Counterfeiting and consumption externalities –

a closer look

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Abstract

Counterfeiting of trademarked products is an increasing problem in national and international trade. We contribute to the analysis of how counterfeiting affects markets by extending the work of Grossman and Shapiro (1988a) on consumption externalities in prestige good markets. We model a general aversion towards large levels of output (denoted \textit{prestige externalities}) interacting with a firm-specific aversion towards the presence of copies in particular (\textit{pirate externalities}). The framework is used to examine several policy-relevant questions. First, we examine how market prices depend on these externalities and provide conditions for counterfeiting as an equilibrium outcome. Second, we compare market outcomes to outcomes in otherwise identical markets that are not subject to prestige externalities. Third, we describe how the substitutability between copies and originals are related to prestige- and pirate externalities respectively. Fourth, we compare market prices to prices chosen by a benevolent social planner. Finally, we re-visit some policy issues previously discussed in the literature.

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1. Introduction

The development of institutions for protecting investments in innovations and product quality, like trademarks and patents, has taken place gradually and alongside with industrialization. The world-wide coverage of such protection has consequently increased, as shown for example by the harmonization expressed in the TRIPS agreement (see Moy, 1992-93). However, the efforts to make infringements on intellectual property more difficult to market are counteracted by new technology in both production and distribution of counterfeit products. The result is that counterfeiting appears increasingly common, and affecting a broader range of goods. A recent OECD report (OECD, 2008) estimates the volume of international trade in counterfeit and pirated products to as much as USD 200 billion per year, and suggests that adding the value of products distributed domestically and via the Internet might as much as double the estimate. However, in spite of its practical importance counterfeiting has not received much attention within economics, and economic analysis has yet to provide guidance to policy-makers in the area.

1In earlier times, manufacturers’ efforts to make imitation of their products more difficult could include complicated patterns or other distinctive characteristics. See Richardson (2008).
2As is made clear in the report the estimates are by no means precise, and the illegality of counterfeiting makes it impossible to estimate its prevalence with any precision.
This paper studies non-deceptive counterfeiting in markets for prestige goods.\footnote{We focus on prestige goods but the analysis extends to the case without consumption externalities and thus applies to all non-deceptive, or secondary markets, counterfeiting.} We present a model that is used to analyze the effects of counterfeiting on the competitive situation in the market. We examine the effects of different policy measures and evaluate them in welfare terms. Demand effects of counterfeiting are modeled as a consumption externality which reduces the value of the good when more people purchase units of the good — legitimate or counterfeit. Our main purpose is to develop a tool to improve understanding of the market mechanisms in markets for prestige goods where there is also counterfeiting. Our policy suggestions are somewhat tentative since by its very nature counterfeiting is difficult to discover and has shown itself to be resistant to policy measures.

A counterfeit product is an imitation made with an intention to deceive or defraud. The economic effects of counterfeiting occur through its effects on market prices as well as on consumer surplus, and the size and distribution of these effects will depend on the extent of deception and on who is deceived or defrauded. Three main cases can be identified:

1. The buyer of the product is deceived about some, in many cases vital, product characteristics. A clear example is counterfeited drugs where the user of
the goods is given the false impression that the sold good is identical with the legitimate good. This is obviously problematic from a welfare point of view, and very serious examples include when a drug without medical effect, or with harmful effect, is sold as the real product.4

2. A second case is when recorded music or film is copied illegally, and the copies are sold or distributed free of charge. In such situations most customers are not fooled, and consumer surplus is likely to increase in the short run. However, negative welfare effects due to reduced investment incentives may be expected in the long run.

3. With some counterfeit goods it is people around the consumer, rather than the consumer herself, who are deceived. An example is a fake product purchased by someone who realizes that it is too cheap to be authentic, and perhaps that it is sold through channels that a legitimate distributor would not use. However, the consumer’s friends and acquaintances, who do not observe either price or place of purchase, think that the good is legitimate and are thus deceived. This third situation fits with prestige or status products, where showing the brand name is part of the consumption appeal.5

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4The OECD (2008) report describes this type of counterfeiting as deceptive infringement, and define the products as sold in the primary market.

5In the OECD (2008) terminology both of the two latter forms of counterfeiting are non-
The third type of counterfeiting is in some ways the most complicated but also the most interesting for economic analysis. Here, even the static effects on competition and welfare are far from straightforward. If direct consumers are not fooled, counterfeiting makes the prestige associated with consuming certain goods available to a wider group of consumers which increases welfare for this group. On the other hand, the existence of a counterfeited alternative may reduce welfare for buyers of the original good as well as of copies, since the status signal is weakened by the counterfeit market. There may also be effects via the competitive structure, since some consumers might be prepared to switch between the original and the counterfeited product, and the producer of the original good may adjust its price in face of the new (albeit illicit) competitor.

The US Government Accountability Office (2010) notes explicitly the ambiguous welfare effects of non-deceptive counterfeiting. The report also emphasizes the need to investigate factors that seem to be crucial to the effects of the counterfeit market, like consumers' willingness to substitute between the legitimate and the counterfeit good.

Economic analysis of prestige goods goes back at least to Veblen (1899) who coined the term *conspicuous consumption*. Veblen’s ideas were formalized by *deceptive infringements*, and the goods are sold in *secondary markets.*
Leibenstein (1950) who suggested a demand structure that has inspired much of the later work in the area, including ours. However, the literature on counterfeiting is small and it is probably fair to say that the standard references are still Grossman and Shapiro (1988a) and Grossman and Shapiro (1988b). The latter study falls into category 1) above as it studies policies for increasing welfare in markets where counterfeiting is deceptive. Our study is quite close in spirit to Grossman and Shapiro (1988a), which examines counterfeiting goods trade.

