the obstacles to parallel trade took the form of contractual clauses by the dominant producers (i.e. clauses on contracts with their distributors-retailers in the Greek market) imposing territorial restrictions/restrictions relevant to clients (restriction on PI). The relevant markets in these cases were the coffee, detergent and cosmetic industries, which have been the constant target of parallel importers in Greece, due to their lower prices in other European counties. Other recent cases of European Competition Authorities include the following: (1) In December 2009, the Swiss Competition Commission (B-506/2010 and B-463/2010) imposed a fine of CHF 4.8 million on Gaba International AG, a manufacturer of toothpaste, because this company had imposed an export ban on its Austrian licensee who was also fined with a symbolic amount of CHF 10,000. This export ban had prevented Swiss retailers from buying the toothpaste at lower prices in neighboring markets. The Swiss Competition Commission qualified this export ban as an illegal impediment of parallel imports into Switzerland by means of a vertical agreement. (2) The *Autorité de la concurrence* has published a decision (10-D-2012) in which it is fining three leading companies in the dog and cat food sector—Nestlé Purina Petcare France SAS (Nestlé SA Group), Royal Canin SAS (Mars Incorporated Group) and Hill's Pet Nutrition SNC (Colgate Palmolive Company Group)—for having, between 2004 and 2008, restricted competition on the dry dog and cat food markets in specialist retail—covering specialist shops (pet shops, garden centers, agricultural self-service, DIY stores), farmers and vets. In particular, Hill's Pet Nutrition (Colgate Palmolive group), which used five wholesalers-vets for the resale of its product ranges aimed at vets, made agreements with its wholesalers-vets over 5 years, from 2004 to 2008, to ban exports of its products outside France. A clause, mentioned in the general terms of sale concluded by Hill's with wholesalers-vets, concerned a ban on delivering products to vets situated outside France without the manufacturer's prior agreement.

[2] "Public interest" concerns, to a smaller or larger extent, characterize competition law provisions in many countries and are very popular in the younger jurisdictions of developing countries and the BRICS.

to the proposal, one of the reasons for allowing PI will be that there is domestic overcharging of goods (see Galtsova and Dovgan, 2018).

We consider the desire expressed by FAS for a shift in policy towards PI[3] as being in the right direction, while we consider unjustified the continuation of EC policy of *per se* prohibition of restrictions to PI. Here we espouse a middle ground in which whether restrictions of PI must be prohibited or not should be the subject of investigation of the specific economic facts of the case and what these imply in terms of the impact on welfare (and specifically on consumer welfare). That is, whether or not there is law violation should be justified on consumer welfare grounds.

In most of the cases that have been examined by European competition authorities a firm with a dominant position selling in different countries is accused of taking measures that inhibit PI in one or more countries. The firm will be engaging in price discrimination and its price will not be the same in the different countries. PI may flow from the low-price to the high-price country and the inhibition of PI can be considered as a method by the firm to protect its price discrimination strategy.[4] As such, EU competition law does not prohibit this conduct (there is certainly no *per se* prohibition of price discrimination in EU) as it is recognized that given differences in demand conditions and/or costs in different countries, firms that operate in these, under competitive conditions, will be expected to set different prices for their products. Moreover, this behavior is not expected to necessarily or often lead to negative effects on the welfare of these countries,[5] or to lower consumers' welfare.[6] The core of this argument revolves around the fact that when firms are free to set their optimal price in different markets, depending on demand and cost conditions, then, in general, differential pricing allows them to serve more markets. In other words, if a company is "obliged" to use a uniform price strategy, then even under the assumption of the same cost but different demand conditions, the company may decide not to serve some markets. Price discrimination thus allows producers to make some consumers better off (those of the low price country), without making other consumers worse off (those of the high price country). As Rey (2003) has put it:

> "If the firm must adopt a uniform price, it can in fact choose between two strategies: serving both markets at a price p reflecting the average price elasticity (so that $p_2 < p < p_1$), or withdrawing from the high-elasticity market and thus serving the low-elasticity one at the same price as before: $p = p_1$. Adopting the latter policy is particularly likely if the elasticity is very high on the second market, since serving both markets would then imply a substantial loss of profitability in the first market. Whenever the firm chooses to withdraw from the second market, price uniformity benefits no customer: in the first market customers are offered the same price as before, while in the second market customers have less choice than before and thus again incur a loss of surplus."

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[3] Many statements by senior FAS officials during 2019 confirm this. See, for example, the statements by Vice Heads Andrey Kashevarov and Anatoly Golomolzin: https://fas.gov.ru/news/28501, or https://fas.gov.ru/news/27672, and https://fas.gov.ru/publications/18345 (in Russian).

[4] PI can also arise not from price discriminating producers but from different vertical distribution arrangements across countries (Maskus and Chen, 2004).

[5] Diverse parallel importing policies among countries today make it possible to analyze how competition between firms and allowing or banning PI can influence competition in foreign and domestic markets (Roy and Saggi, 2012).

[6] For the basic arguments see Varian (1989, 1992).

In this paper we propose a balanced effects-based (or rule-of-reason) approach to the antitrust treatment of restrictions to PI. We show that, under many circumstances, PI are unlikely to have a substantial effect on consumer welfare while there may be other negative effects of PI (that we discuss below in Section 4). We demonstrate that under many configurations of the parameters influencing the outcome, PI are unlikely to exert downward pressures on domestic prices and, when firms take measures to inhibit PI, this is unlikely to generate any significant upward pressure on these prices.[7] This implies that a *per se* prohibition of restrictions to PI cannot be justified. There are, however, also situations in which a policy of prohibiting restrictions to PI makes good sense on consumer welfare grounds because such restrictions can lead to significantly increased prices relative to the situations without restrictions to PI.

The model that we propose assumes that an oligopolistic firm is selling in different markets (specifically, the "domestic" (d) and "foreign" (f) markets) at different prices. The firm is dominant in the d-market and market conditions[8] are such that the price in this market without PI is higher, that is, $p_{d,w} > p_f$. The firm is facing PI in the d-market from a competitive fridge of parallel importers that take as given the domestic price of the firm. In order for parallel importers to have an incentive to engage in parallel trade the gap between the foreign and domestic prices must be such that the cost (transportation and any other cost) of importing from the foreign market can be covered and a positive profit margin can be made. That is, if the minimum price of PI (that equals the foreign price plus the cost of importing and distributing in the domestic market) is p^{PI}, this must be less than $p_{d,w}$, for there to be an incentive to engage in parallel trade. We examine the firm's optimal pricing strategy and, given this, the impact of PI on the domestic market — impact on domestic prices and on profits.

We find that there are two potential outcomes (equilibria) that could emerge, that depend on the configuration of a number of (potentially measurable) parameters: the difference between the firm's domestic price and p^{PI} (that we denote by δ), the fraction of domestic sales that PI can satisfy (γ) and the extent to which the firm can limit PI, that we denote by m (e.g., through exclusive contracts with some independent domestic distributors).

