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EUROPEAN ANTIDUMPING POLICY AND FIRMS' STRATEGIC CHOICE OF QUALITY

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ABSTRACT

European Antidumping Policy
and Firms' Strategic Choice of Quality*

In this paper, we consider a European industry characterized by vertical product differentiation. Using a two-stage model with quality choice made before price competition takes place, we show that EU anti-dumping policy that takes the form of price-undertakings offers a powerful protection to domestic firms, but only at the price competition stage. Once the impact of the A-D policy on quality choices is taken into account, European Welfare as well as profits accruing to the domestic firm decrease whenever the free trade equilibrium is affected. Hence we show that European Antidumping policies may induce 'perverse' leapfrogging.

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NON-TECHNICAL SUMMARY

Whenever a European industry feels that a foreign (extra-EU) supplier is dumping products on the EU market and thereby causing injury to the domestic industry, a dumping complaint is filed with the European Commission. The investigation carried out by the Commission predominantly focuses on price comparisons. If the Commission finds that the foreign price for a product, 'similar' to a European one, is lower than the price charged for this product by the European producers, injury is suspected. When the Commission finds injury in the form of foreign price undercutting on the EU market, it can take antidumping measures. A popular type of antidumping measures is a price-undertaking. This implies that the foreign producer has to increase its price on the European market to the level of the 'similar' European product. Hence, whether antidumping measures are imposed or not hinges on what is considered to be a 'similar' product. Most papers in the field have considered exogenous product differentiation between European and foreign products. In this paper we endogenize product differentiation in the context of European antidumping policy. We consider an industry characterized by vertical product differentiation. We model the interaction of both a European and a foreign firm in two stages. A first stage in which firms simultaneously decide on the quality they offer and a second stage of price competition in which the firms simultaneously decide on what price to charge. The price competition stage can be considered as the 'short-run' whereas quality choices are typically decisions with a somewhat longer time horizon therefore we can refer to the outcome of stage 1 as the 'long-run'. In this paper we show that when the free trade situation is one where the European firm offers a high quality product and the foreign producer offers a low quality product, European antidumping policy in the form of a price-undertaking can induce leapfrogging. This implies that in the presence of antidumping policy, quality leadership is reversed. Our model suggests that the threat of price-undertakings is sufficient for the quality ranking to be the reverse one compared to the absence of antidumping policy. The mere presence of antidumping rules and policies is sufficient to result in leapfrogging. Quality reversals amongst rival firms is an important implication of the existence of price-undertakings and one of which policy makers may be unaware. Although antidumping measures can be in the interest of European producers in the short-run (at the price competition stage), because they result in higher prices in the long-run (including the effects of long run quality choices) they can be to the disadvantage of European producer surplus and European welfare as a whole. Empirically, our results would suggest that as a result of antidumping measures, quality upgrading over time by foreign producers can be expected.

Empirical studies on VERs have shown that quality upgrading of foreign products subject to a VER can arise. For example, Feenstra (1988) showed that under the US VER between 1981-5, both the price and the quality of

Japanese exports of cars to the US increased. Aw and Roberts (1986) found quality upgrading over time of Korean and Taiwanese footwear exported to the US as a result of a quota. Since price-undertakings are similar to VERs in the sense that both types of measures raise the prices of foreign products, we expect future empirical research to confirm that quality upgrading of foreign products can be the result of European antidumping policy in the form of price-undertakings.

1 Introduction

According to the European anti-dumping legislation, whenever a foreign product, which is "similar" to a European one is "dumped" on the European market, trade protection can be imposed (EC regulation 386/94). Once dumping (i.e. price discrimination between national markets) is established,[1] the legislation basically prevents price-undercutting of European produts in the European market. This protectionist policy is justified by the idea that dumping should be viewed as unfair competition, so that the resulting "injury" caused to the European industry must be compensated for. The A-D policy aims then at eliminating the injury as measured by the extent of the "injury margin", grossly defined as the extent of foreign price-undercutting in the European market (Vermulst and Waer (1991)). In order to eliminate the injury, the Commission may either impose a duty or accept a price-undertaking. Price-undertakings are best viewed as commitments of the foreign competitor to match the price of the European product in the European market. A price-undertaking forces the foreign firm to 'meet' the price set by the European producer of the 'like product' in the European market. In this paper we focus on antidumping protection taking the form of price-undertakings[2] which is arguably the most popular type of antidumping measure used by the European Commission (Tharakan, 1994). The case of a duty will briefly be discussed in the paper but results under a duty will appear to be quite similar as those obtained under price-undertakings.