Grossman and Shapiro (1988a) models a domestic oligopoly market for prestigious brand name goods that are perfect substitutes. The oligopolists face a fringe of perfectly competitive foreign producers of counterfeits. Consumers are heterogeneous in income, and the willingness to pay for quality is assumed to increase in income. The willingness to pay for both originals and for counterfeits is assumed to depend negatively on the total level of output, counterfeits included. The idea is that the prestige value of wearing for example a Rolex watch is likely to be reduced when a lot of other consumers wear Rolex-like watches. If the willingness to pay for the original goes down, it also becomes less attractive to buy the copy.

The focus of the paper is on how trade policies can be used to increase welfare

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6 Two other references are Yao (2005), who studies counterfeiting and investment incentives in absence of so called “snob effects”, and Higgins and Rubin (1986), who study private versus public enforcement in a model with “snob” or prestige externalities.
when these kinds of externalities are present.

Our analysis differs from that of Grossman and Shapiro (1988a) in three main respects. First, it contains a more explicit and in certain ways richer characterization of the consumption externalities that may arise from counterfeiting. As in Grossman and Shapiro (1988a), consumer utility is lower the higher the total level of output, including copies. This we call *prestige externalities*. In addition, we take into account that the production of more counterfeits may dilute the consumption value of the prestigious good to a greater extent than an equally large output expansion of originals. It may also be the case that consumers of counterfeits care less (or more) about the number of counterfeit products around than do consumers of originals. In our terminology, we allow for firm-specific *pirate externalities*. As it turns out, these distinctions prove important in determining market outcomes. Second, our modeling choice allows for strategic interaction between a firm producing or importing counterfeits and a producer of an original prestigious product. Third, we consider price competition instead of quantity competition.

We address five broad issues. First, we examine how market prices depend on prestige- and pirate externalities and provide conditions for counterfeiting as an equilibrium outcome. Not surprisingly, the price of originals is always higher than the price of copies. If buyers of originals are subject to strong pirate externalities,
i.e., if they care a lot about the number of copies sold, market prices will be low. Strong pirate externalities among buyers of copies will have the reverse effect. Strong prestige externalities always imply low market prices. Concerning existence of equilibria, the firm producing originals will always be present in the market. As long as the prestige externality is weak this is true also for the counterfeiting firm. However, when prestige externalities are strong, the counterfeiting firm can only co-exist profitably with the producer of originals if pirate externalities are smaller for buyers of originals than for buyers of copies. When prestige externalities are very large, no parameter values exist that will allow the counterfeiting firm a positive market share.

Second, we compare market outcomes to outcomes in otherwise identical markets that are not subject to prestige externalities. Stronger prestige externalities reduce prices, quantities and profits for both firms. As a consequence, prices, quantities and profits are lower in prestige markets than in identical markets that are not subject to prestige externalities.

Third, we describe how the substitutability between copies and originals is related to prestige- and pirate externalities respectively. Measuring substitutability as the market share of copies, we find that stronger prestige externalities will reduce substitutability, as will a general increase in the level of pirate externalities.
Fourth, we compare market prices to prices chosen by a benevolent social planner. The market price of copies turns out always to be too low from a welfare perspective. When the prestige externality is strong, and the pirate firm produces a relatively high quality, this is true also for the market price of originals.

Finally, we re-visit some issues previously discussed in the literature. In terms of the government policies suggested by Grossman and Shapiro (1988a) we reach the following conclusions. There seem to be important strategic welfare gains by allowing some amount of counterfeiting (i.e., competition), but the government would typically want to keep counterfeiting at a low level, at least when enforcement is costless and prestige externalities pronounced.

The paper is structured as follows. In section 2 the basic model is presented. Section 3 provides conditions for existence of equilibria, comparative statics results and a welfare analysis. The paper concludes with some final remarks.

2. The model

We model the market for a counterfeited good as an oligopoly market with vertical product differentiation, using an extended version of the model in Motta (1993). There are two firms; firm $H$ produces a (high-quality) original product while firm $L$ produces a (lower-quality) counterfeit. The utility of an individual with income
V is given by

\[ U_H = V S_H - \alpha (Q_H + z_H Q_L) - P_H \]  \hspace{1cm} (2.1) \]

when buying from firm H and

\[ U_L = V S_L - \alpha (Q_H + z_L Q_L) - P_L. \]  \hspace{1cm} (2.2) \]

when buying from firm L. Quality, in the absence of externalities, is measured by \( S_i, i = L, H \) and \( S_H > S_L \). Following Grossman and Shapiro (1988a) we treat qualities as exogenously determined entities.\(^7\) The multiplicative structure of the terms \( V S_H \) and \( V S_L \) implies that people with higher incomes also have higher marginal valuations of product quality.

The term \( \alpha (Q_H + z_i Q_L), i = L, H \), which is an addition to Motta (1993), captures two types of consumption externalities. Prestige externalities, measured by \( \alpha \), are present when consumers care about the total number of items sold, copies and originals taken together. Basically, the more watches sold that look like Rolexes, the less prestigious it will be to own one. Hence, consumers care about the sum of the outputs of firms \( H \) and \( L, Q_H + Q_L \). Pirate externalities,\(^7\) Even when products are identical it is conceivable that consumers put a higher value on owning the original product.
captured by the variable $z_i \geq 1$, arise when consumers dislike the presence of copies more than that of originals. The idea is that an expansion of the production of copies hurts the brand-name more than an expansion of the production of original products. Pirate externalities imply that the composition of output may play a role of its own. In addition, consumers buying copies might be affected by pirate externalities to a lesser (or greater) extent than those buying originals. Hence, we allow for $z_H \neq z_L$.\(^8\) Note that the functional form implies an interaction between $\alpha$ and $z_i$. The motivation is that consumers are likely to care more about pirate externalities the more they care about prestige. In the extreme case, when consumers do not care about prestige at all, they should not care about pirate externalities either.

