Parallel Trade without Vertical Control[1]

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Abstract

This paper assumes that wholesalers cannot control a retailer in a foreign country once the retailer has ordered inventories and has compensated the wholesaler. Under incomplete information, the retailer, but not the wholesaler, knows the quality of the wholesaler's good as perceived by consumers in the foreign country. The paper discusses the implications of economic integration and of retailer heterogeneity. If parallel trade is prohibited, the wholesaler will offer a set of contracts to the retailer, each designed for a different type. However, if parallel trade is allowed, a separating equilibrium exists only without parallel trade. Parallel trade makes both the wholesaler and foreign consumers worse off.

JEL-Classification: F13, F15.

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1 Introduction

Parallel trade is a situation in which we find a retailer selling a good in the home country of a wholesaler from whom he has imported this good. In this sense, parallel trade implies both an export of a wholesaler to a retailer in another country, and an export of a retailer to the country of the wholesaler. While we do not know too much about the size of parallel imports, because trade statistics do not discriminate between parallel imports and (authorized) other imports, there is anecdotical evidence that parallel trade occurs. Of course, parallel trade is not an option which is necessarily appreciated by wholesalers, so wholesalers might want to prohibit parallel trade by contractual arrangements with retailers in other countries. However, while this is possible in the US, the European Union has regarded the possibility of parallel trade always as a cornerstone of the completion of the internal market.

Of course, allowing parallel trade does not mean that parallel trade will in fact occur as wholesalers are well aware of the retailers' incentives. Furthermore, even if parallel trade is allowed, wholesalers may use other instruments like resale price maintenence as to keep foreign retailers out of their home market. In this paper, we will assume that a foreign wholesaler has no vertical control whatsoever over the retailer. In this sense, we consider a situation which is a sort of pro-competitive to the extreme such that a wholesaler cannot regulate the retailer anymore once the deal between both is done. In standard models of parallel trade, the wholesaler sets a wholesale price (and a fixed fee) and will deliver any quantity the retailer demands for this wholesale price. By doing so, the wholesaler is able to commit himself to sell to the retailer any quantity at a previously fixed wholesale price. In our model, the wholesaler specifies a quantity (exports), and the retailer is free to do with it what he wants. This has important implications, for example that an assumption of zero production costs is not innocuous in this setup: the retailer has already made a payment to the wholesaler, this is sunk, so the retailer decides how to serve the two different markets without taking into account production costs (or any wholesale price).

Furthermore, we want to make some progress on endogenizing the role of the retailer. The standard assumption is that the wholesaler has to employ a retailer (or a set of retailers) as to get access to a foreign market. We will depart from this assumption in two ways. First, we will rationalize the role of the retailer such that the retailer may have some private information which the wholesaler has not. This makes the retailer more efficient in this market, but he may also use this information to guarantee himself a rent. Second, we will also allow the wholesaler to establish a wholly owned retail subsidiary, and we will explore how this option will change the wholesaler's behavior.

To our knowledge, this is the first paper which explores the issue of parallel trade in a setup of incomplete information. Most of the literature has assumed a deterministic setup. In the seminal papers on parallel trade (see Maskus and Chen [5], Chen and Maskus [1]), the setup is such that a wholesaler uses a two-part tariff, and the wholesale price balances the two incentives to reduce parallel trade and to mitigate the double marginalization effect. Ganslandt and Maskus [2] have extended these models to two target markets of the wholesaler and the effects of competition policy requiring a uniform wholesale price. Other models have incorporated cost-reducing investment (Li [4]), product quality (Valetti and Szymanski [8]) and the role of parallel trade and price controls on innovation (Grossman and Lai [3]). However, all these models have in common that the wholesaler exercises some vertical control over the retailer.

Our paper is possibly closest to Raff and Schmitt [6] who demonstrate that parallel trade may even improve wholesaler's profit if demand is uncertain. As in their model, we also assume that retailers decide on sales after they have ordered inventories and have compensated the wholesaler. Hence, the payment to the wholesaler is sunk when the retailer decides on sales in different markets. The difference is that the retail industry in Raff and Schmitt [6] is perfectly competitive and that there is no asymmetric information. Our setup assumes just one retailer who potentially has better information with respect to the market potential of the good produced by the wholesaler.

We regard our analysis as complementary to the existing literature for the case that vertical control cannot be exercised. Note that this is not a matter of formal control. It does not matter whether the transfer to the wholesaler is done via a lump-sum payment or via a variable wholesale price. What matters is whether this payment still plays a role when the retailer decides on sales in both countries. If it does not, any vertical control is lost at this stage. There is even some empirical evidence supporting our approach. Sauer [7] finds no empirical evidence for vertical price control in general for parallel trade, except for high-price exporters and low-priced importers. In our setting, prices are likely to stay high in the retailer's country as a result of the lack of vertical control, and the outcome is that the possibility of parallel trade will not lead to parallel trade under incomplete information. Furthermore, allowing parallel trade is clearly not welfare improving in this setup. This is in deep contrast to the literature which shows that the effect of parallel trade is ambiguous. The reason is the lack of vertical control which forces the wholesaler to offer contracts to the retailer which will not allow parallel imports. Hence, our conclusion is that allowing parallel trade is not a good idea when there is no vertical control.

The remainder of the paper is organized as follows: Section 2 sets up the model and solves the model if parallel trade is prohibited. Section 3 demonstrates the optimal policy under complete information, and Section 4 discusses the implication of incomplete information. Section 5 endogenizes the role of the retailer by allowing the wholesaler to set up his own retail subsidiary. Section 6 concludes.

2 The model

We consider a model with one wholesaler in the home country and one potential retailer in a foreign country. Inverse home demand is given by $p = \alpha - q$ which is known by both firms; the wholesaler's marginal production costs are equal to c. The parameter α measures the quality of the good produced by the wholesaler as it is perceived by consumers as to replace a substitute good. We do not model the substitute good as to focus on the interaction between the wholesaler and the retailer. Instead, we assume that the substitute good is produced under perfect competition and supplied elastically. In this sense,

α measures the quality of the wholesaler's good as compared to the best alternative. As usual in standard models of parallel trade, the foreign market can be served via the retailer. We will explore the wholesaler's optimal policy both if there is complete information and if there is incomplete information. Incomplete information implies that the retailer has some private information about market conditions which is unknown to the wholesaler. In Section 5, we will also allow the wholesaler to serve the foreign market directly via a wholly owned subsidiary, and thus we will endogenize the role of the retailer even further.

In the case of complete information, the foreign inverse demand function is given by $p^* = \beta - q^*$ where β is similar to α in the wholesaler's home country and common knowledge. In the case of incomplete information, however, the wholesaler does not know the market potential β in the foreign country, but the retailer does. A retailer of type β will also face an inverse demand function $p^* = \beta - q^*$, but the parameter β is private information of the retailer. For our analysis in the following two sections, it does not matter whether β is market-specific, that is a generic feature of demand conditions, or whether β is firm-specific, that is it measures the retailer's capability of selling the wholesaler's product as a high quality good compared to the closest substitute in the foreign market. Our basic model can accommodate both setups, but when we allow the wholesaler to set up his own retail subsidiary, we have to be more specific on this. In what follows we will use the notion of β being firm-specific when we will refer to good (bad) types when β is large (small). All the wholesaler knows is that retailers are distributed according to the uniform c.d.f. $F(\beta) = (\beta - b)/(B - b)$ with bounds b and B such that $B > b > c$ and $F(b) = 0$ and $F(B) = 1$. We make the following

Assumption 1 $b > (B + c)/2$

which will guarantee that no type will be excluded without parallel trade. The case of complete information is a special case in which $b = B$. Furthermore, we assume that both markets are potentially profitable, that is, $c < \min\{\alpha, b\}$.