The way the European Commission calculates the injury margin in European antidumping cases has often been criticized. Vandenbussche, Veugelers and Konings (1998) for example have shown that foreign price-undercutting can be the result of a cost advantage of a foreign firm selling a differentiated product on the EU market. Foreign price-undercutting then reflects a comparative advantage rather than unfair trade practices by the foreign importer. In this note we put forward an additional argument which casts doubt on the economic rational of the injury determination.

Our argument can be summarized as follows. Let us suppose that products are vertically

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[1]Legal dumping occurs whenever the price charged by a foreign producer on its own market is higher than the price charged in its export market (in the present case the European one).

[2]Anti-dumping can come in two forms. Either a duty on imports or a price-undertaking by the foreign firm.

differentiated, i.e. products exhibit different, but sufficiently close, quality levels. When products are vertically differentiated, equilibrium prices basically reflect quality levels. Note then that a foreign producer selling a lower quality than the European one will charge a lower price in order to enjoy a positive market share. If the foreign product is considered to be "similar" to the European one by the European Commission, the foreign producer runs the risk of being subject to a price-undertaking under the EU antidumping laws. Moreover, when forced to match the European price, the low quality foreign product cannot survive in the market. This risk spills over to the quality decision stage. We will show that with a price-undertaking, the foreign producer is less inclined to adopt a low quality profile. As a result, both firms' incentives with respect to quality choices are likely to be affected by the mere threat of A-D actions at the price competition stage.

In this paper, we systematically investigate this intuition. To this end, we analyze the effects of price-undertakings on price competition and quality choices when vertically differentiated products are likely to be considered as 'similar' in an antidumping investigation. Note that if 'similar' only refers to horizontally differentiated goods, than foreign importers of vertically differentiated goods should not worry about the Antidumping laws in place. As soon as they can show that the product they sell is of 'lower quality' than the European one, they should be allowed to charge a lower price. However, recent evidence does suggest that the definition of 'similar' can involve vertically differentiated (quality differences) goods.

Although in principle the legislator should allow for price differences between a European and a foreign product when they differ in characteristics (EU regulation 386/94 §3 section D.10), there are many occasions where quality differences between domestic and foreign products are acknowledged, but no price adjustments were made. For example in 1987, a Russian importer of 'standardized electrical motors' in the EU was accused of dumping and injury to the Community industry because of selling at a lower price than the European standardized electrical motors. The Russian exporter argued that the Commission when making a price comparison between European motors and Russian motors, should take into account *the differences in physical characteristics, the poor brand image of USSR products, the lower quality of raw materials and the lower efficiency of after sales service compared to Community products' (L 83/4 27.3.'87).*

A (former) GDR exporter of motors, equally alleged of dumping and injury in the same case, pointed out to the Commission that *'its products contained a lower active material content than most motors manufactured by Community competitors'*. Furthermore it was argued that there were other technical differences between the motors such as *'electricity input, axle height, noise and vibration levels of motors'* which should be taken into account when comparing prices (L 83/4 27.3.'87).

In response to these objections the Commission replied that *'these differences did not affect price comparability and therefore no allowances were made'*. More in particular the Commission argued that *'given the large degree of international standardization in the manufacturing of such motors, each type of motor originating abroad constitutes a 'like product' to the same type of Community standardized motor, although there may be differences in quality''* (L 280/69, 1.10.'86).

This case clearly illustrates that the Commission can acknowledge the difference in quality that may exist between the foreign and European products, but nevertheless decide to consider the products as similar.[3] This implies that a lower price for the foreign product in the EU market is considered to be injurious for the European industry and antidumping protection aimed at offsetting this price difference follows. Thus, this case shows that A-D policies may be implemented even though products are viewed as differing in quality. Interestingly enough, the kind of "differences" mentioned in this case falls into the definition of what are viewed as vertically differentiated goods. Hence, studying the implications of such policies is more than a purely academic exercice.