To sum up, consumer valuation of both copies and originals are affected negatively by prestige externalities. The impact of these externalities are measured by the parameter $\alpha$ which, for simplicity, is taken to be the same for both consumer groups. The valuation of both copies and originals are affected in particular by the number of copies sold. These pirate externalities are measured by $z_i \geq 1$. Finally, as in Motta (1993), prices, $P_i$, enter additively. Thus, utility is measured

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\(^8\)There is no obvious way of linking the magnitude of these externalities to income so we simply make an independency assumption. For example, a relatively poor consumer who buys an original may very well be more concerned over counterfeits than a rich consumer who perhaps socializes exclusively with people who would not dream of buying a copy.
in monetary units.

To find tractable expressions for equilibrium prices and quantities, we let income be uniformly distributed on the interval zero to one. This also means that the number of potential consumers is equal to one. Then, given the structure of utility functions, people with income close to zero will always choose not to consume at all. Consumers in the mid-income range will buy copies, while those with high incomes will buy the original product. The lower cut-off level of income, $V_1$, between non-buyers and buyers of the counterfeit good is

$$V_1 = \frac{\alpha(Q_H + z_L Q_L) + P_L}{S_L} \quad (2.3)$$

while the upper cut-off level, $V_2$, between buyers of counterfeits and buyers of the original good, is given by

$$V_2 = \frac{\alpha Q_L(z_H - z_L) + P_H - P_L}{S_H - S_L}. \quad (2.4)$$

Noting that $Q_H = 1 - V_2$ and $Q_L = V_2 - V_1$ it is straightforward to derive inverse demand functions.
\[ Q_H = \frac{\alpha(z_H(S_L - P_L) - z_L(S_H - P_H)) - S_L(S_H + P_L - P_H - S_L)}{\alpha^2(z_H - z_L) + \alpha(z_H S_L - z_L S_H) - S_L(S_H - S_L)} \]  \hspace{1cm} (2.5)

\[ Q_L = \frac{\alpha(S_H + P_L - P_H - S_L) - P_H S_L + P_L S_H}{\alpha^2(z_H - z_L) + \alpha(z_H S_L - z_L S_H) - S_L(S_H - S_L)}. \]  \hspace{1cm} (2.6)

Firms compete in prices using zero marginal cost technologies. Profit maximization yields the following reaction functions.

\[ P_H(P_L) = \frac{S_L(S_H - S_L) - \alpha(z_H S_L - z_L S_H)}{2(\alpha z_L + S_L)} + \frac{\alpha z_H + S_L}{2(\alpha z_L + S_L)} P_L \]  \hspace{1cm} (2.7)

\[ P_L(P_H) = -\frac{\alpha(S_H - S_L)}{2(\alpha + S_H)} + \frac{\alpha + S_L}{2(\alpha + S_H)} P_H. \]  \hspace{1cm} (2.8)

From these reaction functions we may draw the conclusion that pirate externalities do not affect strategic considerations of the counterfeit firm. These externalities do affect demand and profits but enter the profit function in a multiplicative way. Typical reaction functions are depicted in Figure 1. The fundamental dif-

\footnote{In other words, the costs associated with building a strong brand name are assumed to be mainly fixed.}
ference in comparison to Grossman and Shapiro (1988a) is that they treat $P_L$ as a constant given by marginal cost, which in turn, would imply a vertical reaction function.
3. Results

3.1. Existence of equilibria

The next step is to provide necessary and sufficient conditions for an interior solution equilibrium, i.e., a situation where both firms choose positive output levels. It turns out that for such an equilibrium to exist, $z_H$ cannot be too large relative to $z_L$. For higher levels of $z_H$ relative to $z_L$, the pirate externalities are such that the counterfeit good is crowded out by the original good, and thus only the high-quality producer remains active in the market.

**Proposition 1.** There is an unique threshold level $z^*_H(z_L)$ such that an interior solution equilibrium exists if and only if $z_H < z^*_H(z_L)$. $z_H > z^*_H(z_L)$ leads to a natural monopoly equilibrium where only the high-quality producer is present in the market.

**Proof.** Inserting equilibrium prices into expression (2.6) it follows that $Q_L > 0$ if and only if

$$z_H < \frac{S_H S_L - \alpha (S_H - 2S_L)}{S_L (\alpha + S_L)} z_L - \frac{(\alpha - S_L) (S_H - S_L)}{\alpha (\alpha + S_L)} \equiv z^*_H(z_L).$$
Given that this restriction holds, it can easily be demonstrated that reaction functions intersect at positive prices, that total demand is smaller than the potential market of size one, and that $Q_H > 0$.\footnote{Since, $z_H^*(z_L)$ depends on quality levels ($S_H$ and $S_L$) this opens up the possibility that firm $H$ may have strategic reasons to choose quality in order to exclude competitors. However, as mentioned above, we follow Grossman and Shapiro (1988a) and treat qualities as exogenous variables.}

The intuition for Proposition (1) is the following. An increase in $z_H$ has two effects. First, it reduces consumers’ valuation of product $H$ at given prices and quantities. Second, it strengthens firm $H$’s incentive to reduce firm $L$’s market share in order to mitigate the pirate externality. Both these effects suggest that firm $H$ will cut its price, thereby trying to attract demand away from firm $L$. An increase in $z_L$ has the opposite effect. By lowering the valuation of product $L$, it reduces firm $H$’s elasticity of demand at given prices and quantities. It also has a direct negative effect on $Q_L$ which increases the willingness to pay for good $H$ through a reduction of the pirate externality. Both these effects give firm $H$ an incentive to raise its price, thereby reducing the competitive pressure facing firm $L$. Hence, in order for firm $L$ to survive in the market, $z_H$ cannot be too large in relation to $z_L$. 