In one equilibrium, that will tend to emerge when δ, the difference between domestic price and p^{PI}, is not very large, and m is not very large, the firm's optimal strategy is to set a price just below p^{PI} and deter all PI ("deterrence strategy"). This equilibrium can also emerge for larger δ when γ is quite large and m is not large. In this equilibrium, the threat of PI induces a low-price equilibrium that benefits consumers, with prices falling significantly (according to our simulations by even more than 15%) relative to the prices without the threat of PI. So the policy should certainly be one of allowing PI, though in equilibrium no PI takes place and hence no restrictions to PI are necessary.

In the second equilibrium, that will tend to emerge when the difference between domestic price and p^{PI} is large, as in many cases in practice, e.g., those that have been found to violate EU competition law, the firm's optimal strategy if it cannot

[7] Parallel import issues, albeit with different objectives and modelling, concern also the paper by Bennato and Valletti (2014) who examine the case where export decisions are not exogenous, but rather induced by parallel trade and regulatory decisions. They argue that countries take the impact of firms' decisions to supply the respective country into account when setting price caps, thus abstaining from over-strict regulation.

[8] Market size, cost conditions, consumer preferences and intensity of competition.

restrict PI, is to set a price above p^{PI} and allow PI, i.e. accommodate parallel traders ("accommodation strategy"). In this case, the optimal price (p_d^*) will be again lower than the optimal price without PI ($p_{d,w}$), but the difference will tend to be very small (close to 3% for many parameter configurations, rising to about 8% in a limited number of cases). So PI should be allowed, though the benefit to consumers will tend to be very small and the main benefit from allowing PI will be to shift profits from the firm to the parallel importers. Further, if the firm *can* restrict PI in this case ($m > 0$), it will have an incentive to do so (to minimize the shift in profit to parallel importers). But, very importantly, even if its ability to restrict PI is very significant (being able to reduce PI by even 50%), the effect of this on the price reduction that would be achieved in the absence of any restrictions would be negligible (for reasonable parameter configurations less than 2,5%). This small effect on prices suggests that *per se prohibitions of restrictions to PI (as in EU) is not justified* — given the existence of other potential negative effects often associated with PI (that we discuss below in Section 4).

There are, however, also situations in which a policy of prohibiting restrictions to PI makes good sense on consumer welfare grounds. These are situations in which the parameter configurations favor a deterrence strategy by the firm when there can be no restrictions to PI but induce a switch to the accommodation strategy if the firm would be allowed and can take measures[9] that significantly impede PI. Then, not prohibiting restrictions to PI can lead to very significant price increases (relative to the equilibrium in which there is prohibition of restrictions to PI) as we shift from a low price deterrence equilibrium to a high price accommodating equilibrium.

The structure of the paper is as follows. Section 2 sets out the proposed model and the equilibrium conditions describing how PI impacts on a dominant firm's pricing strategy. Section 3 then derives and discusses our main results. Section 4 discusses whether our results are consistent with the results emerging from recent empirical analyses of the impact of PI and outlines some other recent theoretical arguments that complement our analysis concerning other effects of PI. Section 5 offers concluding remarks.

2. The model

We assume that the *residual demand* of one of the firms,[10] dominant firm I, in an oligopolistic domestic market is linear and that the firm's marginal and unit cost is c_d. So:

$$p_d(Q_d) = a_d - b_d Q_d, \;\; a_d, b_d > 0. \tag{1}$$

Note that given the parameter a, $(1/b)$ also measures market size since:

$$Q_d(p_d) = \frac{1}{b_d}(a_d - p_d), \;\; a_d, b_d > 0, \tag{1'}$$

therefore the smaller the b, the bigger is the market size.

[9] Through, for example, exclusivity agreements with distributors.

[10] This demand curve could also be defined theoretically and empirically. However, the important point for this paper is the assumption regarding the way the domestic demand curve compares with the demand curve in a foreign country — see below.

Assume also that in a representative foreign market (f) in which firm I also operates, i.e. the market from where PI originate, the product unit cost is c_f and the residual demand for the same product of I is:

$$p_f(Q_f) = a_f - b_f Q_f, \;\; a_f, b_f > 0. \tag{2}$$

In the absence of PI, in order for I to maximize its profits in both markets, prices and quantities in the d-market will be, respectively:

$$p_{d,w} = \frac{a_d + c_d}{2}, \;\; Q_{d,w} = \frac{a_d - c_d}{2b_d}, \tag{3}$$

and in the f-market they will be:

$$p_f = \frac{a_f + c_f}{2}, \;\; Q_f = \frac{a_f - c_f}{2b_f}, \tag{4}$$

Therefore, in order for I's domestic prices without PI to be higher than the prices in the f-market:

$$p_{d,w} > p_f \;\text{ if }\; a_d + c_d > a_f + c_f. \tag{5}$$

In other words, given the relevant marginal production costs, prices in the d-market will be higher than prices in the f-market, if the *maximum willingness to pay* for the good is higher in the d-market ($a_d > a_f$). The price difference, which is the result of the different consumer preferences, may become even bigger when marginal cost in the d-market is higher than marginal cost in the f-market ($c_d > c_f$).

On the other hand, the quantities sold in both markets depend on the size of the market and thus the quantity that firm I is going to sell to the f-market will be higher than the quantity that it will sell in the d-market when:

$$Q_f > Q_{d,w} \;\text{ if }\; \frac{a_f - c_f}{b_f} > \frac{a_d - c_d}{b_d}. \tag{6}$$

Even if $a_d > a_f$ the quantity that I will sell on the f-market will be higher than the quantity sold in the d-market if b_f is substantially smaller than b_d.

Regarding parallel importers (or distributors of PI), we consider that the most appropriate assumption to make, i.e. the assumption that most closely reflects reality in most instances where competition authorities have to deal with restrictions of PI, is that generally many small firms can potentially enter the market of PI and thus form what is commonly known as a *competitive fringe*. This implies that PI distributors take the price of I in the d-market (and the f-market) as given: If I's prices in the d-market are higher than those in f-markets (including importation and distribution cost), there exists an incentive for PI. In the opposite case there is no incentive for PI. However, even when the price differences and the transportation cost create an incentive for PI, in practice the actual PI of *each* PI distributor are small, in comparison with the total sales of I in the domestic market. The explanation behind this lies in the fact that the imported quantities from other countries come from third parties' (e.g., foreign wholesalers') surpluses that are likely to be limited and not directly from the producers of those goods. Another complementary

explanation is the existence of sometimes severe legislative barriers on imports creating high administrative/bureaucratic costs.[11]

Assume that per unit minimum cost and minimum sale price for making available PI in the *d*-market by a distributor is:

$$p^{PI} = p_f + c^{PI}, \tag{7}$$

where c^{PI} is defined as the per unit cost of a PI distributor to transport and distribute *I*'s product from the *f*-market to the *d*-market. The distributor will have the motive to engage in PI, if:

$$p^{PI} < p_{d,w}. \tag{8}$$

Assume also that the maximum quantity of *I*'s products that PI distributors can import from the *f*-market equals $\bar{Q}^{PI}$.