In what follows we shall use the stylized model of vertical product differentiation first developed by Mussa and Rosen [1978]. We will show that although a price-undertaking relaxes price-competition for the domestic firm in the short run, in the long run quality choices are affected in a way which always results in a reduction of European Welfare as compared to free trade. More precisely, the presence of a price undertaking tends to make the foreign firm more

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[3]Other cases involving obvious quality differences can of course be found. See for instance case 3651/88 involving Japanese dot matrix printers (Official Journal of the EC, L 317/33-44, of date 24.11.1988) or case 3946/88 involving polyester yarn from the US, Mexico, Taiwan and Korea (Official Journal of the EC, L 348/49-55, of date 17.12.1988)

aggressive in the quality game. When under free trade the foreign firm is a low quality producer, a price undertaking will turn it into a quality leader in the market. To adopt a low quality is no longer profitable when subject to a price-undertaking. This implies that the domestic European firm now faces a more agressive opponent at the quality stage. As a result the European firm is the one which is the more prone to adopt a low quality. Our findings suggest thus that a price-undertaking can lead to a reversal of the quality ranking, where the long-run foreign quality is upgraded and the domestic one downgraded compared to free trade. Domestic Welfare then decreases because of a larger profit diversion effect. In this respect, we may argue that anti-dumping policy tend to induce "perverse" leapfrogging in vertically differentiated industries. Hence, when the European Commission constructs anti-dumping measures that are aimed at offsetting foreign price-undercutting without accomodating for the fact that qualities are affected, long-run European Welfare may well fall.

In the next section we present a stylized model of vertical product differentiation and characterize the associated subgame perfect equilibria under free trade. We then study the same two-stage game in the presence of a price-undertaking. The subgame perfect equilibrium of the modified game shows how quality choices and price competition are altered in the presence of antidumping protection. In section 3, we comment on our main results and look at their robustness. Section 4 concludes.

2 The Model

Let us consider a simple duopoly model of vertical product differentiation where a European (D) and a foreign firm (F) choose quality in the first stage (long run) and compete in prices in the European market in the second stage (short run).

To keep the model as simple as possible we assume zero production cost and zero cost of quality for both the European and the foreign firm. This will allow us to focus precisely on those effects that are exclusively imputable to price competition. As will be discussed in section 3, introducing costs into the picture would not affect the qualitative nature of our results. Consumers in the European market are willing to buy at most one unit of the good and exhibit heterogeneous preferences. More specifically, they are identified by their taste for quality x

which is uniformly distributed on the interval $[0, 1]$.[4] The net utility of consuming good i for the consumer with taste x is $u^i = x.s^i - p^i$, where u^i refers to consumers' utility, s^i refers to the quality and p^i refers to the unit price of good i. We set the default utility of no-consumption to zero. Since we assume that firms choose qualities at zero cost we have to assume that the range of possible qualities is exogenously bounded. Formally we assume $s^i \in [0, 1]$.

2.1 The Free Trade Equilibrium

Under the assumptions stated above, it can be shown that in the absence of trade policy there exist two subgame perfect equilibria in pure strategies: one firm sells the best available quality product and the other firm chooses an optimal degree of product differentiation, i.e. sells a low quality product. In the continuation price equilibrium the price of the high quality product in equilibrium is higher (i.e. $p^H > p^L$) so that both firms enjoy a positive market share. This standard result is summarized in the following lemma.

Lemma 1 *In the quality-price game, there are two subgame perfect equilibria. When costs are nil, the high quality firm chooses the best available quality (i.e. $s^i = 1$) while the low quality firm differentiates to a ratio of 4/7. In all price subgames the equilibrium is unique and in pure strategies.*

Proof: In the appendix we clarify the results in the lemma but since this result is fairly standard we omit a full proof.[5]

The following comments are in order. First, under free trade, product differentiation will always obtain in equilibrium. For the firms it is never optimal to choose identical qualities because this would lead to pure Bertrand competition, i.e. zero profits for both. Note however that from a domestic Welfare point of view, the first best precisely involves both firms choosing the best available quality and naming a price equal to marginal cost. Since we have just seen that

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[4]Note that our assumption on the distribution of consumers' type ensures that the market is not covered in equilibrium.