We will henceforth make the assumption that $z_H < z_H^*(z_L)$ so that both firms produce positive levels of output. Moreover, it will be assumed that the degree of vertical product differentiation is large enough, specifically, that $S_L < 4S_H/7$. The reason is that in the absence of prestige externalities ($\alpha = 0$), $\pi_L$ increases in $S_L$ only for $S_L < 4S_H/7$. Assuming $S_L > 4S_H/7$ would not make sense, since then firm $L$ could have chosen a lower level of quality, thus possibly saving costs, and at the same time increasing revenues.\(^{11}\)

**Assumption 1:** $z_H < z_H^*(z_L)$

**Assumption 2:** $S_L < 4S_H/7$

As long as the prestige externality, $\alpha$, is weak, Assumption 1 is not very restrictive. Also the symmetric case where $z_H = z_L$ (and even $z_H > z_L$) is then compatible with an interior solution equilibrium.

**Proposition 2.** If the prestige externality $\alpha$ is weak in the sense that $\alpha < S_L$, $z_H = z_L$ is compatible with an interior solution equilibrium and so is $z_H > z_L$.

\(^{11}\)It can be shown that the introduction of prestige externalities allows firm $L$ to profitably reduce product differentiation further than what is implied by Assumption 2. Hence, Assumption 2 is a sufficient condition for $\pi_L$ being increasing in $S_L$ for all $\alpha \geq 0$. Basically, a reduction in the degree of product differentiation will tend to reduce prices. When there are prestige externalities, firms partly internalize the negative consumption externalities associated with output expansions. This means that the downward pressure on price will not be as pronounced.
Proof. When \( \alpha < S_L \) it can be shown that i) \( z_L < z_H^*(z_L) \). Hence, for all \( z_L > 1 \) there exists an interval \( z_H \in [1, z_H^*(z_L)] \) which includes \( z_L \) that is compatible with an interior solution equilibrium. ■

The stronger the prestige externality, the larger must the difference between \( z_H \) and \( z_L \) be for positive production of both goods.

**Proposition 3.** If the prestige externality \( \alpha \) is strong in the sense that \( \alpha > S_L \), \( z_H < z_L \) is a necessary condition for an interior solution equilibrium to exist.

Proof. If \( \alpha > S_L \) it follows that \( z_L > z_H^*(z_L) \). ■

When prestige externalities are very large, and firm \( H \) has a large quality advantage, it is impossible for firm \( L \) to coexist with firm \( H \).

**Proposition 4.** When the prestige externality is substantial and quality differences large, there are no parameter values that sustain an interior solution equilibrium. Instead, a natural monopoly will emerge with only the high-quality firm being present in the market.

Proof. When \( z_H^*(z_L) < 1 \), no \( z_H > 1 \) exists that is compatible with \( Q_L > 0 \). Necessary and sufficient conditions for \( z_H^*(z_L) < 1 \) are i) \( \alpha > \frac{S_H S_L}{S_H - 2 S_L} \) and ii) \( S_H > 2 S_L \). ■
3.2. Comparative statics

Given Assumption 1, reaction functions will be of the kind depicted in Figure 1. Hence, firm $H$ will always charge a higher price than firm $L$. As discussed above, an increase in $z_H$ makes firm $H$ more aggressive, reducing equilibrium prices for both firms, while an increase in $z_L$ has the opposite effect. The results on the relationship between prices and pirate externalities are summarized in Proposition (5).

**Proposition 5.** It will always be the case that $P_H^* > P_L^*$. An increase in $z_H$ intensifies competition in the sense that it reduces both prices. An increase in $z_L$ has the opposite effect. The price differential is decreasing in $z_H$ and increasing in $z_L$. A proportionate increase in $z_H$ and $z_L$ reduces prices and the price differential if $z_H > z_L$. For $z_H < z_L$ the effect is the opposite.

**Proof.** The intercept of $P_H(P_L)$ is larger than the intercept of $(P_L(P_H))^{-1}$ for $z_H < z_H^*(z_L)$. Moreover, $(P_L(P_H))^{-1}$ is steeper than $P_H(P_L)$ and has a slope which is greater than one. Hence, in terms of equilibrium prices, $P_H^* > P_L^*$. Only $P_H(P_L)$ is affected by changes in $z_H$ and $z_L$. Since $\frac{\partial P_H(P_L)}{\partial z_H} < 0$ it follows that both prices are reduced as $z_H$ increases. It also follows that the price differential is reduced. An increase in $z_L$ has the reverse effects as $\frac{\partial P_H(P_L)}{\partial z_L} > 0$. Finally, it can easily be
checked that a proportionate increase in \( z_H \) and \( z_L \) puts a downward (upward) pressure on \( P_H(P_L) \) if \( z_H > z_L \) \((z_H < z_L)\). ■

Although the effects of pirate externalities on prices are relatively easy to analyze in a general setting, the effects on quantities and profits become quite intricate. From now on we therefore confine the analysis to the case of symmetric pirate externalities, i.e., \( z_H = z_L = z \). By Assumption 1 it then also follows that \( \alpha \in [0, S_L] \).

**Proposition 6.** With symmetric pirate externalities, \( z_H = z_L = z \), the effects on quantities and profits from small increases in \( z_i \), given a symmetric point of departure, are the following. An increase in \( z_H \) reduces profits for both firms. \( Q_H \) increases while \( Q_L \) increases (decreases) if the prestige externality, \( \alpha \), is weak (strong). An increase in \( z_L \) benefits firm \( H \) in the sense that it raises profits although \( Q_H \) goes down. For firm \( L \), \( Q_L \) and \( \pi_L \) increases (decreases) if the prestige externality \( \alpha \) is strong (weak).