The Supply curve S(p) of PI distributors can be described as follows:

$$Q^{PI} = \frac{0,\ 0 \le p_d \le p^{PI}}{\bar{Q}^{PI},\ p_d \ge p^{PI}}, \tag{9}$$

The supply curve (9) is incorporated in Fig. 1. It is assumed that $p^{PI} = 55$, as in the simulations in the Appendix.

Parallel imports move *I*'s residual demand curve in the *d*-market down and to the left by an amount equal to the amount of PI, for prices higher or equal to p^{PI}. For prices lower than that level, *I*'s residual demand remains the same as without PI. The (reverse) demand function (1) is now defined as:

$$p_d = a_d - b_d(Q_d^r - \bar{Q}^{PI}), \tag{10}$$

where Q_d^r is *I*'s residual demand (where "*r* = *residual*"), in particular:

$$Q_d^r = \left\{ \begin{array}{l} 0,\ p_d \ge p(\bar{Q}^{PI}) \\ \dfrac{a_d - b_d\bar{Q}^{PI} - p_d}{b_d},\ p(\bar{Q}^{PI}) \ge p_d \ge p^{PI} \\ \dfrac{a_d - p_d}{b_d},\ p^{PI} - \varepsilon \ge p_d \ge 0 \end{array} \right\}, \tag{11}$$

where ε is a very small number and $p(\bar{Q}^{PI})$ is the price corresponding to quantity $\bar{Q}^{PI}$.

[11] Consider, for example, the most recent PI case examined by the Hellenic CC (610/2015), concerning Colgate-Palmolive's restrictions of PI. The case concerned an ex-officio investigation in the market for detergents and cosmetics for suspected infringement of national and EU competition law by the Colgate-Palmolive group of companies, as well as by companies active in the retail and wholesale trade of supermarket products. The HCC issued an infringement decision addressed to Colgate-Palmolive (C-P) and supermarket chains for anticompetitive clauses in the supply agreements, that led to the prevention of importing C-P products from other Member States, therefore violating Articles 1 and 2 of the Greek Competition Act and 101 and 102 TFEU. In addition the decision found that C-P had abused its dominant position in the market for glass cleaning products, as the compliance to the contractual terms prohibiting PI is inextricably linked to the granting of rebates to its consumers, having as an effect the loss of the rebate, in case the customer failed to comply with the parallel import prohibitive clause. In this case the maximum level ever attained by PI in the domestic (Greek) market was below 10% of the firm's domestic sales — the average level of PI was a much smaller percentage (less than 5%).

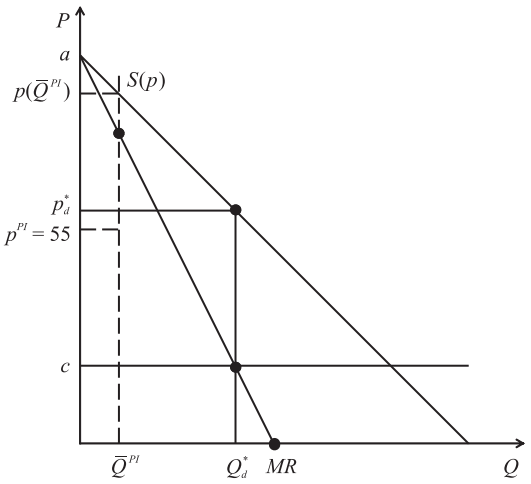

Fig. 1. Domestic market with PI.

Source: Compiled by the author.

I's marginal revenue is given in this case by:

$$MR_d^r = \left\{ \begin{array}{l} a_d - b_d \bar{Q}^{PI} - 2b_d Q_d^r,\ 0 \le Q_d^r \le Q_d^r(p^{PI}) \\ a_d - 2b_d Q_d^r,\ Q_d^r(p^{PI} - \varepsilon) \le Q_d^r \le (a_d / b_d) \end{array} \right\}, \tag{12}$$

where $Q_d^r(p^{PI})$ is the (residual) quantity that corresponds to price p^{PI}.

Note that I's residual demand increases significantly when its price falls by very little below the minimum sale price of PI, i.e., when price decreases from p^{PI} to $(p^{PI} - \varepsilon)$ [equation (11)]. For quantities corresponding to prices higher or equal to p^{PI}, I's optimal quantity (that maximizes I's profit, for the above quantity range) is given by equating the first part of (12) to marginal cost. Assume Q_d^* is defined as this optimal quantity and p_d as the corresponding price given sales of $\bar{Q}^{PI}$ by parallel importers. There is, however, a quantity range corresponding to the quantities between the quantity at price p^{PI} and the quantity at price $(p^{PI} - \varepsilon)$, for which I's marginal revenues are not defined. In order to define I's final choice we must therefore compare, its profit with (Q_d^*, p_d^*), with its profit when price is $(p^{PI} - \varepsilon)$ and sales are $Q_d^r(p^{PI} - \varepsilon)$.

Given the above remarks, let us now examine the relationship between $\bar{Q}^{PI}$, the price p^{PI} and the prices that I will set in the domestic market. Using the first part of (12) the profit maximization condition is:

$$a_d - b_d \bar{Q}^{PI} - 2b_d Q_d^r = c_d. \tag{13}$$

From equation (13) it follows that:

$$Q_d^* = \frac{a_d - c_d - b_d \bar{Q}^{PI}}{2b_d}, \tag{14}$$

and thus from equation (10):

$$p_d^* = \frac{a_d + c_d - b_d \bar{Q}^{PI}}{2}. \tag{15}$$

I's profit with these choices equals:

$$\pi_d^* = (p_d^* - c_d)Q_d^*. \tag{16}$$

On the other hand, I's profit with price $(p^{PI} - \varepsilon)$ and sales $Q_d^r(p^{PI} - \varepsilon)$ is as follows:

$$\pi(Q_d^r(p^{PI} - \varepsilon)) = (p^{PI} - \varepsilon - c_d)\, Q_d^r(p^{PI} - \varepsilon). \tag{17}$$

Thus, the price $\widetilde{p}_d$ and the quantity $\widetilde{Q}_d$ of firm I in the d-market will be:

$$\widetilde{p}_d = \left\{ \begin{array}{l} p_d^*, \text{ if } \pi_d^* \geq \pi(Q_d^r(p^{PI} - \varepsilon)) \\ p^{PI} - \varepsilon, \text{ if } \pi_d^* < \pi(Q_d^r(p^{PI} - \varepsilon)) \end{array} \right\}, \tag{18}$$

$$\widetilde{Q}_d = \left\{ \begin{array}{l} Q_d^*, \text{ if } \pi_d^* \geq \pi(Q_d^r(p^{PI} - \varepsilon)) \\ Q_d^r(p^{PI} - \varepsilon), \text{ if } \pi_d^* < \pi(Q_d^r(p^{PI} - \varepsilon)) \end{array} \right\}, \tag{18′}$$

In the case where the first of the equations for the price in (18) above holds, the parallel importers will make positive profit $\pi^{PI} > 0$, absorbing a part of I's profit that equals

$$\pi^{PI} = (p_d^* - p^{PI})\overline{Q}^{PI}. \tag{19}$$

If, on the other hand, the price drops to the level $(p^{PI} - \varepsilon)$, then PI (and therefore the profit of parallel importers) drops to zero.