[5]The interested reader is referred to Choi and Shin (1992) or Wauthy (1996) for a full proof. Of course, the specific value of 4/7 has no particular meaning since it is striclty conditional to our simplifying assumptions. However, the important, and robust, point is that product differentiation *always* prevails in the free trade equilibrium.

in a Subgame Perfect Equilibrium, product differentiation prevails, Domestic Welfare is lower than at the first best for three main reasons. First, there is under-provision of quality since one of the two firms adopts a low quality profile. Second, because of product differentiation, price competition is relaxed, so that equilibrium prices are above marginal costs and some of the consumers refrain from buying any of the two products: given product qualities, prices are too high. Third, the foreign producer makes positive profits, which have to be substracted from domestic Welfare. We will define this part of the industry profits that goes abroad the profit diversion effect. Due to this "profit diversion" effect a domestic government is not indifferent between the two SPE identified in Lemma 1: the equilibrium that sees the domestic producer as the quality leader is strictly preferred to the other one, simply because it involves less profit diversion.

Under free trade, two products' ranking are possible in the pricing subgames. Either the domestic firm is the high quality producer and the foreign firm is the low quality producer ($s^D = 1, s^F = 4/7$) or vice versa ($s^D = 4/7, s^F = 1$). It is only in the former case that the foreign firm runs the risk of being subject to the EU's Antidumping legislation. In the case where it produces the high quality product and hence charges a higher price in the EU market there is no foreign price-undercutting and thus no risk for the A-Dlegislation to apply. A first result emerges: antidumping policy cannot affect price competition in the cases where the foreigner is the quality leader. Hence we focus hereafter on the pricing games where the domestic firm sells the high quality product and the foreign firm sells the low quality product. We keep in mind however that the alternative quality hierarchy remains an appealing candidate SPE.

2.2 Price-Undertakings and Quality choice

Let us assume that the European government has decided on an antidumping policy at time $t = 0$. This policy consists in allowing the domestic firm to file in case of dumping[6], in which

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[6]Note that we do not explicitly model the existence of dumping. Rather we implicitly assume that the foreign product is sold at a higher price in its home market. It should be clear that a sufficient condition for a foreign low quality firm to charge a higher price in its home market than in the EU is simply the absence of a competitor selling a product of a higher quality than its own. Differences in the distribution of consumers' willingness to pay could also lead to the same result.

case the government will evaluate the injury. This injury is defined as the price differential that prevails between domestic and foreign prices. In case the European and the foreign product are considered as 'similar' products and injury is detected, we assume that a price-undertaking is implemented. This involves a penalty for the foreign firm when the injury is not eliminated. With a price-undertaking, the low quality foreign firm's best reply consists in matching the domestic price, i.e. $p^D = p^F$ (as in Vandenbussche, Veugelers and Konings [1998]). More generally, we assume that both firms perfectly anticipate the free trade equilibrium associated to their quality levels. Given the specification of the anti-dumping policy, they both anticipate that whenever $s^F \geq s^D$, the continuation price equilibrium does not lead to injury whereas it always does under the alternative quality hierarchy.

With the foreign firm selling the low quality product, the antidumping law as it stands must come into play and affect the free-trade outcome when products are 'similar'. To capture this in our model, we parameterize the 'degree of similarity' between the vertically differentiated goods by Δ. By definition, Δ identifies the largest quality differential which would lead the commission to consider that products are similar. We have assumed that the quality chosen by either of the firms is indicated by s (s^i with $i = D, F$) which can lie between zero and 1. The widest possible interpretation of 'similarity' then involves a value of $\Delta = 1$. This implies that whatever the quality difference between the European and the foreign product on offer, the European Commission will always consider the two as 'similar' products and consider a lower price by the foreign product as a violation of the 'injury' condition in the AD-law resulting in a price-undertaking. We will first consider the case where $\Delta = 1$. This represents the most extreme case and as such will exagerate the likely impact of the policy. However, it will provide a suitable benchmark for less extreme situations in which $\Delta < 1$, as discussed in section 3.

In order to study the impact of the undertaking on quality choices, we characterize first equilibrium price subgames which are subject to the price-undertaking.