**Proof.** See the Appendix. ■

As pointed out above, an increase in \( z_H \) reduces prices which in turn affects profits negatively for both firms. Firm \( H \) expands output in order to reduce firm \( L \)'s market share. If the prestige externality is small \( Q_L \) will nonetheless increase.
The reason is that the reduction in equilibrium prices enables firm $L$ to attract new low-income consumers whose utilities are not greatly affected by the expansion in $Q_H$ given that $\alpha$ is small. An increase in $z_L$ on the other hand reduces the price elasticity facing firm $H$, enabling it to increase profits by raising its price, thereby reducing the quantity produced. When $\alpha$ is large, this reduction in $Q_H$ will have a large impact on the perceived quality offered by firm $L$. This makes it possible for firm $L$ to increase its quantity and level of profits simultaneously.

Next, we compare market outcomes to outcomes in otherwise identical markets that are not subject to prestige externalities.

**Proposition 7.** With symmetric pirate externalities, $z_H = z_L = z$, an increase in $\alpha$ reduces prices, quantities and profits for both firms. As a consequence, prices, quantities and profits are lower in prestige markets ($\alpha > 0$) than in identical markets without prestige externalities ($\alpha = 0$).

**Proof.** The results follow directly from differentiation. □

Introducing prestige externalities has two effects. First, it reduces the overall willingness to pay for both products. Second, it introduces an incentive to reduce output in order to mitigate the externality problem. Ceteris paribus, the second effect would tend to increase profits. Obviously, the first effect dominates in our
model.

As mentioned above, The US Government Accountability Office (2010) emphasizes the need to investigate factors determining consumers’ willingness to substitute between the legitimate and the counterfeit good. Since prestige- and pirate externalities affect overall willingness to pay, as well as e.g., own-price and cross-price elasticities, it seems reasonable to measure substitutability in terms of a relative measure. We will use firm $L$’s market share as a proxy for substitutability. Basically, the larger firm $L$’s market share, the closer substitutes are products in a vertical sense.

**Proposition 8.** With symmetric pirate externalities, $z_H = z_L = z$, firm $L$’s market share decreases as $\alpha$ gets larger. An increase in $z_H$ always reduces firm $L$’s market share. Given symmetric pirate externalities as a point of departure, an small increase in $z_L$ reduces (increases) firm $L$’s market share when $\alpha$ is small (large). Finally, the overall effect of an increase in $z_H = z_L = z$ is a reduction of firm $L$’s market share.

**Proof.** See the Appendix. ■

We may conclude that both prestige externalities and pirate externalities have the effect of reducing the market share of the counterfeiting firm. Essentially,
since the pirate firm has a quality disadvantage to begin with, it is relatively more sensitive to reinforced consumption externalities. The only exception is that $z_L$ has a positive impact on the market share when $\alpha$ is large. Recall that firm $H$ will increase its price and reduce its production in response to an increase in $z_L$. When prestige externalities are strong this reduction in $Q_H$ makes the counterfeit product considerably more appealing which, in turn, translates into an increase in $Q_L$.

The main conclusion from Proposition (8) is that prestige- and pirate externalities tend to protect the market share of the producer of originals. From an empirical point of view, this observation does seem to make sense. In markets belonging to category 2) above, e.g., markets for music, films and software, counterfeits seem to be a potentially greater problem, compared to markets for prestigious luxury goods.\(^{12}\)

### 3.3. Welfare and policy

The framework introduced above makes it possible to examine various aspects of the welfare effects of counterfeiting. For example, will the competitive pressure

\[^{12}\text{It is true that a lot of the counterfeit material distributed through the internet is in fact free of charge. As it turns out, however, the results in Proposition (8) are still valid under the assumption of a competitive fringe delivering the counterfeit good at price equal to marginal cost, which is zero by assumption.}\]
be too strong or too lax in the counterfeiting equilibrium? The answer to this question is not obvious since there are opposing forces at work. On the one hand, the fact that firms in an oligopoly market have market power suggests that prices will be too high from a social perspective. On the other hand, since the market is also characterized by consumption externalities that are not fully internalized by firms, market prices might instead be too low.

To investigate whether market prices are too high or too low we first calculate socially optimal prices. Here, we assume like Grossman and Shapiro (1988a) that the social planner maximizes the unweighted sum of consumer surplus, producer surplus and, if applicable, government revenues. We differ, however, in that we treat the low-quality producer as a domestic firm, possibly an importer. This is not an issue in their framework since foreign firms are assumed to be perfectly competitive. However, with imperfect competition the counterfeiting firm will also make a profit.

It is quite intuitive that a social planner would not choose to produce the pirate good. First, it is of lower quality and second it is associated with stronger externalities. It is straightforward to calculate the demand facing a high-quality monopolist, noting that $Q_H = 1 - V_1$ (where $V_1$ is equivalent to expression (2.3) with $Q_L = 0$ and subindex $L$ substituted for by $H$) and integrate consumer
utility over the interval \([V_1, 1]\). Maximizing the sum of profits and utility yields the following socially optimal price and quantity where subscript \(SO\) stands for socially optimal.\(^{13}\)

\[
P_{SO} = \frac{\alpha S_H}{2\alpha + S_H} \tag{3.1}
\]

\[
Q_{SO} = \frac{S_H}{2\alpha + S_H} \tag{3.2}
\]

Note that unless there are no prestige externalities, the socially optimal price is strictly above marginal cost, and the market is only partially covered, i.e., \(Q_{SO} < 1\). The oligopoly market equilibrium prices, given symmetry, are given by the following expressions.

\[
P^*_H = \frac{(\alpha + 2S_H)(S_H - S_L)}{3\alpha + 4S_H - S_L} \tag{3.3}
\]

\[
P^*_L = \frac{(S_L - \alpha)(S_H - S_L)}{3\alpha + 4S_H - S_L} \tag{3.4}
\]

**Proposition 9.** With symmetric pirate externalities, \(z_H = z_L = z\), the market

\(^{13}\)There is no aggregation problem here since utility is measured in monetary terms.
price of the low quality good is always too low from a welfare perspective. When
the prestige externality is strong, and the pirate firm produces a relatively high
good, this is true also for the market price of the high-quality good.