Note that we can also write the condition

$$\pi_d^* \geq \pi(Q_d^r(p^{PI} - \varepsilon)), \tag{20}$$

using the equations (14)–(17) as follows:

$$(p_d^* - c_d)^2 \geq (p^{PI} - c_d)(a_d - p^{PI}), \tag{21}$$

or:

$$\left(\frac{a_d - c_d - b_d\overline{Q}^{PI}}{2}\right)^2 \geq (p^{PI} - c_d)(a_d - p^{PI}), \tag{21′}$$

Also, from (3), inequality (21) can alternatively be written as:

$$\left(p_{d,w} - c_d - \frac{b_d\overline{Q}^{PI}}{2}\right)^2 \geq (p^{PI} - c_d)(a_d - p^{PI}), \tag{21″}$$

where

$$p_{d,w} > p_d^* > p^{PI} \geq c_d \tag{22}$$

and

$$p^{PI} = p_f + c^{PI}, \tag{23}$$

The inequality (22) results from comparing (3) with (15). Even though p_d^* was defined above to be in the range of prices that are greater than *or equal* to p^{PI}, the inequality (23) is implied by the fact that when the price p_d is close enough to p^{PI}, firm *I* would prefer to increase significantly its sales, with a price $(p^{PI} - \varepsilon)$, thus making more profit, since at this price PI would fall to zero (so, p_d^* cannot be equal to p^{PI}). Finally, we assume that the third (non-strict) inequality holds (although, in principle, if the marginal cost varies very considerably between countries, this may not hold). If this was not true, (21) and (21′) would always hold and *I* would always choose to produce quantities that lead to price p_d^*.

We can use (21″) in order to determine the optimal pricing strategy of firm *I* when faced with PI. Once this is done we can then compare the prices under the optimal strategy with the prices without PI as well as with the prices when PI is restricted by *I* through contractual clauses with its distributors.

Given the minimum level of the PI prices (p^{PI}) — the minimum level for which there is incentive to undertake PI, and the marginal costs, we can undertake the comparisons for different levels of three important parameters:

(i) δ: this measures the difference between p^{PI} and the optimal domestic price without PI, that is:

$$p_{d,w} = (1 + \delta)p^{PI},\ 0 < \delta < 1. \tag{24}$$

(ii) γ: this measures the percentage of PI in the total domestic sales of *I*, that is:

$$\bar{Q}^{PI} = \gamma Q_{d,w},\ 0 \le \gamma < 1. \tag{25}$$

(iii) m: this measures the extent to which restrictive contractual clauses imposed by *I* on its distributors limit PI, that is, if g is the percentage of PI sales in the total domestic sales of *I with the restrictions imposed by I on PI*, then:

$$g = \gamma(1 - m)p^{PI},\ 0 \le m \le 1. \tag{26}$$

Of course, if restrictive contractual clauses are prohibited by competition law then $m = 0$. But even in the absence of a prohibition by competition law there will be constraints to the extent to which PI can be restricted by *I*, so in practice, even in such cases m is unlikely to be very large — see also below.

Assume also for simplicity that:

$$c_d = c_f = c. \tag{27}$$

Then, given (3), (25) and (27):

$$\frac{b_d \bar{Q}^{PI}}{2} = \left(\frac{\gamma}{2}\right)\left(\frac{a_d - c}{2}\right). \tag{28}$$

Given (28), taking into account (24) and (27), (21″) becomes:

$$[(1 + \delta)p^{PI} - c]^2 (1 - \frac{\gamma}{2})^2 \ge (p^{PI} - c)(a_d - p^{PI}). \tag{29}$$

Substituting, from (3), for:

$$a_d = 2p_{d,w} - c = 2(1+\delta)p^{PI} - c, \tag{30}$$

we have, taking into account (24), that the condition (20) becomes:

$$[(1+\delta)p^{PI} - c]^2(1-\frac{\gamma}{2})^2 \geq (p^{PI} - c)(p^{PI} - c + 2\delta p^{PI}). \tag{31}$$

(31) determines the optimal pricing strategy of firm I for any given value of the parameters γ and δ, in the absence of any contractual restrictions on its distributors and given the minimum price level required for PI to take place (p^{PI}) and c.

When firm *I* restricts PI by imposing contractual restrictions (such as exclusivity agreements) on its distributors, then condition (31) becomes:

$$[(1+\delta)p^{PI} - c]^2(1-\frac{g}{2})^2 \geq (p^{PI} - c)(p^{PI} - c + 2\delta p^{PI}). \tag{31′}$$

We can also write the optimal price (p_d^*), from (15) and (28), as follows:

$$p_d^* = \frac{a_d + c}{2} - \left(\frac{\gamma}{2}\right)\left(\frac{a_d - c}{2}\right). \tag{32}$$

and so, given (30):

$$p_d^* = (1+\delta)p^{PI}\left(1 - \frac{\gamma}{2}\right) + c\left(\frac{\gamma}{2}\right). \tag{33}$$

Given p^{PI}, (33) determines the optimal price of firm *I* (if it chooses the first pricing option mentioned above) for any given value of the parameters γ and δ (and in the absence of contractual restrictions on its distributors).

Finally, the price when firm *I* restricts PI, by imposing contractual restrictions on its distributors that prohibit PI sales by them, is given by:

$$(p_d^*)^{restr.} = (1+\delta)p^{PI}\left(1 - \frac{g}{2}\right) + c\left(\frac{g}{2}\right). \tag{34}$$

where $g \leq \gamma$ is given by (26) and, of course, $(p_d^*)^{restr.} > p_d^*$.

Thus, given the presence of contractual restrictions that limit PI in the domestic market, the optimal price $\widetilde{p}_d$ set by firm *I* in the presence of PI will be given by:

$$\widetilde{p}_d = \begin{Bmatrix} (p_d^*)^{restr.}, \text{ if } (\pi_d^*)^{restr.} \geq \pi(Q(p^{PI} - \varepsilon)) \\ p^{PI} - \varepsilon, \text{ if } (\pi_d^*)^{restr.} < \pi(Q(p^{PI} - \varepsilon)) \end{Bmatrix}, \tag{18″}$$

where, of course, $(\pi_d^*)^{restr.}$ is profit at price $(p_d^*)^{restr.}$.