2.2.1 The second Stage: best replies in prices

Recall that the only price subgames that are affected by the EU policy are where the foreign firm is the low quality firm. Under free trade, the foreign firm will always set a price lower

than that of the domestic firm.[7] In particular the free trade best reply for the low quality firm always consists in choosing an optimal discount on the high quality product's price. Thus, any possible free trade best reply causes "injury", i.e. under the assumption that price-undercutting leads to a price -undertaking, the foreign firm is always constrained in the price competition stage. Whatever the price set by the domestic firm, the foreign firm will have to respect the price-undertaking by meeting the European price. It is not difficult to see that in this case, the foreign firm enjoys zero demand and thus earns zero profits: since it sells a lower quality product at the same price than the domestic firm, all consumers will prefer the high quality product. Therefore, we can say that a price-undertaking turns the domestic producer into a pure monopolist whereas the foreigner's payoffs under the undertaking is invariably nil when it sells a strictly lower quality. The optimal price for the domestic firm (and followed by the foreign firm) is the monopoly price. Since the foreign firm is forced to match this price despite its lower quality, the domestic firm enjoys the full monopoly profits. Direct computations then show that the corresponding payoff is strictly increasing in the domestic quality.

As mentioned previously, assuming that $\Delta = 1$ leads to the most extreme form of protection:*a price-undertaking in the short run is beneficial to the domestic firm by completely relaxing price-competition in the market.* However, we will now argue that in the long run, the conclusion is reversed.

2.2.2   The first Stage analysis: best replies in qualities

We only need to study the best replies in quality under the hierarchy $s^D \geq s^F$. Recall indeed that in the alternative hierarchy, anti-dumping is ineffective, so that the analysis of quality choices exactly replicates the free trade one: against a high foreign quality, the domestic producer optimally differentiates with a lower quality. Therefore $(s^D = 4/7, s^F = 1)$ remains a SPE of the full game with price-undertaking. We consider now the alternative hierarchy. From the analysis of the price subgames we know that in the presence of the price-undertaking, the European producer is an effective monopolist whenever it sells the high quality. It is immediate to show that in this case its best reply in quality is independent of the other's action and consists in

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[7]See the appendix for a detailed analysis.

choosing the highest possible quality. Therefore against any $s^F < 1$, the best reply of the domestic producer is $s^D = 1$. On the other hand, against $s^F = 1$, the domestic firm is better off differentiating. Recall indeed that if products are identical there exists a unique symmetric equilibrium (the pure Bertrand equilibrium) in the corresponding price subgame where no injury prevails.[8]

To choose a lower quality as in the case of free trade is no longer optimal for the foreign producer. If it were to do so its market share in the pricing game would be zero under a price-undertaking. Matching the domestic quality results in a Bertrand outcome, i.e. zero profits. By slightly improving upon the domestic quality, the foreign firm can secure positive profits. In other words, under the hierarchy $s^D \geq s^F$, the foreign best reply is invariably $s^F = s^D$. But we also know that foreign profits are increasing at $s^F = s^D$. From the free trade analysis, we know that the payoff of a high quality firm is monotonically increasing in own quality In other words, because of the undertaking, the foreign firm is always better off by matching and even improving upon the domestic quality. Its best reply is then invariably equal to 1, whatever the domestic quality.

Our analysis of the best replies at the quality stage of the game leads us to conclude that in the presence of the price-undertaking there is a unique SPE exhibiting $(s^D = 4/7, s^F = 1)$. We have therefore established the following proposition.

Proposition 1 *When the foreign product is regarded as 'similar' to the European product regardless of the quality difference between them ($\Delta = 1$), European Antidumping Policy taking the form of a price-undertaking induces the unique subgame perfect equilibrium $(s^D = 4/7, s^F = 1)$*

An immediate corollary may then be established.

Corollary 1 *The price-undertaking leads to a lower expected domestic Welfare.*

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[8]Note that even if we assume that the price-undertaking applies in the case of homogeneous products, the unique equilibrium is still the Bertrand equilibrium exhibiting marginal cost pricing. The reason is that although the foreign firm can no longer undercut, the domestic firm still can and finds it profitable to do so. Any price differential is matched by the foreign firm whereas any tie is undercut by the domestic one so that the unique equilibrium is the Bertrand one.

