Counterfeiting in primary markets

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Abstract

This paper studies counterfeiting in primary markets, that is, deceptive counterfeiting in which consumers unwillingly purchase substandard counterfeit goods. Using monopolistic competition, counterfeiting is shown to occur under lax intellectual property rights law enforcement and/or large markets of existing legitimate goods, as a general equilibrium outcome. Even though the counterfeiters themselves may lose along with all legitimate agents, once counterfeiting is conducted, it prevails. Strengthening of IPR law enforcement has no effect on the amount of counterfeiting conducted unless it is strengthened enough to totally eliminate counterfeiting.

Keywords: counterfeit, primary market, entrepreneur, monopolistic competition, general equilibrium

JEL classification: D21, D43, K42

1. Introduction

All sorts of things are counterfeited in various ways today. According to a comprehensive survey on counterfeiting and piracy by the OECD (2008, p. 66), "the scope of products being counterfeited and pirated is broad and expanding," and "a notable shift is occurring from luxury to common products." The OECD survey raises concerns regarding health and safety risk based on their finding that substandard counterfeits of common products are spreading. WHO (2006), for example, estimates that counterfeits occupy more than 10% of the global medicines market, and constitute an estimated 25% of the medicines consumed in developing countries.

The broadening of items counterfeited also refers to there being two different types of purchases, or sub-markets: the primary market and the secondary market. In the primary market, consumers purchase counterfeits believing that they have purchased genuine products, whereas actually the consumers have been deceived and are buying substandard fakes. The health and safety risks associated with some of the counterfeits in the primary markets, such as food and medicine, can be life-threatening. In the secondary market, consumers knowingly buy counterfeits, which are usually cheaper than genuine products. The latter type of counterfeiting typically occurs in snob or status goods.

Previous studies have focused on counterfeiting in secondary markets. Higgins and Rubin (1986) considered counterfeiting of snob goods. In their model, low-income consumers look for low-priced counterfeits. Grossman and Shapiro (1988a) analyzed status goods which are counterfeited by foreign suppliers. Grossman and Shapiro (1988b) also studied a situation where foreign companies supply counterfeits and low-quality goods. Choi (2008) studied a mixed market in which genuine brand producers compete with firms that produce counterfeits.

Changes are also seen in the distribution of counterfeits and pirated goods. Previously, they were distributed largely through informal markets. As Higgins and Rubin (1986) assumed in their analysis, the markets of genuine products and counterfeits used to be separated. However, according to the OECD survey mentioned above, counterfeits today are increasingly infiltrating legitimate supply chains, and they are now appearing in the shelves of well-known retail shops. This suggests that consumers are now more liable to purchasing counterfeits in the primary market, due to being deceived. Further, the OECD survey reveals significant evidence of the role of criminal networks and the involvement of organized crime in counterfeiting today.

This paper departs from the existing analyses in two ways. The first is on the market of counterfeiting. While previous studies on counterfeiting focused on the secondary markets of snob or status goods, this paper focuses on the primary market in which deceptive counterfeiting is conducted. This is motivated by the OECD's reporting on the growing concern of people unwillingly purchasing goods of substandard quality, through formal, legitimate distribution channels. The second departure is on the type of analysis. In contrast to previous studies based on partial equilibrium, this paper attempts to consider counterfeiting in general equilibrium. It is motivated by the observation that counterfeiting is no longer confined to a particular sector but it has spread into a large variety of goods that are consumed daily. Its aim is to complement the existing studies by studying the primary market of counterfeits and to clarify in what way such counterfeiting harms societies.

Technically, the approach of the theoretical analysis in this paper is to use the entrepreneur formulation of monopolistic competition, which assumes that each firm is set up by an entrepreneur who earns profits. This formulation has been used in macroeconomics and in new economic geography. Frank (1990) and Clemens (2006, 2008) applied this formulation of monopolistic competition to study the impact of entrepreneurial behavior on macroeconomic fluctuations and economic growth. Forslid and Ottaviano (2003) analyzed a model of monopolistic competition in which geographically mobile skilled workers are needed to set up firms. Their model is now known as the footloose entrepreneur model and it explains the relation between inter-regional trade costs and agglomeration created by the migration of skilled workers. In this paper, I extend the entrepreneur formulation of monopolistic competition to incorporate acts of counterfeiting.