3. The main results

We can now establish a number of results using the model presented in the previous section. The main results are presented below in the form of propositions and a number of corollaries. The results are supported by the simulations presented in the Appendix, that are based on the above model calibrated by using reasonable

values for the parameters γ, δ and m (and hence g) that can be found in real world cases. Specifically: $0.1 \le \gamma \le 0.2$; $0.1 \le \delta \le 0.5$; $0.1 \le m \le 0.5$.[12]

Proposition 1 (accommodating equilibrium as a result of small γ or large m):

(i) Even when firm I cannot restrict PI,[13] i.e. $m = 0$, if PI are a sufficiently small fraction of I's domestic sales (γ is sufficiently small), it will find it optimal to accommodate all PI (rather than to deter PI by lowering its price), setting its optimal price at p_d^*. Since $p_d^* < p_{d,w}$, there is a decrease in domestic price relative to the situation with no PI. The exact effect on domestic price depends on the value of γ, but is likely to be neglibible when, as we assume here, γ is small.

(ii) When I's ability to restrict PI is significant (m is large), firm I will have incentives to restrict PI (even if PI is a significant fraction, γ, of domestic sales) and set a price at $(p_d^*)^{restr.} > p_d^*$, accommodating all (non-restricted) PI. The effect of this on domestic price will depend on whether, if I were unable to restrict PI[14], the optimal stategy would be also accommodating (i.e., as in (i) above) or it would be deterring (as described below in Proposition 2). In the first case, the loss in price reduction relative to non-restriction of PI ($m = 0$) would be negligible. In the second case, the loss in price reduction relative to non-restriction can be very significant (as described in Proposition 4).

Proof: Condition (31′) can also be expressed as follows:

$$(p^{PI} - c)(\lambda - 1)[(1 + \delta)p^{PI} - c + \delta p^{PI}] + \lambda(\delta p^{PI})^2 \ge 0. \tag{31″}$$

where

$$\lambda = \left(1 - \frac{g}{2}\right)^2 < 1,\ g = \gamma(1 - m),\ \text{ for } 0 \le \gamma \le 1,\ 0 \le m \le 1. \tag{35}$$

Thus, for part (i) of the Proposition 1, given that $g = \gamma$ when $m = 0$, when γ is small, λ will be close to 1 and the expression on the LHS in (31″) will be positive, so I will prefer to accommodate PI and set price equal to p_d^*.

For part (ii) of the Proposition 1, even if γ is not small, if $m > 0$ and sufficiently large, g will be close to zero, λ will be close to one and (31″) will again hold, so I's optimal strategy will be to restrict PI and set price $(p_d^*)^{restr.}$.

To see the effect on domestic price described in the Proposition 1, from (33), taking into account of (24), the difference between optimal domestic price with and without PI for this case (expressed in percentage terms) is:

$$\frac{p_d^* - p_{d,w}}{p_{d,w}} = -\left(\frac{\gamma}{2}\right)\frac{p_{d,w} - c}{p_{d,w}}. \tag{36}$$

of 50% at the optimal price without PI, then from (36), the reduction in price from PI at the accommodating equilibrium will be just 2,5% (i.e. very small, as

[12] We note that all the main results presented below have been confirmed for a much wider range of simulations than those included in the Appendix.

[13] Through exclusivity agreements with distributors.

[14] As would be the case if restrictions on PI were strictly prohibited by competition law (as in the EU).

mentioned in part (i) of the Proposition 1). Note that the main impact of PI here is to reduce significantly the profit of firm *I* that loses sales volume of 10% and sells at a price 2,5% lower which is redistributed to the parallel importers.

When firm *I* can restrict PI (so $m > 0$), as in part (ii) of the Proposition 1, its optimal price would be $(p_d^*)^{restr.} > p_d^*$ and this will limit the reduction in price from PI. Specifically, now the reduction in price will be:

$$\frac{(p_d^*)^{restr.} - p_{d,w}}{p_{d,w}} = -\left(\frac{g}{2}\right)\frac{p_{d,w} - c}{p_{d,w}},\ g < \gamma. \tag{37}$$

Even if m is as high as $m = 50\%$, with $\gamma = 10\%$, the value of g would be 5% and the reduction in price would be 1,25%. What is important is that, relative to the reduction in price without restrictions to PI ($m = 0$) there is a loss in price reduction from restrictions of PI of just 1,25% (i.e. from 2,5% to 1,25%). If γ were 20%, the reduction in price without restrictions ($m = 0$) would be 5% while with 50% restrictions ($m = 50\%$), and so $g = 10\%$, the price reduction would be 2,5%, so there would be a loss in price reduction from restrictions of PI of just 2,5%. It is worth remembering here that since firm *I* will be able to reduce PI by imposing restrictions only on those large distributors (e.g., supermarket chains) with which it has direct collaboration, *it is unable to control a potentially large part of PI.* Therefore, $m = 50\%$ is likely to be an overestimate[15].

Proposition 2 (deterrence equilibrium): Given that there is a potential for PI to take place ($\gamma > 0$), and $m < 1$ (so it is impossible to restrict all PI), if the difference between the optimal price in the absence of PI and the minimum price required for PI to take place (p^{PI}) is sufficiently small (that is, if δ is small), firm *I* will prefer to set price ($p^{PI} - \varepsilon$) and exclude all PI (deterrence strategy). The deterrence strategy will also emerge for higher δ for as long as γ is quite large and m is not large.

Proof: in (31″) the first term of the LHS is negative (since $\lambda < 1$, with $m < 1$). If δ is sufficiently small, the positive second term of the LHS will be close to zero and the expression in (31″) will be certainly negative, implying that firm *I* will prefer to choose the pricing strategy of setting price ($p^{PI} - \varepsilon$) (the deterrence strategy) thus excluding PI from the domestic market. From (31″) we also see that if m is not large and γ is quite large (so g is quite large and λ quite small), the first term on the LHS will be more negative and this will make the LHS negative even for higher δ. This is confirmed by our simulations results in the Appendix — see Table A.8, where the deterrence strategy is, for example, chosen with $\delta = 0{,}3$ and $\gamma = 0{,}2$ (with $m = 0$ and $m = 0{,}25$). Table A.9 shows that the deterrence strategy will be chosen even with $\delta = 0{,}4$ (and $\gamma = 0{,}2$), if $m = 0$.

WIth this deterrence strategy, that may be maintained — as illustrated in the Appendix simulations — even for very significant levels of m ($m = 0{,}5$), as shown in Table A.7, the threat of PI induces a low-price equilibrium that ben-

[15] In the Col Pal case mentioned above the estimate is that contractual clauses affected at most 20–30% of the PI into Greece.

efits consumers, with prices falling significantly (16,7% in Table A.7; 23,1% in Table A.8), relative to the prices without the threat of PI — so the policy should certainly be one of allowing PI, though no PI (and, of course, no restrictions to PI) is observed.