The proof of the corollary is straightforward. We only have to compare the unique equilibrium induced by the possibility of a price-undertaking, henceforth the 'undertaking' equilibrium ($s^D = 4/7, s^F = 1$) to the two equilibria applying under free trade: $\{(s^D = 1, s^F = 4/7), (s^D = 4/7, s^F = 1)\}$. Note first that consumers are indifferent as to who is selling what so that the two equilibria are strictly equivalent from a European consumer Welfare viewpoint The only difference comes from the fact that the high quality firm makes higher profits. Therefore, whenever the foreign firm is the high quality firm, domestic Welfare is lower because more profits go "abroad". We note then that the anti-dumping policy precisely selects as the unique possible equilibrium, the equilibrium which sees the foreign producer as the quality leader. It follows that the expected domestic Welfare must be lower in the presence of antidumping.

The protection offered to the domestic firm by a price-undertaking applies only at the price competition stage. But the relaxation of price competition has long run implications. As a result of the price-undertaking, the foreign firm cannot survive with a lower quality. The only way out is to be more aggressive at the quality stage. The price-undertaking allows the foreign firm to credibly *commit* to the best available quality, against any possible quality chosen by the domestic firm.

This result can be compared to Boccard and Wauthy (1998) where it is shown that a quota on foreign imports, which relaxes price competition in the last stage also results in more aggressive behaviour in the quality stage by one of the firms. But in the case of a quota, it is the domestic firm that behaves more aggressively which leads to a Welfare increase for the domestic country.

Proposition 1 is also reminiscent of some results obtained in the literature on Leapfrogging, as surveyed for instance by Herguera and Lutz [1997]. This literature essentially focuses on the conditions under which a domestic government can induce leapfrogging by the *domestic* firm in equilibrium through an adequate choice of policy instruments (subsidies, tariffs, quota, or minimum quality standards). In our paper, "perverse"leapfrogging occurs as a result of AD policy , turning a low quality foreign firm into a high quality one. Note however that in our paper, leapfrogging is an *undesirable side-effect* of the anti-dumping policy whereas domestic leapfrogging is the objective pursued by govenrments in Herguera and Lutz [1997]. In fact,we have shown that the price-undertaking leaves no other choice for the foreign firm than to leapfrog

the European one.

3   Comments

We would like to argue now that the qualitative implication of proposition 1 holds true under more general settings, that is, this kind of anti-dumping policy is very likely to be Welfare decreasing once its impact on quality choice is fully taken into account.

Consider first the case where the definition of "similar" product does not cover the whole quality spectrum. This amounts to assume that $\Delta < 1$. As previously, the free trade equilibrium involving a high quality foreign product is not affected. As for the alternative quality configuration, two cases are possible. First, for $\Delta < 3/7$, the free trade equilibrium involving $(s^D = 1, s^F = 4/7)$ is not affected either. To see this, consider the following: by choosing a quality level $s^F = 4/7$, the foreign firm is in no danger of alledly "injuring" the domestic industry because products are sufficiently different in quality, i.e. they are not considered as similar ones. Domestic Welfare is therefore not affected in this case.

Second, for $\Delta \in]3/7, 1[$, the free trade equilibrium whereby the foreign firm sells the lower quality would induce a price-undertaking, since products would be viewed as similar. However, in this case, the foreign firm cannot credibly commit to the best available quality against *any* domestic quality choice. In particular, against a high s^D, the best response in quality by the foreign firm consists in choosing a quality level that lies "just below" the limit of what is considered to be "similar" by the Commission ($s^F = 1 - \Delta$). We therefore obtain a second SPE exhibiting ($s^D = 1, s^F = 1 - \Delta$). It can then be shown that the corresponding domestic Welfare is a decreasing function of Δ. This suggests that the European government would gain from adopting a restrictive view of "similarity". Or in other words, the European government would be better off by exempting vertically differentiated goods from antidumping policies.

Another limitation of our approach is that we have confined the analysis to the case of price competition. In this respect, it is important to note that, under our zero cost for quality assumption, no product differentiation would prevail under Cournot competition and free trade. It is indeed easy to show that the unique SPE of a two-stage game with quality choice followed by

quantity competition involves both firms choosing the best available quality.[9] In this case, the A-D legislation would not apply. Cournot competition yields product differentiation in equilibrium only if the cost for quality is strictly positive. If this cost is the same for both firms, there will exists two symmetric SPE exhibiting product differentiation. Again, a price-undertaking will affect quality choice only in the case where the foreigner sells the low quality product. Since the price-undertaking means that prices have to be equal, it will again be true that the foreign firms end up with zero demand. We are then lead to conclude that, as under price competition, the incentive to adopt a low quality profile is drastically weakened for the foreign firm. In the same vein, it is now easy to see that the presence of positive cost, in particular for quality, will preserve the qualitative nature of our results. Indeed, the main driving force in our model is that, because of the antidumping legislation, the foreign firm is systematically "at risk" when choosing a lower quality. As a consequence, to choose a lower quality cannot be a valid equilibrium strategy for the foreigner, irrespective of costs.[10]