Table 1: Sequence of moves when parallel trade is permitted

Stage I: The wholesaler offers a set of contracts to the retailer.
Stage II: The retailer accepts one contact or rejects them all. In case of acceptance: The wholesaler delivers x to the retailer and receives transfer T.
Stage III: The wholesaler decides on his sales. *In case of rejection:* No further action of the retailer. *In case of acceptance:* The retailer decides on sales in his market and the domestic market.

The timing of the game is demonstrated by Table 1 for the case of parallel trade. In the first stage, the wholesaler offers a set of contracts to the retailer which specifies a transfer T from the retailer to the wholesaler and the level of exports x from the wholesaler to the retailer.[1] In the second stage, the retailer either rejects all contracts or agrees to one contract. In case of acceptance, the wholesaler delivers x to the retailer. In the third stage, the wholesaler decides on his sales y. If parallel trade is allowed, the retailer decides on the level of sales in the two markets at the same time such that both firms potentially compete against each other à la Cournot in the domestic market.

In the remainder of this section, we will develop the optimal sales strategy of the wholesaler if parallel trade is prohibited. The case of complete information and no parallel trade is straightforward: the wholesaler makes one offer to the retailer which specifies the monopoly export level of $(\beta-c)/2$ for transfers of $(\beta - c)^2/4$. This offer makes the retailer just indifferent between acceptance and rejection, in which case we will assume that it will be accepted. The wholesaler is thus able to capture the aggregate maximum profits from both markets.

The case of incomplete information is a standard principal-agent case. Since the wholesaler cannot observe β, he will offer a set of contracts $\{x(\beta), T(\beta)\}$, where T is the transfer from the retailer to the wholesaler. Without parallel imports, the profit of a retailer of type β pretending to be of type $\hat{\beta}$ is equal to

$$\Pi^*(\beta, \hat{\beta}) = [\beta - x(\hat{\beta})]x(\hat{\beta}) - T(\hat{\beta}). \tag{1}$$

The retailer can pretend to be of any type which is in the support of β. Appendix A.1 shows that the optimal set of contracts is given by

[1] Note that it does not matter that contracts are offered as combinations of x and T. They can easily be rewritten as contracts which specify a wholesale price $w = T/x$ and x. What matters is that the transfer is sunk after the second stage, and that x restricts the retailer's sales in both markets.

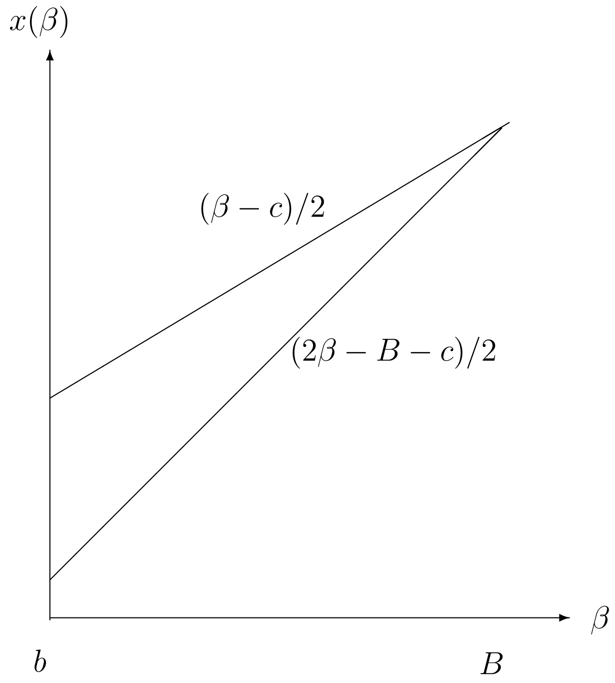

Figure 1: Optimal exports without parallel trade

$$
\begin{aligned}
x(\beta) &= \frac{2\beta - B - c}{2}, \\
T(\beta) &= l + \tau(\beta), \\
l &= \frac{2b(b - B - c) - (B + c)^2}{4}, \\
\tau(\beta) &= \frac{\beta}{2}(2B - \beta + 2c).
\end{aligned} \tag{2}
$$

The term l denotes the optimal license fee which is the fixed payment made by all types. It is derived such that the worst type's operating profits are equal to the sum of his transfer payment and the production cost. The optimal set of contracts guarantees (i) that all types reveal their true type and (ii) that the best type gets the first-best output level. Note that Assumption 1 guarantees that all types will be included if the wholesaler's outside option is not profitable. Figure 1 compares the optimal policy under incomplete information with the one under complete information.

In the following sections, we will also be interested in the role potential heterogeneity of the retailer will play for consumers and for the wholesaler. Given the optimal policy (2) without parallel imports, implying $q = y$, the wholesaler will set y equal to $(\alpha - c)/2$ in his home market. The price in the foreign market is equal to

$$p^* = \frac{B + c}{2}$$

and does not depend on β. The constant price is a result of our uniform distribution, but it does not mean that foreign consumer surplus does not depend on β. The reason is that the level of exports varies with the type, and the type itself contributes to expected foreign consumer surplus, denoted by $\widehat{CS}^*$:

$$\widehat{CS}^* = \int_b^B \frac{x(\beta)^2}{2} \frac{d\beta}{B - b} = \frac{(B - b)^2 + 3(b - c)^2}{24} \tag{3}$$

The case of complete information is a special case for which $B = b$ which yields an expected consumer surplus of $(b - c)^2/8$. Expected export profits of the wholesaler, denoted by the superscript x, are equal to

$$\widehat{\Pi}^x = \frac{B^2 + 4b^2 + 3c^2 - 2b(B + 3c)}{12}, \tag{4}$$

which boil down to the monopoly profits if $B = b$. We will explore the role of firm heterogeneity by a mean-preserving spread: the uniform distribution is spread out such that $dB = -db > 0$ which guarantees that the mean $(B+b)/2$ stays constant. In this sense, we will label a mean-preserving spread as an increase in retailer heterogeneity, and we arrive at

Proposition 1 *If parallel trade is prohibited, an increase in retailer heterogeneity reduces both the expected exporting profits of the wholesaler and foreign consumer surplus.*

Proof: Differentiating (3) and (4) w.r.t. B and b, respectively, yields

$$\frac{\partial \widehat{CS}^*}{\partial B} - \frac{\partial \widehat{CS}^*}{\partial b} = \frac{2B - 5b + 3c}{12} < -\frac{B - c}{24} < 0$$

and

$$\frac{\partial \widehat{\Pi}^x}{\partial B} - \frac{\partial \widehat{\Pi}^x}{\partial b} = \frac{2B - 5b + 3c}{6} < -\frac{B - c}{12} < 0$$

because $b > (B + c)/2$ (see Assumption 1). □

Both the expected consumer surplus and the expected export profits are harmed by a mean-preserving spread. The reason is that a mean-preserving spread increases the rent for the good types. This is partially compensated by reducing exports to bad types, but both effects reduce the expected export profits. Foreign consumers are harmed by a mean-preserving spread because exports to good types will not change much but exports to bad types will be reduced. Indeed, expected exports $\int_b^B x(\beta)d\beta/(B - b)$ are equal to $(b - c)/2$. Therefore, a mean-preserving spread will unambiguously reduce expected exports and harm foreign consumers.