Proposition 3 (accommodation equilibrium due to high value of δ): Given a maximum level of PI that is not too large,[16] if the difference between optimal price in the absence of PI and p^{PI} is sufficiently large (δ is large), firm *I* will, even if it cannot restrict PI ($m = 0$), prefer to set price equal to p_d^* and accommodate all PI (i.e. it will again choose the accommodation strategy). For larger values of γ, the same result will hold for larger δ.

Proof: In condition (31″) if the maximum level of PI is not too large (γ is not large), λ will not be much smaller than one (even with $m = 0$), the negative first term on the LHS of (31″) will be small and thus, for large δ, the second positive term in (31″) will dominate the first (negative) term and the expression on the LHS in (31″) will be positive. Our extensive numerical simulations imply that for γ not larger than 10%, differences between domestic prices in the absence of PI and p^{PI} that exceed 25% will lead *I* to set price equal to p_d^* and accommodate all PI.[17] For larger γ (e.g., $\gamma = 20\%$), larger values of δ ($\delta > 40\%$) will lead to the same result. As in the case of Proposition 1 (i), in this case, too, the reduction in domestic price will be given by (36) and is likely to be very small: the consumers do *not* get significant benefit and the main effect of PI is to shift profits from firm *I* to the parallel importers.

Of course, in these circumstances firm *I* will have incentives, if this is feasible, to restrict PI (so make $m > 0$) to limit the loss of its profit. As in case (ii) of Proposition 1, the reduction in domestic price will be given by (37) and the loss in price reduction relative to non restriction of PI ($m = 0$) would be negligible.

Proposition 3 will hold when the difference between domestic and foreign prices is large and there are relatively small transport or other costs that the parallel importers have to incur.

Finally, we derive the following important result that describes the case in which firm *I* switches from a deterrence to an accommodating equilibrium as *m* (ability to restrict PI) increases:

Proposition 4 (switch in strategy): Restrictions in PI can have a very significant effect in the extent to which domestic price is reduced (i.e. in limiting the extent of price reduction induced by PI) when, without restrictions in PI, firm *I* chooses

[16] As noted above, in practice in many cases PI will not exceed 10–20% of the domestic sales of firm *I,* and may be much smaller than that (as in the Hellenic CC Colgate–Palmolive case mentioned above) Vadim Radaev's (2013) most comprehensive study on the topic for Russia is based on data collected from a specialized survey of retailers, suppliers, IPR-holders and the representatives of executive authorities. According to this study, if parallel import were allowed, the amount of parallel import would be about 5–10% of market sales in the auto component market.

[17] In the recent PI case examined by the Hellenic CC, concerning Colgate–Palmolive's restrictions of PI of its products in the Greek market, the PI originated mainly from Italy where prices have been lower by over 35–40% than the domestic (Greek) prices. According to Radaev's (2013) study for Russia, differences in auto-component prices reach 60%–80% for perfumes and cosmetics 15–30% while for consumer electronics just 5–10%.

the deterrence strategy and switches to the accommodating strategy under sufficiently high levels of PI restrictions. That is, when large increases in m induce I to shift from a low-price (deterrence) strategy (when $m = 0$ or small) to a high-price (accommodation) strategy (when m is large).

Proof: A switch in strategy will occur when the LHS of equation (31″) is negative when $m = 0$ or m is not large (so the deterrence strategy is optimal) and becomes positive as m increases. Certainly, as m increases, g approaches 0, so λ approaches 1, the first term on the LHS of (31″) approaches zero and so the LHS of (31″) is certainly positive. Thus with sufficiently large m, certainly an accommodating strategy will be chosen.[18] On the other hand, as we have seen in Proposition 2, there will be a large range of parameter configurations, with m not large for which the LHS of (31″) will be negative and the deterrence strategy will be chosen.

Proposition 4 is illustrated in Appendix Table A.2 of the simulation results in the Appendix below. With $\gamma = 0{,}1$ and $\delta = 0{,}2$ (moderate differences between domestic and foreign prices), if m can increase to 0,5 (so firm I can take actions that restrict PI to half of their potential maximum level) then firm will switch price-setting strategies and by doing so a price reduction of 16,71% will be limited to just 1,17%. A similar situation under different parameter configurations is described in Appendix Tables A.8 and A.9. In Table A.8 a price reduction of 23,1% is limited to just 3,6% by the switch in strategy when $m = 0.5$. As we have noted already, we consider a value of $m = 0.5$ extremely high: firm I will only be able to reduce PI by imposing restrictions on those large distributors (e.g., supermarket chains) with which it has direct collaboration (and who are likely to avoid using PI even in the absence of any contractual restriction imposed by I)—therefore *it is unable to control the potentially very large part of PI which is distributed through smaller distributors and informal channels.*

Results from calibrated simulations. In the Appendix we present a number of simulation results. In the first set of five Tables we assume that $\gamma = 10\%$, which will often be close to the maximum percentage of domestic sales that PI can capture.[19] We allow δ, the difference between domestic price and the minimum price of PI, to vary between 10% and 50%. And we allow m, measuring the extent of contractual restrictions that can be imposed by firm I on PI, to vary from 0% to 50%.

In the second set of five Tables we repeat the simulations for a value of $\gamma = 20\%$. In all the Tables the equilibrium domestic price is $\tilde{p}$ and this is obtained by the profit comparison in (18″).

In each Table we explicitly indicate the strategy (of deterrence or accommodation) followed by firm I and whether there is a switch in strategy when such a switch occurs). The simulation results support the conclusions reached in the four Propositions given above.

[18] This is intuitively very plausible. An accommodating strategy is the more attractive the less the PI that have to be accommodated, and the smaller the PI that have to be accommodated, the higher is m.

[19] As already noted above, in the Colgate-Palmolive case recently examined by the Hellenic CC, the average PI was significantly less than 10%. Indeed 10% was the level that, according to the evidence collected by the HCC, the company considered as the worst-case scenario.