Sofar, we have conducted the analysis assuming that the governement will impose a price-undertaking. However, EU antidumping policy can also involve an antidumping duty on foreign imorts. In principle, the purpose of the duty is the same as that of a price-undertaking, namely to eliminate the injury as measured by the extent of price undercutting in the absence of measures.[11] A duty thus results into identical market prices, leaving a low quality firm with zero demand. Qualitatively, quality incentives are then equivalent to those prevailing with the price undertaking.

4   Conclusion

The purpose of this paper was twofold. First, we showed how price competition between a domestic and a foreign firm selling vertically differentiated goods on the European market is affected by European antidumping protection. We focused on the effects of price-undertakings

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[9]See for instance Eaton and Harrald (1992) for a proof of this result.

[10]Note however that the presence of costs differentials could result into the eviction of the foreign producer in equilibrium. But again this is likely to be Welfare decreasing because of the resulting monopoly outcome

[11]Absorption of the duty by the foreign firm is outruled by law. To put it differently, when the foreign firm does not fully pass through the duty to consumers, it will be subject to an additional penalty.

on foreign imports. Second, we analyzed the long term effects of such trade policies on the qualities offered by the firms in the European market. Our findings suggest that when accounting for the effect on firm's quality choices in the long-run, whenever the antidumping policy affects the free trade outcome, it leads to an overall Welfare loss. The intuition for our result is easily summarized. While a price-undertaking protects the domestic firm in the short run by relaxing price competition, it allows the foreign firm to credibly commit to a high quality in the first stage of the game (precisely to avoid the price-undertaking in the second stage). The best reply of the domestic firm is then to produce the low quality variant. This is likely to be damaging for the Domestic Welfare because it increases profit diversion.

A   Appendix: Price Competition under vertical differentiation

Consider a two-stage game with quality choice in the first stage. In the second stage, two firms sell indivisible goods differentiated by their quality index, respectively denoted by s^h and s^l with $s^h > s^l$. Consumers in the market buy at most one unit of the good and exhibit heterogeneous preferences. More precisely, they are identified by their "taste for quality", x, which is uniformly distributed in the interval $[0, 1]$. The net utility of consuming good $i = \{h, l\}$ for a consumer with taste x is defined by the following equation:

$$u^i = x.s^i - p^i \qquad (A.1)$$

where p^i is the unit price of good i. The default utility of no-consumption is assumed to be zero. We assume that firms choose qualities at zero cost. The range of possible qualities is exogenously bounded between zero and 1, i.e. $s^i \in [0, 1]$.

We develop the construction of firms' best replies in the pricing game because they provide a very useful benchmark for the analysis of antidumping policies.

Observe first that for $i \in \{l, h\}$, the consumer located at $x^i = p^i/s^i$ enjoys zero utility, hence, every consumer with taste $x > x^i$ is willing to buy product i at price p^i. Potential markets are thus respectively $[x^l, 1]$ and $[x^h, 1]$. The second step is to identify the marginal consumer $\tilde{x}$ who is indifferent between the two products h and l. Solving for $\tilde{x}s^l - p^l = \tilde{x}s^h - p^h$, we obtain $\tilde{x}(p^l, p^h) = \frac{p^h - p^l}{s^h - s^l}$. Obviously, any consumer $x > \tilde{x}$ prefers h to l whereas the contrary prevails for $x < \tilde{x}$. Observing that quality levels can be re-scaled, we may set $s^h = 1$ so that demands are given by $(A.2)$ and $(A.3)$

$$D^l(p^l, p^h) = \begin{cases} \tilde{x} - x^l & \text{if } p^l \leq p^h s^l \\ 0 & \text{if } p^l > p^h s^l \end{cases} \qquad (A.2)$$

$$D^h(p^l, p^h) = \begin{cases} 1 - \tilde{x} & \text{if } p^l \leq p^h s^l \\ 1 - x^h & \text{if } p^l > p^h s^l \end{cases} \qquad (A.3)$$

The particular shape of demands reflects the fact that in vertically differentiated industries, the high quality firm may exclude the low quality one from the market. The latter, in order to enjoy a positive market share must quote a price p^l significantly lower than p^h to compensate

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for a lower quality ($p^l < p^h s^l$). Note also that since $x \in [0,1]$, the market cannot be covered in equillibrium, expect perhaps for the case where $s^l = 0$.