What happens if parallel trade is not prohibited? Scheme (2) is vulnerable to parallel imports if the price in the home market less the trade cost t is larger than the price in the foreign market:

$$p - t > \frac{B + c}{2}.$$

Given that the wholesaler is a monopolist in his home market without parallel trade and his monopolistic output is equal to $(\alpha - c)/2$, this condition translates into

Assumption 2 $\alpha - B - 2t > 0$

which will hold for the case of parallel imports. Hence, we have a simple model in which all retailers go for parallel trade if the set of optimal contracts under a parallel import ban is offered. Note that the condition for profitable parallel trade also implies that $\alpha - c - 2t > 0$ because $B > c$. Furthermore, it also implies that the domestic market potential is larger in any case as $\alpha > B > b$ must hold. If the opposite were true parallel trade would not occur as the foreign retailer would never have any interest in the domestic market.

3 Parallel trade without vertical control

We now turn to the possibility of parallel trade in more detail. This section will deal with the case of complete information. Therefore, the wholesaler will offer just one contract by which the wholesaler is able to reap all operating profits from the retailer. Suppose that the contract has been accepted. In the last stage, the retailer plays a potential Cournot game against the wholesaler in the wholesaler's home market. Let us denote all operating profits in the last stage by the lower case π, whereas the overall profits will be continued to be denoted by the upper case Π. Suppose that the contract specifies exports x, and let $\pi^*(m, y)$ denote the retailer's profits after having paid for x. Hence, x is fixed, but the level of parallel imports, m, and the wholesaler's output, y, are determined in a Cournot game. The retailer maximizes its profits

$$\pi^*(m, y) = (\alpha - (m + y) - t)m + (\beta - (x - m))(x - m) \text{ s.t. } 0 \leq m \leq x$$

over m. t denotes the trade cost of parallel imports. Note that T is irrelevant for the retailer's decision at this stage. The marginal profits of the retailer are equal to

$$\frac{\partial \pi^*}{\partial m} = \alpha - \beta + 2x - y - 4m - t.$$

The wholesaler maximizes its profits

$$\pi(m, y) = (\alpha - (m + y) - c)y$$

over y which yields the optimal production level for his home market

$$y = \frac{\alpha - c - m}{2}.$$

We now have to distinguish three cases: (i) the retailer does not want to serve its local market but the wholesaler's market only ($m = x$); (ii) the retailer serves the local market only ($m = 0$); (iii) the retailer serves both markets ($0 < m < x$).

Case (i) is an equilibrium if the retailer's marginal profits are non-negative for $m = x$:

$$\frac{\partial \pi^*(m = x)}{\partial m} = \alpha - \beta - 2x - y - t \geq 0.$$

The wholesaler's sales will be equal to $y = (\alpha - c - x)/2$ which leads to

$$\begin{aligned} \frac{\partial \pi^*(m = x)}{\partial m} &= \alpha - \beta - 2x - \frac{\alpha - c - x}{2} - t \geq 0 \\ \Leftrightarrow x &\leq \frac{(\alpha + c) - 2(\beta + t)}{3} \end{aligned} \tag{5}$$

Case (ii) is an equilibrium if the retailer's marginal profits are non-positive for $m = 0$:

$$\frac{\partial \pi^*(m = 0)}{\partial m} = \alpha - \beta + 2x - y - t \leq 0.$$

The wholesaler's sales will be equal to $y = (\alpha - c)/2$ (monopolistic output) which leads to

$$\begin{aligned} \frac{\partial \pi^*(m = x)}{\partial m} &= \alpha - \beta + 2x - \frac{\alpha - c}{2} - t \leq 0 \\ \Leftrightarrow x &\leq \frac{2(\beta + t) - (\alpha + c)}{4} \end{aligned} \tag{6}$$

Case (iii) gives the interior solutions and leads to

$$m = \frac{\alpha + c + 4x - 2(\beta + t)}{7}, y = \frac{3\alpha + \beta + t - 2(x + 2c)}{7}. \tag{7}$$

Note that conditions (5) and (6) are mutually exclusive because $x \geq 0$. We make the following

Assumption 3 $\beta > \dfrac{\alpha + c}{2}$.

Assumption 3 has two important implications: first, case (i) does never materialize because $(\alpha + c) - 2(\beta + t)$ is negative due to $\beta > (\alpha + c)/2$, (but $m = 0$ may materialize). Second, $\beta < \alpha$ due to Assumption 2 warrants that $m = 0$ can be achieved for low trade costs only if x is set below the profit-maximizing level $(\beta - c)/2$ which would be optimal if parallel imports were prohibited.

Intuitively, $\beta < \alpha$ due to Assumption 2 guarantees that the retailer's market is not too profitable such that parallel trade will never occur. Furthermore, Assumption 3 guarantees the retailer's market is not too unprofitable such that the retailer would not want to serve it at all.

The wholesaler may make an offer of which he knows that it will not be accepted. He may want to do exactly this if any acceptable offer would make him worse off compared to serving the domestic market only, yielding profits of size $(\alpha - c)^2/4$. Let us assume for the time being that $x = 0$ is not the best policy. In this case, the wholesaler will always make an offer to the retailer such that the retailer is just indifferent between acceptance and rejection. Thus, we can solve stage 1 such that the wholesaler will maximize the combined profit of himself and the retailer over x, correctly anticipating potential parallel trade. Let us denote aggregate profits by Π, and let us write y and m according to (7) as functions of x. More formally, the wholesaler maximizes

$$\Pi = \pi[y(x), m(x), x] + \pi^*[y(x), m(x), x] - cx$$

over x where we have taken into account that exports imply production costs which are not taken into account by the retailer once the transfer to the wholesaler has been made.

The wholesaler has two options, either allowing parallel trade or reducing exports such that parallel trade is just not profitable. If parallel trade is to be avoided, the best the wholesaler can do is to set the export level below $(\beta - c)/2$ such that

$$x = \frac{2(\beta + t) - (\alpha + c)}{4}. \tag{8}$$

Alternatively, the wholesaler maximizes Π w.r.t. x, taking into account (7). This leads to an optimal export level

$$x = \frac{4\alpha + 13\beta - 17c - 36t}{26}. \tag{9}$$

Note that expression (8) increases with t while expression (9) decreases with t. Furthermore, we find that both expressions coincide for $t = 3(\alpha - c)/14$.