Proof. It is obvious that a social planner will not choose to produce the pirate
good. Hence, $P_L$ should be prohibitively high. This proves the first part of the
proposition. It is easy to verify that $S(P_{SO} - P^*_H) = S(\alpha(S_H + 2S_L) - 2S_H(S_H - S_L)) \equiv S(I)$ where the first term is positive and the last term negative. The
conditions for this sum to be positive are best illustrated graphically. $I > 0$ for
$\alpha > \frac{2S_H(S_H-S_L)}{S_H+2S_L}$. Additional parameter restrictions are $\alpha < S_L$ and $S_L < \frac{4}{7}S_H$
(Assumptions 1 and 2). In Figure 2, the dark grey area represents the set of
permissible parameters for which $P_{SO} > P^*_H$, while the light gray area permissible
values for which $P_{SO} < P^*_H$. ■

Not surprisingly, welfare-maximizing prices are higher the stronger the pres-
tige externality, and when the degree of vertical product differentiation is small,
competition drives market prices down.\footnote{Note that the result differs from Häckner and Nyberg (1996) who show that free market
prices are always too high in a model with congestion externalities and identical consumers.}

Next, we investigate the welfare effects of the government policies proposed
by Grossman and Shapiro (1988a). These are, 1) confiscation of a fraction of

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Graphical representation of permissible parameter values for different welfare effects.}
\end{figure}
Figure 2: Illustration to Proposition 9

Dark grey area: $P_{SO} > P_H^*$, Light grey area: $P_{SO} < P_H^*$

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imports and 2) a tariff on imported low-quality products. As in Grossman and Shapiro (1988a), we assume that confiscated goods are destroyed hence yielding no revenues to the government.

Introducing an import tariff on low-quality goods is conceivable in a scenario where fake trade-mark labels are added once products have been imported. It should be noted, however, that such a policy would have a negative impact on welfare also in markets for legitimate low-quality goods. These effects are not accounted for. As in Grossman and Shapiro (1988a) we also abstract from third part externalities arising from the possibility that people mistakenly believe that a fake product is genuine, as well as from possible envy effects. Finally, we do not take into account dynamic effects on the willingness to invest in product quality.

In contrast to Grossman and Shapiro (1988a), our welfare analysis includes both prestige externalities and pirate externalities. Moreover, it takes into account effects on firm $L$’s profits which is zero by definition in their model. While Grossman and Shapiro (1988a) provides few clear-cut policy conclusions, the structure imposed in our model allows us to study not only marginal welfare effects but the entire relationship between welfare and the intensity of enforcement.

Let us begin with the case of confiscation. Confiscating a fraction of imported low-quality goods will have the same effect as increasing firm $L$’s marginal cost.
of reaching an additional consumer. Let $c$ denote firm $L$’s marginal cost and let $\tau$ denote the level of marginal cost that drives $Q_L$ to zero in equilibrium. Hence, we want to evaluate welfare, $W$, for $c \in [0, \tau]$ where it is easy to verify that

$$\tau = \frac{(S_L - \alpha)(S_H - S_L)}{\alpha + 2S_H - S_L}.$$  \hspace{1cm} (3.5)

**Proposition 10.** With symmetric pirate externalities, $z_H = z_L = z$, welfare increases monotonically in the fraction of imports confiscated as long prestige externalities are strong. When prestige externalities are weak, the relationship is u-shaped.

**Proof.** See the Appendix. \hfill \blacksquare

The introduction of a confiscation policy basically has three effects. First, it shifts demand from firm $L$ to firm $H$, which improves welfare given equal marginal production costs and vertical product differentiation. Second, it widens the wedge between price and marginal production cost for the low-quality good, thereby driving some poor consumers out of the market which reduces welfare. Third, it mitigates the problem of pirate externalities, improving the consumption value of both goods. When prestige externalities are weak, the second effect dominates for low $c$’s while the first effect dominates for larger $c$’s. For larger prestige
externalities, the third effect comes into play which reinforces the benefits of limiting the amount of counterfeiting.

Introducing a tariff on firm $L$’s imports is basically the same experiment as increasing the firm’s marginal cost, apart from the fact that government revenues, $cQ_L$, are now included in the welfare measure $W$.

**Proposition 11.** With symmetric pirate externalities, $z_H = z_L = z$, welfare increases monotonically in the level of tariffs as long prestige externalities are strong. When prestige externalities are weak, the relationship is inversely u-shaped.

**Proof.** See the Appendix. ■

To summarize, we find that when prestige externalities are strong, confiscation and tariffs have the same qualitative effects. Less counterfeiting then leads to increased welfare, and if enforcement costs are zero it would be optimal to minimize the incidence of counterfeiting. For small prestige externalities, there is a u-shaped relationship between welfare and the confiscation fraction and an inverse u-shaped relationship between welfare and the level of tariffs. The reason for the difference is simply that tariff revenues are included in the latter case and that they are maximal for intermediate tariff levels. Here, the welfare effects of
reducing counterfeiting depend on market conditions, as well as on the available policy.

Propositions (10) and (11) are based on the assumption that there are two firms in the market. Hence, the counterfeiting firm has a strategic influence even at small (or zero) output levels. Our final welfare result concerns the question whether or not counterfeiting should be banned altogether, if this were somehow possible. That is, we compare the free market equilibrium to monopoly, i.e., the case where no counterfeiting firm exists. Here, the algebra becomes extremely messy in the general case so we confine the analysis to the extreme cases where \( \alpha = 0 \) and \( \alpha = S_L \). In both these cases, welfare is higher in a free market equilibrium than under monopoly. Therefore, it is perhaps not too speculative to presume that the result would hold also for intermediate levels of prestige externalities.