Previewing the results, it will be shown first that, consistent with intuition, counterfeiting occurs under lax intellectual property rights (IPR) law enforcement and/or large markets of existing legitimate goods, implying larger profit opportunities for potential counterfeiters. When found profitable, some of the 'legitimate' people become counterfeiters or 'shadow' entrepreneurs and start producing fakes of existing brands. By studying the counterfeiting equilibrium in which all brands are counterfeited by such counterfeiters, it will be shown that (unsurprisingly) all legitimate people lose, while the counterfeiters can gain if the outputs of the brands they counterfeit are sufficiently large. Otherwise, nobody gains in the counterfeiting equilibrium. In either case, the counterfeiting equilibrium is found to be stable, implying that

once counterfeiting spreads, it prevails. Finally, it will also be shown that strengthening of IPR law enforcement has no effect on the amount of counterfeiting conducted unless it is strengthened enough to totally eliminate counterfeiting. These findings may help to increase our understanding of the general equilibrium welfare deteriorating effect of counterfeiting in primary markets, as well as the difficulty of eliminating counterfeiting.

The rest of the paper is organized as follows. In the next section, I review standard results from the entrepreneur formulation of monopolistic competition. This will be the benchmark of the study. In Section 3, I present the assumptions of counterfeiters and derive the conditions under which counterfeiting is conducted. Section 4 analyzes changes in behaviors when counterfeiting is conducted, to derive equilibrium under counterfeiting. Then the equilibrium under counterfeiting is compared with the benchmark equilibrium. Impact of a change in the level of IPR law enforcement is also analyzed. Section 5 concludes.

2. Entrepreneur formulation of monopolistic competition, the benchmark

The population mass of the economy is denoted as L. Members are either entrepreneurs or workers. The share of the entrepreneurs within the population is denoted as e $(0<e<1)$.[1] Correspondingly, the share of the workers is $1-e$. The firms run by the entrepreneurs are assumed to be monopolistically competitive. Each entrepreneur sets up an original brand, and it is assumed that c units of workers are needed per unit output.

The same population also comprises the consumers. The assumption for consumer behavior is a standard one, originally developed by Dixit and Stiglitz (1977). All consumers have the same preferences, which are defined by

$$U=\left[\int_0^n m_i{}^{\rho}\,di\right]^{1/\rho},$$

which is the composite of all the differentiated varieties. Here, n is the mass of brands, m_i is the consumption of brand i, and ρ is the substitution parameter. It is assumed that $0<\rho<1$ to ensure that the brands are imperfect substitutes. $\sigma\equiv 1/(1-\rho)>1$ represents the elasticity of substitution between any two brands. Higher (lower) σ means weaker (stronger) love of variety. Denoting the price of a brand as p_i, a price index

[1] In the Forslid and Ottaviano (2003) model, this share is fixed.

$$G \equiv \left[\int_0^n p_i^{1-\sigma} di \right]^{1/(1-\sigma)} \tag{1}$$

is introduced such that total expenditure is GU. G is an overall level of prices that each firm takes as given.

In the above setting, consumers' utility maximization leads to demand for each brand being $p^{-\sigma} G^{\sigma-1} Y$, where Y is aggregate income. (Hereafter subscript i is omitted.) Demand therefore depends not only on p and Y but also on G. Y consists of total profits earned by the entrepreneurs and total earnings of the workers. When π is the profit of each firm and each worker's wage is set equal to one,

$$Y = eL\pi + (1-e)L. \tag{2}$$

On the supply side, entrepreneurs of monopolistically competitive firms will set their prices so that marginal revenues equal marginal costs:

$$p(1-1/\sigma) = c. \tag{3}$$

This is known as mark-up pricing, in which firms always set their prices above their marginal costs, c. However, since rival brands are producing more or less substitutable varieties, the mark-up depends on σ: when the varieties are close substitutes (or consumers' love of variety is weak), i.e., when σ is high, then consumers are sensitive to prices and the prices become closer to c. By substituting Eq. (3) into (1), we find that the mark-up pricing by each firm leads to the price index being

$$G = n^{1/(1-\sigma)} \frac{\sigma c}{\sigma - 1}, \tag{4}$$

where

$$n = eL. \tag{5}$$

Further, denoting the output of each firm as q, since the profit of each firm (π) is $pq - cq$, using (3), we have

$$\pi = \frac{c}{\sigma - 1} q. \tag{6}$$

We can now consider equilibrium. Equilibrium is defined as a situation in which the goods and the factor markets clear (i.e., supply equals demand), under free entry. The goods market clearing condition is

$$q = p^{-\sigma} G^{\sigma-1} Y, \tag{7}$$

and the factor market clearing condition is

$$L = n + ncq\,, \tag{8}$$

which means that the population (L) needs to match the amount of entrepreneurs and workers, i.e., those other than entrepreneurs must be fully employed as workers.