Therefore, parallel trade will occur for low levels of t but not for high levels of t because the wholesaler has no interest in restricting exports more than necessary as to avoid parallel trade. Once trade costs reach $(\alpha - c)/2$, parallel trade does not impose any threat for the wholesaler but he can sell the monopolistic output $(\beta - c)/2$ to the retailer. We summarize these findings in

Lemma 1 *If the optimal policy warrants $x > 0$, the wholesaler will allow parallel trade for low levels of trade costs, but avoid parallel trade for high levels of trade costs. Exports to the retailer decrease (increase) with trade costs if these exports imply (do not imply) parallel trade.*

One immediate finding from Lemma 1 is that both the retailer and the consumers in the foreign country are worse off by trade liberalization, measured by a decline in trade costs, when trade costs are large to start with. Expression (8) shows that a decline in t reduces exports which fall further below the monopolistic level. The reason is that the wholesaler still wants to avoid parallel trade, and trade liberalization makes parallel trade more profitable.

As for low trade costs, the equilibrium levels of the wholesaler's production for his home market, y, parallel imports, m, and the aggregate output in the home and the foreign market, q and q^*, are respectively given by

$$\begin{aligned} m &= \frac{3(\alpha - c) - 14t}{13}, \\ y &= \frac{5(\alpha - c) + 7t}{13}, \\ q &= \frac{8(\alpha - c) - 7t}{13}, \\ q^* &= \frac{13\beta - 2\alpha - 11c - 8t}{26}. \end{aligned} \tag{10}$$

Both home and foreign consumers benefit from trade liberalization because both q and q^* decrease with t. We also find that wholesaler's profit is non-monotonic.

Lemma 2 *If the optimal policy warrants $x > 0$, the maximized wholesaler's profit has a minimum at $t = (\alpha - c)/9 < 3(\alpha - c)/14$. If the wholesaler's optimal policy implies parallel trade, profits are largest for $t = 0$. If the wholesaler's optimal policy does not imply parallel trade, profits are largest for $t \geq (\alpha - c)/2$.*

Proof: Using (10) to rewrite Π as a function of t and differentiation yields

$$\left.\frac{d\Pi}{dt}\right|_{x>0} = -\frac{2(\alpha - c - 9t)}{13}, \left.\frac{d^2\Pi}{dt^2}\right|_{x>0} = \frac{18}{13} > 0 \tag{11}$$

and shows that the maximized wholesaler's profit has a minimum at $t = (\alpha - c)/9 < 3(\alpha - c)/14$. For $t \geq 3(\alpha - c)/14$, the wholesaler will export to the retailer such that parallel imports do not occur. In that case the change with trade costs is equal to

$$\left.\frac{d\Pi}{dt}\right|_{x=0} = -\frac{\alpha - c - 2t}{8}, \left.\frac{d^2\Pi}{dt^2}\right|_{x=0} = -\frac{1}{4} < 0, \tag{12}$$

Furthermore, profits are linear-quadratic in t for the case of parallel trade, and thus profits are symmetric around $t = (\alpha - c)/9$. Hence $\Pi(t = 0)|_{x>0} = \Pi(t = 2(\alpha - c)/9)|_{x>0}$ but $2(\alpha - c)/9 > 3(\alpha - c)/14$ such that $\Pi(t = 0)|_{x>0} = \Pi(t = 3(\alpha - c)/14)|_{x>0}$. $\square$

Lemma 2 shows that trade liberalization increases (decreases) the wholesaler's profits in case of parallel trade and if trade costs are small (moderate) to start with. From (12), we observe that trade liberalization will decrease the wholesaler's export profits in this range. His domestic profits stay unchanged, but he has to reduce exports to the retailer as to maintain his monopoly position in the domestic market. Taking (11) and (12) together, we see that his profits are maximal when $t = (\alpha - c)/2$ and parallel imports are no threat anymore. The behavior of wholesaler's profits can be summarized by Figure 2.

We are now also ready to scrutinize whether $x = 0$ can be an optimal policy as we know that maximized wholesaler's profits are minimal at $t = (\alpha - c)/9$.

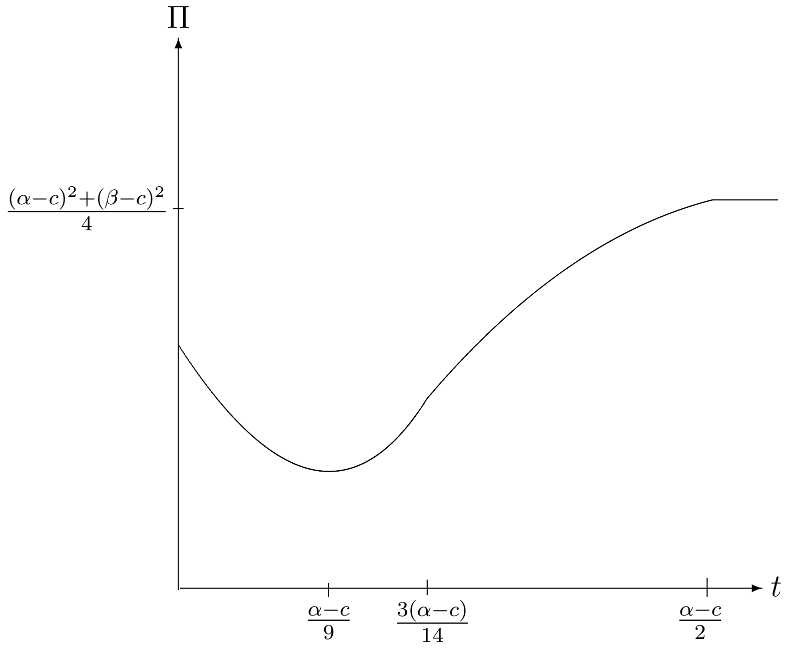

Figure 2: Wholesaler's profits

Lemma 3 *The wholesaler will always export to the retailer if β is not too small. If β is too small, $x = 0$ is the optimal policy either for an intermediate range of trade costs or for all trade costs too small. If $x = 0$ is the optimal policy for all trade costs too small, parallel trade will not occur.*

Proof: See Appendix A.2.

Lemma 3 demonstrates that Assumption 3 is not sufficient for strictly positive exports for all levels of trade costs. If the foreign market potential is too small, monopoly home profits $(\alpha - c)^2/4$ are larger than profits which imply parallel trade. This may even be true for $t = 0$, and in this case, no parallel trade would happen.

The non-monotonicity of wholesaler's profits and foreign consumer surplus can also be found in models with vertical control. The main difference is that the wholesaler controls the retailer's activities via a wholesale price such that this wholesale price is the marginal cost of the retailer. Without control, any transfer from the retailer to the wholesaler is sunk, and the wholesaler can only restrict the level of exports to the retailer, but not affect the relative profitability of both markets.

4 Parallel trade under incomplete information

Let us now turn to the case in which the wholesaler does not know the retailer's type. This is by no means a simple extension of the case without parallel trade. In particular, the wholesaler may be able to learn the type of the retailer which is important because the wholesaler will determine his output for the domestic market after potential acceptance of a contract by the retailer. If this acceptance is revealing the retailer's type, the wholesaler's output decision will be conditioned upon this signal. Without parallel trade, the type of the wholesaler is also learned but this has no effect on the wholesaler's behavior. If parallel trade is allowed, however, we must take into account that the wholesaler will potentially use the signal of the retailer as to update his beliefs consistently. Consistency requires that the beliefs of the wholesaler are confirmed in equilibrium, and thus we now explore the possibility of a perfect Bayesian Nash equilibrium.