**Proposition 12.** Assume symmetric pirate externalities, \( z_H = z_L = z \). Then, welfare is higher in the free market equilibrium than under monopoly both for extremely weak \( (\alpha = 0) \) and extremely strong \( (\alpha = S_L) \) prestige externalities.

**Proof.** Let \( \Delta \) be defined as the difference in welfare in the free market equilibrium and under monopoly. Then, \( S(\Delta \mid \alpha = 0) = \frac{S_H S_L (20S_H - 11S_L)}{8(4S_H - S_L)^2} > 0 \) and \( S(\Delta \mid \alpha = S_L) = \frac{S_H S_L (20S_H - 11S_L)}{8(4S_H - S_L)^2} > 0 \)
\[ S_L = \frac{s_L(2s_H - s_H s_L - 2s_L^2)}{8(s_H - s_L)^2} > 0 \text{ by Assumption 2.} \]

Hence, there seem to be important strategic welfare gains by allowing some amount of counterfeiting (i.e., competition), but the government would typically want to keep counterfeiting at a low level, at least when enforcement is costless and prestige externalities pronounced.

4. Concluding remarks

The analysis presented in this paper suggests that prestige- and pirate externalities affect the market mechanism in important ways in the presence of counterfeiting. They affect prices, they determine whether or not counterfeiting is possible at all, and they affect the degree of substitutability between copies and originals. In particular, we may draw the conclusion that producers of originals should be able to gain larger market shares in markets where prestige- and pirate externalities are strong, e.g., markets for luxury products, compared to markets where they are weak, e.g., markets for music and film.

When it comes to policy conclusions, there seem to be important strategic welfare gains by allowing some amount of counterfeiting (i.e., competition), but the government would typically want to keep counterfeiting at a low level, at
least when enforcement is costless and prestige externalities pronounced. However, since the welfare analysis is partial, ignoring for instance monitoring costs, dynamic effects and the cost of imposing tariffs also on legitimate low-quality products, we refrain from drawing any strong policy conclusions in this respect.

In terms of robustness it should be noted that our results are not primarily driven by the assumption of strategic interaction. In contrary, with a few exceptions the results go through also assuming a perfectly competitive fringe of counterfeit producers as in Grossman and Shapiro (1988a).15

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15 A proof is available from the authors on request. There are however two results that change slightly. In Proposition (7), an increase in $\alpha$ only affects firm $L$’s quantity which is reduced as before. In Proposition (6), firm $L$’s quantity is negatively effected by an increase in $z_H$. Naturally, given the assumption of a perfectly competitive fringe, prices and profits are always zero for low-quality producers. Finally, in Proposition (12), welfare may actually be higher under monopoly than in the free market equilibrium. The reason is that the market price of counterfeits tend to be too low when there is strong competition among counterfeiting firms. It can actually be shown that welfare is always lower in a market with a competitive fringe than in a duopoly. In a sense, the more competitive the counterfeit market, the more reasonable it becomes to protect the producers of originals.
5. References


6. Appendix

Proof. (Proposition 6) First, let us analyze the effects of a small increase in $z_H$ given a symmetric point of departure. When evaluated at $z_H = z_L = z$, $S(\frac{\partial L}{\partial z_H}) = S(3\alpha^3 + 6\alpha^2(S_H - S_L) + \alpha(4S_H^2 - 12S_H S_L - S_L^2) - 2S_H S_L(2S_H + S_L)) \equiv S(A)$. The expression $A$ is convex in $\alpha$. Since, $S(A) < 0$ for both $\alpha = 0$ and $\alpha = S_L$ we may conclude that $\frac{\partial L}{\partial z_H} < 0$. The effect from $z_H$ on $Q_L$ is somewhat more complex. $S(\frac{\partial Q_L}{\partial z_H}) = S(-3\alpha^2 - \alpha(5S_H - 2S_L) + S_L(S_H - S_L)) \equiv S(C)$. The expression $C$ is concave in $\alpha$. Moreover, $S(C) > 0$ for $\alpha = 0$ and $S(C) < 0$ for $\alpha = S_L$. Hence, $\frac{\partial Q_L}{\partial z_H} > 0$ for sufficiently small $\alpha$. This proves the first statement. It can be demonstrated that $S(\frac{\partial L}{\partial z_H}) < 0$. Consequently, $S(\frac{\partial Q_L}{\partial z_H}) > 0$. Hence, $\frac{\partial Q_L}{\partial z_H} > 0$ for sufficiently small $\alpha$. Now, let us analyze the effects of a small increase in $z_L$ given a symmetric point of departure. It can be demonstrated that $S(\frac{\partial L}{\partial z_L}) = S(-A)$. Obviously, $-A$ is concave in $\alpha$. Since, $S(-A) > 0$ for both $\alpha = 0$ and $\alpha = S_L$ we may conclude that $\frac{\partial L}{\partial z_L} > 0$. The effect from $z_L$ on $Q_L$ is the following. $S(\frac{\partial Q_L}{\partial z_L}) = S(3\alpha^3 + 9\alpha^2 S_H + \alpha(4S_H^2 + 5S_L^2) - S_H S_L(4S_H - 7S_L)) \equiv S(D)$. The expression $D$ is convex in $\alpha$. Moreover, $S(D) < 0$ for $\alpha = 0$ given that Assumption 2 is satisfied. Moreover, $S(D) > 0$ for $\alpha = S_L$. Hence, $\frac{\partial Q_L}{\partial z_L} < 0$ for sufficiently small $\alpha$. Straightforward differentiation yields that $\frac{\partial Q_L}{\partial z_L} < 0$. The effect from $z_L$ on $Q_L$ is the following. $S(\frac{\partial Q_L}{\partial z_L}) = S(3\alpha^3 + 2\alpha^2(4S_H - S_L) + \alpha(4S_H^2 - 4S_H S_L + 3S_L^2) - 4S_H S_L(4S_H - 7S_L)) \equiv S(E)$. The expression $E$ is convex in $\alpha$. Moreover, $S(E) < 0$ for $\alpha = 0$ and $S(E) > 0$ for $\alpha = S_L$. Hence, $\frac{\partial Q_L}{\partial z_L} < 0$ for sufficiently small $\alpha$. ■