The profit of the low quality firm is given by equation $(A.4)$

$$\pi^l(p^l, p^h) = p^l \left(\frac{p^h s^l - p^l s^h}{s^l(1 - s^l)} \right) \qquad (A.4)$$

The solution to $\frac{\partial \pi^l}{\partial p^l} = 0$ is $\psi^l(p^h) = \frac{p^h s^l}{2}$. Since $\psi^l(.)$ always lies strictly in the region where firm l enjoys a positive market share, the low quality firm best reply is fully described by ϕ^l.

As for the high quality firm, two regions are of interest. The monopoly region and the duopoly one. In the monopoly region ($p^l > p^h s^l$), the best reply is the monopoly price $1/2$ which is feasible if and only if $p^l > s^l/2$. Otherwise, π^h is strictly increasing in the monopoly region and we always reach the duopoly one,where the profit is given by equation $(A.5)$

$$\pi^l(p^l, p^h) = p^l \left(1 - \frac{p^h - p^l}{1 - s^l} \right) \qquad (A.5)$$

The solution to $\frac{\partial \pi^h}{\partial p^h} = 0$ is $\psi^h(p^l) = \frac{p^l + 1 - s^l}{2}$ and is feasible whenever $\psi^h(.) \le p^l/s^l \iff p^l \le \frac{s^l(1-s^l)}{2-s^l}$. Otherwise, $\pi^h(., p^l)$ is strictly increasing in the duopoly region and the frontier price p^l/s^l is optimal. Since we have $\frac{s^l(1-s^l)}{2-s^l} < \frac{s^l}{2}$, the best reply of firm h is

$$\phi^h(p^l, p^h) = \begin{cases} \psi^h(p^l) & \text{if } p^l \le \frac{s^l(1-s^l)}{2-s^l} \\ \frac{p^l}{s^l} & \text{if } \frac{s^l(1-s^l)}{2-s^l} \le p^l \le \frac{s^l}{2} \\ 1/2 & \text{if } p^l \ge \frac{s^l}{2} \end{cases} \qquad (A.6)$$

Figure 1 depicts a standard configuration for free trade best replies, where ϕ^h is drawn in plain bold and ϕ^l in bold dashed. As one can see on figure 1, the free trade equilibrium is given by the intersection of ψ^h and ψ^l, i.e. in the region where both firms enjoy a positive market share, which in turn requires that the low quality firm names a price that is strictly lower the the high quality one.
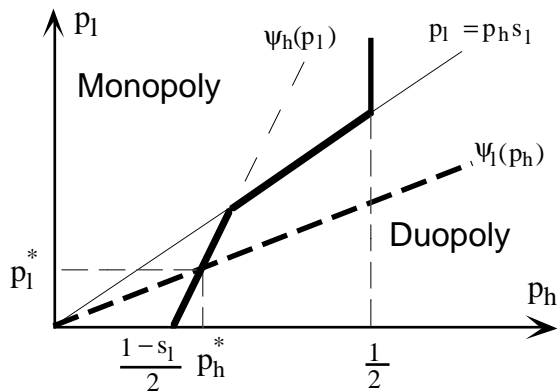
Figure 1

Using equations $(A.4)$ and $(A.6)$, it is a matter of computations to show that the unique Nash equilibrium is defined by equations $(A.7)$ and $(A.8)$

$$p^{l*} = \frac{s^l(1 - s^l)}{4 - s^l} \tag{A.7}$$

$$p^{h*} = \frac{2(1 - s^l)}{4 - s^l} \tag{A.8}$$

Plugging these prices into $(A.3)$ and $(A.5)$, we obtain the reduced forms for payoffs at the quality stage as a function of the products' quality ranking. Straightforward computations then establish Lemma 1.

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