When doing so, we have to specify out-of-equilibrium beliefs, and as it is well known, the specification of out-of-equilibrium beliefs is crucial to support the equilibrium beliefs and activities. In what follows, we will focus only on the existence of separating equilibria such that the wholesaler offers a separate contract for each type and consequently updates his beliefs such that he will assume that a contract designed for type β will be picked by type β only. Of course, there may be other pooling equilibria as well, but this is not of our interest in this paper. The confinement on separating equilibria has a strong implication as is demonstrated by

Proposition 2 *There is no separating equilibrium with parallel trade.*

Proof: See Appendix A.3.

The proof of Proposition 2 is tedious and lengthy and thus relegated to the appendix. The intuition, however, is straightforward. As before in the case without parallel trade, the wholesaler wants a good type to reveal that it is good type such that this good type receives a larger x than worse types. Without parallel trade, the wholesaler could do so by offering a higher rent and a larger x to better types. When parallel trade is permitted, however, there is another additional incentive: if you signal to be a good type, the wholesaler will learn the type and thus decide for a large y because the wholesaler knows (and the retailer knows that he knows, etc.) that the foreign market is more interesting than the domestic market for the retailer. Therefore, the retailer has the additional incentive to pretend to be a worse type than he actually is as to make his sales in the domestic country more profitable. In the end, there is no incentive scheme in which both opposing effects can be reconciled but the retailer would always want to conceal his type if the wholesaler tries to learn it.

Proposition 2 is a central result of our analysis as it indicates that parallel trade will not occur if the wholesaler goes for a policy which is separating. It is thus in contrast with the case of complete information in which parallel trade will occur for low trade costs unless the foreign market potential is too small. This result does not survive even the smallest increase in uncertainty about the retailer's type.[2] Proposition 2 does not claim that no separating equilibrium exists in general, but only that none exists which involves parallel trade. Hence, we will now explore whether a separating equilibrium without parallel trade will exist. For this purpose, we make

Assumption 4 $b > \dfrac{\alpha + c - 2t}{2}$,

which will ensure that exports in this type of equilibrium are non-negative. Proposition 3 has the answer to our existence question.

Proposition 3 *A fully separating equilibrium without parallel trade exists if b is not too small.*

Proof: See Appendix A.4.

[2]Of course, as mentioned before, pooling equilibria may still exist in which parallel trade will occur.

Appendix A.4 finds that $b > 2(B+c)/3 - (\alpha + c - 2t)/6$ does not want the wholesaler to discriminate against bad types but to include all types. It also shows that the optimal policy of the wholesaler implies

$$\begin{aligned} x(\beta) &= \frac{\beta}{2} - \frac{\alpha + c - 2t}{4}, \\ T(\beta) &= l + \tau(\beta), \\ l &= \frac{4b(b - (\alpha + c - 2t)) - (\alpha + c - 2t)^2}{16}, \\ \tau(\beta) &= \frac{\alpha + c - 2t}{4}\beta. \end{aligned} \tag{13}$$

Why does a separating equilibrium exist if parallel trade does not occur? The reason is that the wholesaler will also learn the type but that his policy for his home market will not be affected by this Bayesian update. Without parallel trade, $y = (\alpha - c)/2$ irrespective of the retailer's type. Therefore, also the retailer has no reason to conceal his type as he will not sell in the domestic market anyway. Note carefully that, although both $x(\beta)$ and $\tau(\beta)$ increase with β and the worst type b does not receive a rent, it is not true that there is no distortion at the top:

$$x(B) = \frac{B}{2} - \frac{\alpha + c - 2t}{4} < \frac{B - c}{2}$$

because $\alpha - c - 2t > 0$. In general, $x(\beta)$ according to (13) is smaller than $x(\beta)$ according to (2) which leads to

Lemma 4 *Parallel trade makes both the wholesaler and foreign consumers worse off under incomplete information.*

Proof: It is sufficient to prove that the outputs for each type are smaller for policy (13) compared to policy (2) because policy (2) falls short of the monopolistic outcome:

$$\begin{aligned} \frac{2\beta - B - c}{2} &> \frac{\beta}{2} - \frac{\alpha + c - 2t}{4} \Leftrightarrow \\ \alpha - c + 2t + 2\beta - 2B &> 2\beta - (\alpha + c - 2t) > 0 \end{aligned}$$

because $B < \alpha - 2t$ (see Assumption 2) and $\beta > b > (\alpha + c - 2t)/2$ (see Assumption 4). $\square$

Scheme (13) is determined such that each retailer truthfully reports his type and is just indifferent between selling and not selling in the domestic market. Given (13), we can now determine the expected export profits and the expected foreign consumer surplus which are respectively given by

$$\begin{aligned} \widehat{\Pi}^x &= \frac{4b(b-(\alpha+c-2t)) - (\alpha+c-2t)^2}{16} \\ &+ \int_b^B \left(\frac{(\alpha+c-2t)\beta}{4} - c\left(\frac{\beta}{2} - \frac{\alpha+c-2t}{4}\right)\right) \frac{d\beta}{B-b} \end{aligned} \tag{14}$$

and

$$\begin{aligned} \widehat{CS}^* &= \int_b^B \frac{x(\beta)^2}{2} \frac{d\beta}{B-b} \\ &= \frac{4(b^2+bB+B^2) - 6(b+B)(\alpha+c-2t) + 3(\alpha+c-2t)^2}{96}. \end{aligned} \tag{15}$$

Without parallel trade, the domestic market stays completely unaffected by changes in the foreign market. We are now ready to explore how an increase in retailer heterogeneity and trade liberalization, measured by a decline in t, affect the wholesaler's export profits and foreign consumer surplus.

Proposition 4 *A mean-preserving spread increases expected foreign consumer surplus and decreases the expected export profits of the wholesaler. Trade liberalization decreases both expected foreign consumer surplus and the expected export profits of the wholesaler*

Proof:

$$\frac{\partial \widehat{\Pi}^x}{\partial B} - \frac{\partial \widehat{\Pi}^x}{\partial b} = -\frac{2b - (\alpha+c-2t)}{4} < 0,$$

$$\frac{\partial \widehat{\Pi}^x}{\partial t} = -\frac{B - b - \alpha + c + 2t}{4} > 0$$

because Assumption 2 implies that $B - b - \alpha + c + 2t < -(b - c)$.

$$\frac{\partial \widehat{CS}^*}{\partial B} - \frac{\partial \widehat{CS}^*}{\partial b} = \frac{B-b}{24} > 0,$$

$$\frac{\partial \widehat{CS}^*}{\partial t} = \frac{B + b - (\alpha + c - 2t)}{8} > 0. \square$$

The effect of trade liberalization is straightforward. As the whole scheme makes each type indifferent between selling in the domestic market or not, a decline in trade costs implies that exports have to be reduced. This reduces both the wholesaler's expected export profits and the expected foreign consumer surplus. As in Proposition 1, the wholesaler suffers from an increase in heterogeneity but for different reasons. It is straightforward to see that the second part of (14) is not changed by a mean-preserving spread because the integrand is linear in β, and thus its mean stays constant. In other words, what the wholesaler gets more from better types in terms of variable transfers τ minus costs will be exactly offset by what he gets less from worse types. The license fee l, however, is designed such that the worst type does not get a rent, and a mean-preserving spread will reduce the operating profits of the worst type. Therefore, only the negative effect on the fixed license fee counts for the wholesaler.