4. Are the predictions of the model aligned with existing theoretical and empirical economic literature on PI effects? Other effects of PI

In recent decades, the European Court of Justice has repeatedly upheld European Commission decisions against firms that had sought to limit parallel trade within the EU. This strong (*per se*) prohibition of restrictions to parallel trade is firmly anchored in EU competition law. However, against this background, economic literature's (theoretical and empirical) support of this approach has not been demonstrated (see also Petit, 2011).[20]

Proponents of PI, usually intuitively, argue that PI leads to downward price equalization and increased intra-brand competition (competition between perfect substitutes, i.e. products/services of a same brand) to the benefit of consumers. However, this argument has not been documented in the theoretical or empirical economic literature. The model of PI presented in this paper suggests that even quite large levels of PI in a domestic market are not expected, in many realistic cases, to have significant effects on domestic prices, which also explains why economists have often doubted that PI can induce positive effects on consumer welfare (*albeit* also on the basis of rather informal theorizing).[21]

The above results of our model are perfectly aligned and confirm the existing studies which indicate that the effects of PI are at best ambiguous. Indeed, many *empirical* studies have found no effect (or significant influence) of PI on domestic prices and the effect of PI seems to be mainly to redistribute to parallel importers a part of the profit of the firms whose products are imported—see for example the review of N. Petit (2011) that refers to the empirical studies of NERA (1998), the LSE (2004), Linnosmaa et al. (2003), the Swedish Competition Commission (1999), and Person et al. (2001) that find that there are no effects on domestic prices or if there are, they are limited to specific products and are at best very small or negligible.[22]

There are also other reasons for these empirical results, reasons that cannot be dealt with within the context of our model. One of these reasons is that often clients of parallel importers (for example the supermarket chains) have sufficient market power that allows them not to pass on to final consumers the lower prices at which they buy products via PI—so the PI simply lead to an increase in supermarket profit and the profit of parallel importers and a reduction of the profit of firms whose products are imported.

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[20] In addition to the lack of clear-cut empirical evidence in support for parallel trade, economic theory puts another dent in the blanket intuition that parallel trade improves short-term consumer welfare. Many economists consider that parallel trade is indeed detrimental to consumer welfare because it prevents firms from charging different prices in countries where consumers have different preferences (Malueg and Schwartz, 1994).

[21] Firms are indeed using other strategies to hinder parallel trade, typically differentiating products across countries by altering the brand name, dosage form, and strength, as a response to changes in intellectual property rights and trade barriers that legalized parallel imports within the European Union (Kyle, 2011).

[22] Petit (2011) refers to 3 studies that empirically tested the effects of parallel imports on various pharmaceutical product categories on domestic prices. Overall, the empirical economic literature hardly provides any conclusive evidence that parallel trade delivers lower prices to consumers. Kyle (2011) studies in an empirical paper the non-price response to parallel trade. Her study reveals that firms are indeed using other strategies to hinder parallel trade, typically differentiating products across countries by altering the brand name, dosage form, and strength, as a response to changes in intellectual property rights and trade barriers that legalized parallel imports within the European Union (EU). Duso et al. (2014) found that parallel imports reduces the prices of brand-name drugs by 11%.

Apart from the empirical studies, as we have already mentioned (see Rey, 2003), the economic literature has examined a number of other reasons that PI should not be encouraged, indeed should be discouraged as harmful to consumers. One of these reasons is that they prevent firms from engaging in discriminatory pricing when consumers in different countries/markets have different willingness to pay for the same product — which may be due to different preferences, differences in culture, investment in "branding" etc (see NERA, 1998). The non-discriminatory pricing constraint is likely to lead firms to not sell their products in countries/markets where consumer willingness to pay is low. By following a differential pricing policy in these cases the total consumption can be increased as well as the total welfare (see also Valetti and Szymanski, 2005; Grossman and Lai, 2008; Kenny and McNutt, 1999).[23]

Parallel imports can lead to significant negative *long-term effects* on consumers when, because of the considerable reduction of profit, they have a negative effect on firms' incentives to invest in research and development (R&D) and innovation. This effect has been noted particularly in the huge literature (see also Müller-Langer, 2008) on PI in the pharmaceutical industry; this analysis can also be applied to any market where companies are investing in R&D with the aim of improving the quality of their products. Given that in many cases PI would not lead to price reductions, but simply to the transfer of part of firms profits, that invest significant amounts in R&D, to wholesalers who do not invest in R&D or in some productive activity and whose activity has no additional social value (in essence they are simply "speculators"), the application of competition policy in Europe to the issue of PI in the past has basically encouraged a redistribution of profits (from producers to wholesalers) with highly controversial implications.

Finally, PI may have several, direct or complementary, negative effects on consumer welfare (see also Petit, 2011), such as:

- suppliers facing PI competition may seek to recoup the profits lost on the product subject to PI through price increases on the other complementary products/services (e.g., a car manufacturer that provides also credit and financial services to customers). Alternatively, suppliers may decide to cut down on investments in these products/services;
- PI increases the cost devoted to the fight against counterfeiting and piracy and thus forces suppliers (especially IPR holders) to invest significant resources into branding and other market promotional activities (e.g. re-labelling on export markets, change of the product specifications in export markets; adoption of different trademarks in each country to discourage grey trade) that "discourage" PI, activities that create no added social value (i.e. PI are socially wasteful);

[23] As mentioned above, regarding total welfare, Malueg and Schwartz (1994) show that parallel trade reduces global welfare if there are large differences in demand across countries, because firms will choose not to serve low-price countries. A limitation of applying the Malueg and Schwartz (1994) model to the pharmaceutical industry is that it does not explicitly consider how an inability to price discriminate affects incentives to invest in R&D. Valletti and Szymanski (2006) addressed this question and they point out that parallel trade can reduce investment in quality or R&D as a result of reducing profits to patent-holders, so that even in cases where parallel trade benefits many consumers in the short run, welfare tends to be lower in the long run.

- PI limits the effectiveness of distribution systems; a distributor contemplating the decision to invest, for example, in a joint distribution network will typically request assurances from the supplier that she will not be confronted with cut-throat price competition from PI.

5. Concluding remarks

An important conclusion that emerges from the Propositions above and the simulations in the Appendix, is that prohibiting *restrictions to PI may not affect (reduce) significantly dominant firm I's domestic price (and hence may not increase consumers' welfare) in many circumstances, something that is particularly important given that PI may have other detrimental consequences.* Specifically, when firm *I* chooses an accommodating strategy, as described in Propositions 1 and 3, in equilibrium, domestic price reductions will be small and the effect of even very significant restrictions to PI will affect negligibly these price reductions. The intuition here is that firm *I* would prefer in this case to reduce its own domestic sales thus accommodating parallel importers, enabling them to make all the imports that they can and so maintaining domestic prices at relatively high levels. Although this results in a loss of profit, as sales pass to parallel importers, the profit with this strategy is still greater than the profit that would be made by a deterrence strategy of increasing sales to a level which would lead the domestic price to the minimum price required for parallel importers to be active in the domestic market.

More generally, a policy of prohibiting restrictions of PI will not have a significant effect on price unless (a) in the absence of any restrictions to PI firm I will have chosen a (low-price) deterrence strategy, and (b) its ability to restrict PI is significant, and will switch to a (high-price) accommodating strategy having restricted, if allowed to do so, sufficiently PI. In case (a) and (b) hold, on the other hand, restrictions in PI can have a very significant effect in limiting the extent of price reduction induced by PI and hence a very significant adverse effect on consumer welfare, that would be unlikely to be outweighed by other potential benefits of restricting PI.

Due to the fact that our analysis points to a wide range of potential outcomes that would emerge under different conditions characterizing different antitrust cases in the area of PI in the real world, we consider that their appraisal should rely on case-by-case investigations of the specific economic facts of each case and what these imply in terms of the impact of the conduct on consumer welfare.