Proof. (Proposition 8) Let firm $L$’s market share be denoted by $\phi$. When evaluated at $z_H = z_L = z$, $S(\frac{\partial \phi}{\partial \alpha}) = S(-z(\alpha^2(S_H - S_L) + 2\alpha S_H S_L + S_H^2 S_L) - S_L(\alpha^2 + 4\alpha S_H + S_H^2(2S_H - S_L)) \equiv S(F)$. The expression $F$ is concave in $\alpha$. Moreover, $S(F) < 0$ for $\alpha = 0$ and $\alpha = S_L$ but $S(F)$ is larger for $\alpha = 0$. This proves the first statement. It can be demonstrated that $S(\frac{\partial \phi}{\partial \alpha}) = S(-\alpha^2 z_L(S_H + 2S_L) - S_L(\alpha^2 z_L(S_H(3z_L + 2) + 4S_L) + \alpha S_L(S_H(6z_L + 1) + 2S_L)) + 3S_H S_L^2) \equiv S(G)$. The expression $G$ is concave in $\alpha$. Moreover, $\frac{\partial G}{\partial \alpha} < 0$ and $G < 0$ for $\alpha = 0$. This
proves the second statement. Now, let us analyze the effects of a small increase in \( z_L \) given a symmetric point of departure. When evaluated at \( z_H = z_L = z \),
\[
S(\frac{\partial z}{\partial z_L}) = S(\alpha^2(2S_H + S_L) + \alpha(2S_H^2 + S_L^2) - 2S_H S_L(S_H - S_L)) = S(H).
\]
The expression \( H \) is convex in \( \alpha \). \( \frac{\partial H}{\partial \alpha} > 0 \) and \( H < 0 \) for \( \alpha = 0 \) and \( H > 0 \) for \( \alpha = S_L \). This proves the third statement. The fourth statement follows from straightforward differentiation. \( \blacksquare \)

**Proof. (Proposition 10)** It is straightforward to aggregate welfare and to insert equilibrium quantities and prices given \( c \geq 0 \). Let welfare be denoted by \( W \). \( \frac{\partial^2 W}{\partial c^2} \)

is independent of \( c \), so we may conclude \( W \) is either strictly convex or strictly concave in \( c \). The next step is to evaluate the slope of \( W \) at \( c = \bar{c} \) and \( c = 0 \). It is straightforward to verify that \( S(\frac{\partial W}{\partial c} | c = \bar{c}) = \alpha(3zS_H - S_L(2z + 1)) + S_L(S_H - S_L) \)

which is positive for \( z > 1 \). Moreover, \( S(\frac{\partial W}{\partial c} | c = 0) = S(z^2\alpha^2(\alpha + 2S_H)(3S_H - 2S_L) + z\alpha[2\alpha^2(S_H - 2S_L) + \alpha(4S_H^2 - 7S_H S_L + 2S_L^2) + S_L(4S_H^2 + S_H S_L - 2S_L^2)] + S_L[\alpha^3 + \alpha^2(5S_H - 6S_L) + \alpha(6S_H^2 - 14S_H S_L - 2S_L(S_H - S_L)(2S_H - S_L)]) = S(J) \).

The function \( J \) is convex in \( \alpha \). \( J < 0 \) for \( \alpha = 0 \) while \( J > 0 \) for \( \alpha = S_L \). Hence, \( S(\frac{\partial W}{\partial c} | c = 0) > 0 \) for \( \alpha \) sufficiently close to \( S_L \). \( \blacksquare \)

**Proof. (Proposition 11)** It is straightforward to aggregate welfare and to insert equilibrium quantities and prices given \( c \geq 0 \). Let welfare be denoted by \( W \). \( \frac{\partial^2 W}{\partial c^2} \)

is independent of \( c \), so we may conclude \( W \) is either strictly convex or strictly concave in \( c \). The next step is to evaluate the slope of \( W \) at \( c = \bar{c} \) and \( c = 0 \).

\[
S(\frac{\partial W}{\partial c} | c = 0) = S(\bar{c}^2\alpha^2(\alpha + 2S_H)(3S_H - 2S_L) - \alpha[2\alpha^2(S_H + S_L) + \alpha S_L(2S_L - S_H) - S_L(8S_H^2 - 4S_H S_L - S_L^2)] + S_L[\alpha^3 + \alpha^2(2S_H - 3S_L) + \alpha(2S_H^2 - 6S_H S_L + S_L^2)] + S_L^2(S_H - S_L)]) = S(K).
\]

Although \( K \) is a complex expression it is easy to establish that \( K \) is convex in \( \alpha \) and that \( K > 0 \) for \( \alpha = 0 \) and \( \alpha = S_L \). Moreover, \( K \) is larger for \( \alpha = S_L \) than for \( \alpha = 0 \). Hence, \( S(\frac{\partial W}{\partial c} | c = 0) > 0 \).

\[
S(\frac{\partial W}{\partial c} | c = \bar{c}) = S(\bar{c}\alpha S_H(3S_H - 2S_L) + \alpha^2(S_H - S_L) + \alpha(2S_H^2 - 5S_H S_L + 2S_L^2) - S_L(S_H^2 - 2S_H S_L + S_L^2)) = S(L).
\]

The function \( L \) is increasing in \( \alpha \). Moreover, \( L \)

is negative for \( \alpha = 0 \) and positive for \( \alpha = S_L \). Hence, \( S(\frac{\partial W}{\partial c} | c = \bar{c}) > 0 \) for \( \alpha \) sufficiently close to \( S_L \). \( \blacksquare \)