Contrary to Proposition 1, Proposition 4 shows that a mean-preserving spread increases expected foreign consumer surplus. The reason is that a mean-preserving spread leaves the mean of $x(\beta)$ now unchanged, but since consumer surplus is quadratic in outputs, the reduction at the low end is more than overcompensated by the increase at the high end of types. Foreign consumers will therefore appreciate an increase in retailer heterogeneity ex ante, although the level of exports will still fall short of the monopolistic output level.

5 Outside option of the wholesaler

All results so far have been developed under the hypothesis that the wholesaler does not have an outside option. We will now explore the implications if the wholesaler may also set up a retail subsidiary in the foreign country. We assume an extra fixed greenfield cost, G, to establish this affiliate; the retailer as an incumbent firm, however, does not have to carry this investment. Until now, we did not distinguish whether β is a generic feature of demand, known to the retailer only, or whether it measures the individual capability of the retailer to sell this product as a high quality product. This distinction becomes important now when considering the wholesaler's outside option. The reason is that the wholesaler may now decide to offer contracts only to sufficiently good types, whereas he would rather try his own luck instead of employing bad types. He can do so by not making type b but another type $\widetilde{\beta}$ with $\widetilde{\beta} \in [b, B]$ indifferent between accepting and rejecting.[3] As a consequence, all worse types will reject.

For this exercise, it is important whether β is *market*- or *firm-specific*. Suppose that offers have been made which will be accepted by types for which $\beta \in [\widetilde{\beta}, B]$ and rejected by types for which $\beta \in [b, \widetilde{\beta}]$. If the retailer rejects all offers, the wholesaler learns that $\beta \in [b, \widetilde{\beta}]$ if β is market-specific. Accordingly, this should lead to a Baysian update of beliefs about market conditions and the corresponding conditional greenfield profits. However, if β is firm-specific, the wholesaler does not learn anything except that the potential partner was a bad one. In this case, it is fair to assume that the wholesaler will then draw from the same basic distribution if he wants to make a greenfield investment, and thus no update of beliefs about market conditions should result from rejection by the retailer.

Furthermore, we have to distinguish whether the wholesaler will learn its type after having made the investment or whether he will have to determine output in the foreign market without knowing β. In the first case, the optimal output will always be equal to the monopolistic output $(\beta - c)/2$; in the second case, the wholesaler has to set one output level which balances the prospect of high and low β's. Let the expected conditional greenfield profits of the wholesaler be denoted by $\widehat{\Pi}^g(\widetilde{\beta})$. Table 2 summarizes these operating profits as they arise under all four possible cases.

Note that in the case of complete information, all operating profits are the same for all cases and equal to $(\beta - c)^2/4$.[4] The game played now is a different

[3] Of course, $\widetilde{\beta} = B$ is also an option such that greenfield investment becomes dominant. This case is trivial and thus not considered any further.

[4] In the case of no parallel trade and complete information, the outside option is irrelevant as its profits are always smaller due to G.

Table 2: Expected conditional greenfield profits of the wholesaler

Wholesaler learns type ...	β is firm-specific	market-specific
before	$\int_b^B \frac{(\beta-c)^2}{2} \frac{d\beta}{B-b}$	$\int_b^{\widetilde{\beta}} \frac{(\beta-c)^2}{2} \frac{d\beta}{\widetilde{\beta}-b}$
after investment	$\int_b^B \frac{4(\beta-c)-B-b-2c}{4} \frac{B+b-2c}{4} \frac{d\beta}{B-b}$	$\int_b^{\widetilde{\beta}} \frac{4(\beta-c)-B-b-2c}{4} \frac{B+b-2c}{4} \frac{d\beta}{\widetilde{\beta}-b}$

one both if parallel trade is permitted and if parallel trade is banned. Table 3 shows how the last stages are affected by an outside option of the wholesaler if parallel trade is permitted. If $\widehat{\Pi}^g(\widetilde{\beta})$ is larger than G, the wholesaler may discriminate against bad types and offer contracts to good types only. Note that $\widehat{\Pi}^g(\widetilde{\beta}) > G$ is only a necessary, but not a sufficient condition.

The case of complete information is the easiest to deal with. Since Lemma 2 demonstrates that the wholesaler's profits are convex in trade costs, the following result is obvious.

Lemma 5 *If the wholesaler's outside option is profitable and the wholesaler knows the type of the retailer, the wholesaler may not employ a retailer if trade costs are in an intermediate range.*

Let us now discuss how an outside option will affect the wholesaler's optimal policy in the case of incomplete information. We will once again focus on a separating equilibrium, but now it will not be fully separating but will discriminate against bad types. To this end, let us assume that $\widehat{\Pi}^g(b) > G$ which means that a greenfield investment is always profitable, irrespective of the foreign market potential. Otherwise, we would have to take into account that the wholesaler might not want to make an investment if he learns the type. While this might be an interesting option, its implications are straightforward and do depend very much on $\widehat{\Pi}^g(b)$.

Table 3: Sequence of moves when the wholesaler has an outside option

Stages I and II as in Table 1
Stage III: *In case of rejection:* The wholesaler decides on setting up a foreign subsidiary. *In case of acceptance:* The wholesaler decides on his sales. The retailer decides on sales in his market and the domestic market.
Stage IV: *In case of rejection and a foreign subsidiary:* The wholesaler decides on sales at home and abroad. *In case of rejection and no foreign subsidiary:* The wholesaler decides on sales at home.

The expected export profit of the wholesaler has now two components which depend both on $\widetilde{\beta}$. If the retailer accepts, the game is similar as played in Section 4. However, the wholesaler will get a higher license fee because it is now $\widetilde{\beta}$ and not the worst type b which is made indifferent between acceptance and rejection. While this effect is profit enhancing, acceptance is not guaranteed but its probability is equal to $(B - \widetilde{\beta})/(B - b)$. In the case of rejection, the wholesaler will make a greenfield investment, and this will happen with probability $(\widetilde{\beta} - b)/(B - b)$. Consequently, the expected export profit is equal to

$$\begin{aligned} \widehat{\Pi}^x &= \frac{\widetilde{\beta} - b}{B - b}(\widehat{\Pi}^g(\widetilde{\beta}) - G) + \frac{B - \widetilde{\beta}}{B - b} l(\widetilde{\beta}) \qquad (16) \\ &+ \int_{\widetilde{\beta}}^{B} (\tau(\beta) - cx(\beta)) \frac{d\beta}{B - b}, \\ l(\widetilde{\beta}) &= \frac{4\widetilde{\beta}(\widetilde{\beta} - (\alpha + c - 2t)) - (\alpha + c - 2t)^2}{16}, \end{aligned}$$

where $l(\widetilde{\beta})$ follows from the condition that type $\widetilde{\beta}$'s operating profits are equal to his transfers to the wholesaler and the production cost. The license fee now depends positively on the cutoff $\widetilde{\beta}$; the variable transfers $\tau(\beta)$ are not reported here but are the same as in (13). It is, of course, not guaranteed that discrimination against bad types will occur, so assuming concavity w.r.t. $\widetilde{\beta}$, we can write the Kuhn-Tucker conditions as

$$\begin{aligned} \Psi(\cdot) &\equiv \widehat{\Pi}^g(\widetilde{\beta}) - G + (\widetilde{\beta} - b)\frac{\partial \widehat{\Pi}^g(\widetilde{\beta})}{\partial \widetilde{\beta}} - l(\beta) \qquad (17) \\ &+ (B - \widetilde{\beta})\frac{\partial l(\beta)}{\partial \widetilde{\beta}} - (\tau(\widetilde{\beta}) - cx(\widetilde{\beta})) \leq 0, \\ &\widetilde{\beta} \geq b, \Psi(\widetilde{\beta} - b) = 0. \end{aligned}$$