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Appendix A: Calibrated simulations

Table A.1
$\delta = 0.1$, $\gamma = 10\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	1480.326	1480.326	1480.326
$(\Pi_d^*)^{restr.}$	1480.326	1519.538	1559.263
$\Pi(p^{PI} - \varepsilon)$	1610.000	1610.000	1610.000
$p_{d,w}$	60.5	60.5	60.5
p_d^*	58.475	58.475	58.475
p^{PI}	55	55	55
$(p_d^*)^{restr.}$	58.475	58.981	59.488
$\widetilde{p}$	55	55	55
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.091	–0.091	–0.091

Note: Deterrence strategy is chosen with equilibrium price equal to p^{PI}. With $m > 80\%$ (not shown here) there will be a switch to the accommodation strategy and all price reductions from the deterrence strategy are then lost.
Source: Authors' calculations.

Table A.2
$\delta = 0.2$, $\gamma = 10\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	1909.690	1909.690	1909.690
$(\Pi_d^*)^{restr.}$	1909.690	1960.276	2011.523
$\Pi(p^{PI} - \varepsilon)$	1995.000	1995.000	1995.000
$p_{d,w}$	66	66	66
p_d^*	63.7	63.7	63.7
p^{PI}	55	55	55
$(p_d^*)^{restr.}$	63.700	64.275	64.850
$\widetilde{p}$	55	55	64.850 Switch from deterrence to accommodation strategy
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.167	–0.167	–0.017

Source: Authors' calculations.

Table A.3
$\delta = 0.3$, $\gamma = 10\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	2393.656	2393.656	2393.656
$(\Pi_d^*)^{restr.}$	2393.656	2457.061	2521.295
$\Pi(p^{PI} - \varepsilon)$	2380.000	2380.000	2380.000
$p_{d,w}$	71.5	71.5	71.5
p_d^*	68.925	68.925	68.925
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	68.925	69.569	70.213
$\widetilde{p}$	68.925	69.569	70.213
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.036	–0.027	–0.018

Note: Accommodation strategy is chosen with equilibrium price equal to $(p_d^*)^{restr.}$.
Source: Authors' calculations.

Table A.4
$\delta = 0.4$, $\gamma = 10\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	2932.223	2932.223	2932.223
$(\Pi_d^*)^{restr.}$	2932.223	3009.894	3088.581
$\Pi(p^{PI} - \varepsilon)$	2765.000	2765.000	2765.000
$p_{d,w}$	77	77	77
p_d^*	74.150	74.150	74.150
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	74.150	74.863	75.575
$\widetilde{p}$	74.150	74.863	75.575
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.037	–0.028	–0.019

Note: Accommodation strategy is chosen with equilibrium price equal to $(p_d^*)^{restr.}$.
Source: Authors' calculations.

Table A.5
$\delta = 0.5$, $\gamma = 10\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	3525.391	3525.391	3525.391
$(\Pi_d^*)^{restr.}$	3525.391	3618.774	3713.379
$\Pi(p^{PI} - \varepsilon)$	3150.000	3150.000	3150.000
$p_{d,w}$	82.5	82.5	82.5
p_d^*	79.375	79.375	79.375
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	79.375	80.156	80.938
$\widetilde{p}$	79.375	80.156	80.938
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.038	–0.028	–0.019

Note: Accommodation strategy is chosen with equilibrium price equal to $(p_d^*)^{restr.}$.
Source: Authors' calculations.

Table A.6
$\delta = 0.1$, $\gamma = 20\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	1328.603	1328.603	1328.603
$(\Pi_d^*)^{restr.}$	1328.603	1403.439	1480.326
$\Pi(p^{PI} - \varepsilon)$	1610.000	1610.000	1610.000
$p_{d,w}$	60.5	60.5	60.5
p_d^*	56.450	56.450	56.450
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	56.450	57.463	58.475
$\widetilde{p}$	55.000	55.000	55.000
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.091	–0.091	–0.091

Note: Deterrence strategy is chosen with equilibrium price equal to p^{PI}.
Source: Authors' calculations.

Table A.7
$\delta = 0.2$, $\gamma = 20\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	1713.960	1713.960	1713.960
$(\Pi_d^*)^{restr.}$	1713.960	1810.503	1909.690
$\Pi(p^{PI} - \varepsilon)$	1995.000	1995.000	1995.000
$p_{d,w}$	66	66	66
p_d^*	61.400	61.400	61.400
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	61.400	62.550	63.700
$\widetilde{p}$	55.000	55.000	55.000
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.167	–0.167	–0.167

Note: Deterrence strategy is chosen with equilibrium price equal to p^{PI}.
Source: Authors' calculations.

Table A.8
$\delta = 0.3$, $\gamma = 20\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	2148.323	2148.323	2148.323
$(\Pi_d^*)^{restr.}$	2148.323	2269.331	2393.656
$\Pi(p^{PI} - \varepsilon)$	2380.000	2380.000	2380.000
$p_{d,w}$	71.5	71.5	71.5
p_d^*	66.350	66.350	66.350
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	66.350	67.638	68.925
$\widetilde{p}$	55.000	55.000	68.925 Switch from deterrence to accommodation strategy
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.231	–0.231	–0.036

Source: Authors' calculations.

Table A.9
$\delta = 0.4$, $\gamma = 20\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	2631.690	2631.690	2631.690
$(\Pi_d^*)^{restr.}$	2631.690	2779.926	2932.223
$\Pi(p^{PI} - \varepsilon)$	2765.000	2765.000	2765.000
$p_{d,w}$	77	77	77
p_d^*	71.300	71.300	71.300
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	71.300	72.725	74.150
$\widetilde{p}$	55.000	72.725 Switch from deterrence to accommodation strategy	74.150
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.286	–0.056	–0.037

Source: Authors' calculations.

Table A.10
$\delta = 0.5$, $\gamma = 20\%$, $c = 20$, $p_f^* = 50$, $c^{PI} = 0.1$ (equilibrium domestic price is $\widetilde{p}$).

	m		
	0%	25%	50%
Π_d^*	3164.063	3164.063	3164.063
$(\Pi_d^*)^{restr.}$	3164.063	3342.285	3525.391
$\Pi(p^{PI} - \varepsilon)$	3150.000	3150.000	3150.000
$p_{d,w}$	82.5	82.5	82.5
p_d^*	76.250	76.250	76.250
p^{PI}	55.000	55.000	55.000
$(p_d^*)^{restr.}$	76.250	77.813	79.375
$\widetilde{p}$	76.250	77.813	79.375
$\frac{\widetilde{p} - p_{d,w}}{p_{d,w}}$	–0.076	–0.057	–0.038

Note: Accommodation strategy is chosen with equilibrium price equal to $(p_d^*)^{restr.}$.
Source: Authors' calculations.