Note that $\partial \widehat{\Pi}^g(\widetilde{\beta})/\partial \widetilde{\beta} = 0$ if β is firm-specific, that is if the wholesaler cannot draw any conclusion from rejection. If an interior solution exists, we find that trade liberalization has an unambiguous effect on both the cutoff level $\widetilde{\beta}$ and the wholesaler's expected export profit.

Proposition 5 *If the wholesaler has a profitable outside option and discriminates against bad types, economic integration will lead to more discrimination and to a lower expected export profit.*

Proof: Given that $\partial^2\Psi/\partial\widetilde{\beta}^2$, the change of $\widetilde{\beta}$ with t is determined by

$$\frac{\partial^2\Psi}{\partial\widetilde{\beta}\partial t} = -\frac{\alpha - c + t - 2(B - \widetilde{\beta})}{4} < 0 \qquad (18)$$

because $\alpha - c + t - 2(B - \widetilde{\beta}) > 2\widetilde{\beta} - (\alpha + c - 2t) > 0$ due to Assumption 2, $\widetilde{\beta} \geq b$ and Assumption 4. Furthermore, due to the envelope theorem, expected export profits change with t according to

$$\frac{d\Pi^x}{dt} = \frac{\partial\Pi^x}{\partial t} = -\frac{B - \widetilde{\beta} - \alpha + c + 2t}{4} > 0 \qquad (19)$$

because Assumption 2 implies that $B - \widetilde{\beta} - \alpha + c + 2t < -(\widetilde{\beta} - c)$. $\square$

With an outside option of the wholesaler, there is little we can say on the effect of trade liberalization on foreign consumer surplus. While we know from Proposition 4 that trade liberalization harms foreign consumers without outside option of the wholesaler, this effect now becomes ambiguous and will depend on the type of the outside option. For example, if β is firm-specific and learned before output decisions have to be made, an increase in the cutoff level $\widetilde{\beta}$ will at least partially benefit foreign consumers because there is now a larger chance for a larger (monopolistic) output. It goes without saying that similar ambiguous effects are also present for a mean-preserving spread, and any detailed analysis would at least require to be more specific on the type of the outside option. In any case, parallel trade will also not occur even in an equilibrium which is only separating among good types.

6 Concluding remarks

This paper has explored how the lack of vertical control affects the optimal policy of a wholesaler. We have found that parallel trade may occur in a setup of symmetric information. However, if information is asymmetric – as we would expect to make sense of employing a foreign retailer – parallel trade will not occur even if permitted. The reason is that any set of contracts which wants to separate types has to fight with two conflicting interest: the interest of the wholesaler to learn the type of the retailer, and the interest of the retailer to conceal its type as to increase profits in the wholesaler's market. We have found that no set of contracts exists which can reconcile both demands, but only a set which rules out parallel trade. So the sobering news for those in favor of permitting parallel trade is that it will not occur without vertical control.

Appendix

A.1 Optimal policy without parallel trade

Any contract scheme has to make sure that a type β' prefers a contracts designed for his type and not for any other type, say type β''. Hence, we require that $\Pi^*(\beta', \beta') \geq \Pi^*(\beta', \beta'')$ and $\Pi^*(\beta'', \beta'') \geq \Pi^*(\beta'', \beta')$. Adding up both conditions yields

$$(\beta' - \beta'')(x(\beta') - x(\beta'')) \geq 0 \tag{A.1}$$

which implies that the export level should not declines with β. Using the tools of principal agent theory, we can determine the optimal set of contracts by maximizing the virtual surplus of the wholesaler, that is

$$\int_b^B \{[\beta - x(\beta) - c]x(\beta) - \frac{1 - F(\beta)}{f(\beta)} x(\beta)\} dF(\beta) \tag{A.2}$$

w.r.t. $x(\beta)$. The last term captures the rent to be paid to more productive firms as to guarantee incentive compatibility. Maximization of (A.2) w.r.t. $x(\beta)$ leads to (2). Furthermore, $x(\beta)$ increases with β as requested by condition (A.1). The wholesaler has also no interest in discriminating against worse types such that only good types will accept but all others will reject. Suppose the wholesaler did, and let $\bar{\beta}$ denote the type which is just indifferent between acceptance and rejection. The expected export profit would be equal to

$$\int_{\bar{\beta}}^B \left(\frac{\beta}{2}(2B - \beta + 2c) - c\frac{2\beta - B - c}{2} \right) \frac{d\beta}{B - b}$$

and its first derivative w.r.t. $\bar{\beta}$ for $\bar{\beta} = b$ is

$$-\frac{(2b-(B+c)^2)}{B-b}<0$$

which proves that discrimination against some (bad) types would reduce expected export profits. □

A.2 Proof of Lemma 3

Computing the wholesaler's maximized profits when they are lowest yields

$$\Pi(t=(\alpha-c)/9)=\frac{61\alpha^2+108\beta^2+169c^2-2c(61\alpha+108\beta)}{432}$$

which is larger than $\Pi(x=0)=(\alpha-c)^2/4$ if

$$\beta>(\alpha-c)\frac{1}{6}\sqrt{\frac{47}{3}}+c>\frac{\alpha+c}{2}. \tag{A.3}$$

If condition (A.3) is fulfilled and thus β is not too small, any optimal policy will imply $x>0$. If not, the optimal policy warrants $x=0$ at least in the neighborhood of $t=(\alpha-c)/9$. Computing the wholesaler's maximized profits for $t=0$ and comparing them with $\Pi(x=0)$ yields

$$\Pi(t=0)>\Pi(x=0)\Leftrightarrow\beta>(\alpha-c)\frac{1}{26}\sqrt{\frac{2191}{3}}+c>\frac{\alpha+c}{2}. \tag{A.4}$$

and thus Assumption 3 cannot guarantee that $\Pi(x=0)<\Pi(t=0)$. Due to the symmetry of the wholesaler's profits with parallel trade in this range and that the level of $\Pi(t=0)$ will be reached again at a level of trade for which $m=0$ (see proof of Lemma 2), $\Pi(t=0)<\Pi(x=0)$ implies that exports become profitable only if $m=0$. □

A.3 Proof of Proposition 2

We will do the proof by contradiction. Assume that a separating equilibrium with parallel imports exists. In this case, each retailer would pick the contract designed for him. Importantly, this choice will give the wholesaler an important piece of information: as the wholesaler decides on his output for the domestic market after the retailer has chosen a contract, the wholesaler will learn the exact type of the retailer. Hence, if a separating equilibrium exists, it serves two purposes for the wholesaler: (i) design contracts such that the expected profits of the wholesaler are maximized by the offered set of contracts $x(\beta), T(\beta)$, (ii) learn from the choice the true type as to adjust your home outputs.

Assume that a retailer of type β' accepts a contract which is designed for type β''. In case of parallel imports, this will lead to an import level of

$$m(\beta', \beta'') = \frac{\alpha - \beta' + 2x(\beta'') - y(\beta'') - t}{4}$$

which will prompt the wholesaler to chose an output level

$$y(\beta'') = \frac{2(\alpha + \beta'') - 4x(\beta'') + 2t}{5}.$$

This will be correctly anticipated by the retailer who will in turn know that his import level will thus be equal to

$$m(\beta', \beta'') = \frac{3\alpha - 5\beta' - 2\beta'' + 14x(\beta'') + 4c - 7t}{20}.$$

We can now compute the retailer's profits as a function of his true type β and his announced type $\hat{\beta}$. For the case above, we have

$$\begin{aligned} \pi^*(\beta', \beta'') &= (\alpha - (m(\beta', \beta'') + y(\beta'')) - t)m(\beta', \beta'') \\ &+ (\beta - (x(\beta'') - m(\beta', \beta'')))(x(\beta'') - m(\beta', \beta'')) - T(\beta'') \end{aligned} \tag{A.5}$$

A similar expression, denoted by $\pi^*(\beta'', \beta')$ can be derived if the true type is β'' and the announced type is β'. If a separating equilibrium exists, it must fulfill that both $\pi^*(\beta', \beta') - \pi^*(\beta', \beta'') \geq 0$ and $\pi^*(\beta'', \beta'') - \pi^*(\beta'', \beta') \geq 0$, that is, true revelation must weakly dominate. Adding both conditions leads to condition

$$(\beta' - \beta'')(\beta' - \beta'' + 12(x(\beta') - x(\beta''))) \geq 0. \tag{A.6}$$

In case of true revelation, $\partial\pi^*(\beta, \hat{\beta})/\partial\hat{\beta} = 0$ such that the increase in rent with the type is given by

$$\frac{d\pi^*(\beta, \hat{\beta} = \beta)}{d\beta} = \frac{\partial\pi^*(\beta, \hat{\beta} = \beta)}{\partial\beta} = \frac{y(\beta, x(\beta)) + 2x(\beta) + t + \beta - \alpha}{4}$$

due to the envelope theorem. The wholesaler maximizes the virtual surplus

$$
\begin{aligned}
\int_b^B \{ & [\alpha - (y(\beta, x(\beta)) - m(\beta)) - c] y(\beta, x(\beta)) \\
& + [\alpha - (y(\beta, x(\beta)) - m(\beta)) - c - t] m(\beta) \\
& + [\beta - (x(\beta) - m(\beta)) - c](x(\beta) - m(\beta)) \\
- \frac{1 - F(\beta)}{f(\beta)} & \frac{y(\beta, x(\beta)) + 2x(\beta) + t + \beta - \alpha}{4} \} dF(\beta)
\end{aligned} \tag{A.7}
$$

over $x(\beta)$. The first derivative set equal to zero yields

$$
x(\beta) = \frac{21B - 16\beta - 13c + 8\alpha - 16\beta}{10}.
$$

Put in condition (A.6), however, this leads to $-13(\beta' - \beta'')^2 < 0$ which is a contradiction that the first derivative of the virtual surplus leads to a truth-telling mechanism. $\square$

A.4 Proof of Proposition 3

Let us write the retailer's profits as a function of his true type β, his pretended type $\hat{\beta}$ and his level of imports into the domestic country m:

$$
\begin{aligned}
\Pi^*(\beta, \hat{\beta}, m) &= \left(\frac{\alpha + c}{2} - m - t \right) m \\
&+ \left(\beta - \left(\frac{\hat{\beta}}{2} - \frac{\alpha + c - 2t}{4} - m \right) \right) \left(\frac{\hat{\beta}}{2} - \frac{\alpha + c - 2t}{4} - m \right) \\
&- T(\hat{\beta})
\end{aligned} \tag{A.8}
$$

Given the transfer and export scheme (13), the retailer's profits consist of his operating profits in the domestic market, given that the wholesaler behaves as if he were a monopolist, and his operating profits in the foreign market, corrected by the transfers paid to the wholesaler. The retailer is free to sell in the foreign market and to mimic any type. The derivatives w.r.t. sales in the domestic country and the pretended type are respectively equal to

$$
\begin{aligned}
\frac{\partial \Pi^*(\beta, \hat{\beta}, m)}{\partial m} &= (\hat{\beta} - \beta) - 4m \text{ and} \\
\frac{\partial \Pi^*(\beta, \hat{\beta}, m)}{\partial \hat{\beta}} &= \frac{\hat{\beta} - \beta}{2} + m.
\end{aligned} \tag{A.9}
$$

Since $\partial\Pi^*(\cdot)/\partial m = -4, \partial\Pi^*(\cdot)/\partial\hat{\beta} = -\frac{1}{2}, \partial^2\Pi^*(\cdot)/\partial m\partial\hat{\beta} = 1$,

$$\frac{\partial^2\Pi^*(\cdot)}{\partial m^2}\frac{\partial^2\Pi^*(\cdot)}{\partial\hat{\beta}^2} - \frac{\partial^2\Pi^*(\cdot)}{\partial m\partial\hat{\beta}} = 1 > 0,$$

and thus the sufficient conditions are fulfilled and (A.9) implies true revelation and no sales in the domestic country, that is $\hat{\beta} = \beta$ and $m = 0$. Now assume that the wholesaler decides to discriminate against all worse type than $\bar{\beta}$ such that only better type will accept a contract. This will lead to a larger license fee, but at the risk that the contract may not be accepted. Accordingly, the expected export profit is equal to

$$\begin{aligned} \Pi^x &= \frac{B-\bar{\beta}}{B-b}\frac{4\bar{\beta}(\bar{\beta}-(\alpha+c-2t))-(\alpha+c-2t)^2}{16} \\ &+ \int_{\bar{\beta}}^{B}\left(\frac{(\alpha+c-2t)\beta}{4} - c\left(\frac{\beta}{2} - \frac{\alpha+c-2t}{4}\right)\right)\frac{d\beta}{B-b}. \end{aligned} \tag{A.10}$$

The first term is the probability of acceptance times the license fee designed such that type $\bar{\beta}$ is indifferent between acceptance and rejection, the second term is similar to (14) except that it includes only the types which will accept. Assuming an interior solution, maximization w.r.t. $\bar{\beta}$ yields an optimal cutoff level

$$\bar{\beta} = \frac{2(B+c)}{3} - \frac{\alpha+c-2t}{6} \quad \square \tag{A.11}$$

Thus, if b is not too small but $b > \bar{\beta}$, the wholesaler will include all types. □

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