Solving (7) and (8) simultaneously after substituting in (2) through (6), we have

$$q = \frac{1-e}{ec}\,. \tag{9}$$

Substituting (9) into (6), the entrepreneurial profit is

$$\pi = \frac{1-e}{e(\sigma-1)}\,. \tag{10}$$

Free entry, however, drives π down to the workers' wage, which is one. That is, $\pi = 1$ in equilibrium. Then, using (10), we have

$$e = 1/\sigma\,, \tag{11}$$

which, using (5), implies

$$n = L/\sigma\,. \tag{12}$$

Substituting (11) into (9), the equilibrium output of each brand is

$$q = (\sigma-1)/c\,. \tag{13}$$

Substituting (12) into (8) gives the equilibrium mass of workers, which is $L(\sigma-1)/\sigma$. These are summarized in Table 1 as the benchmark equilibrium.

3. Counterfeiting

3.1. Incentive for counterfeiting

Assumptions

Before proceeding to analyzing counterfeiting, it is necessary to define what counterfeits are and to lay out some assumptions on counterfeiting. As mentioned at the outset, the subject of this paper is counterfeiting in primary markets. In the present analysis, therefore, a counterfeit is defined as something that appears to be the same as an original but does not function and offers no utility to a consumer. That is, the consumer cannot distinguish between the original and the counterfeit until they 'open the box'. Consumers, however, know the share of counterfeits, or the probability that their purchases turn out to be successful/unsuccessful. Agents are homogeneous and anyone can become a counterfeiter. Counterfeiters can produce fakes in a costless manner

(using, say, wild plants or trash to produce fake medicine and food), and deceive consumers by getting their fakes through legitimate distribution channels, as reported by OECD (2008). Being sold in legitimate channels means that the counterfeits are sold at the same prices as the originals.

There exist IPR laws but they are imperfectly enforced. Counterfeiters know their probability of being caught, which is positively associated with the amount of counterfeit production. If caught, they lose all their income from counterfeiting. Increasing involvement of organized crime, as reported by OECD (2008), is also taken into account: once agents become counterfeiters and establish their 'territory' of counterfeiting particular brands, they 'turf out' any others who attempt to counterfeit the same brands, thereby monopolizing on their activities. This implies that each counterfeiter can only produce fakes of a particular brand; they 'specialize' on counterfeiting of specific brands as 'shadow' entrepreneurs, creating an entry barrier.

Both consumers and counterfeiters face uncertainty. Because of counterfeits, consumers' utilities from their purchases become uncertain. In addition, the counterfeiters face uncertainty in their incomes because of the risk of being caught for IPR infringements.

The assumptions on counterfeiting mentioned above are summarized as follows:

1) Counterfeited goods do not offer any utility to the consumers.
2) Any individual, i.e., entrepreneur or worker, can become a counterfeiter.
3) Everyone behaves so as to maximize expected utility in the presence of uncertainty.
4) Each counterfeiter produces counterfeits of a particular brand. That is, each counterfeiter can only produce counterfeits of one brand.
5) Counterfeits can be produced without cost.
6) Counterfeits are distributed through legitimate distribution networks and are sold at the same price as their originals.
7) Counterfeiters can be caught; the probability of being caught is positively related to the amount of counterfeit production, and this probability as a function of the amount of counterfeit production is known to everyone.
8) When caught, the counterfeits are confiscated and discarded, so the counterfeiter loses all his/her income from counterfeiting.

Incentive to counterfeit

Under the above-listed assumptions, would any individual have an economic incentive to conduct counterfeiting? Let $x(>0)$ be the size of counterfeit production relative to that of the original, which means that the counterfeit output is xq. Also, to facilitate the analysis by specifying assumption 6, we assume that the probability of being caught is $1-\beta^x \ (0<\beta<1)$, which is shown in Figure 1. This simply means that the larger the production of counterfeits, the greater the likelihood of being caught. Parameter β indicates the degree of law enforcement: the smaller the β, the stricter the law enforcement. Then the expected counterfeiting income is $pqx\beta^x$. From the benchmark result, it is known that $p=\sigma c/(\sigma-1)$ and $q=F(\sigma-1)/c$. Then expected counterfeiting income ($pqx\beta^x$) can be written as $\sigma x\beta^x$, which is illustrated in Figure 2. The expected (indirect) utility from counterfeiting is

$$\sigma x\beta^x/G_0 \ . \tag{14}$$

Since G_0 is given for everyone, maximizing (14) is equivalent to maximizing the expected counterfeiting income, $\sigma x\beta^x$. In this sense, the population is risk-neutral. Given that the probability of being caught is $(1-\beta^x)$, the optimal level of x to maximize $\sigma x\beta^x$ is $-1/\log\beta$. Hence, the expected counterfeiting income is $-\sigma\beta^{-1/\log\beta}/\log\beta$, as indicated in Figure 2.

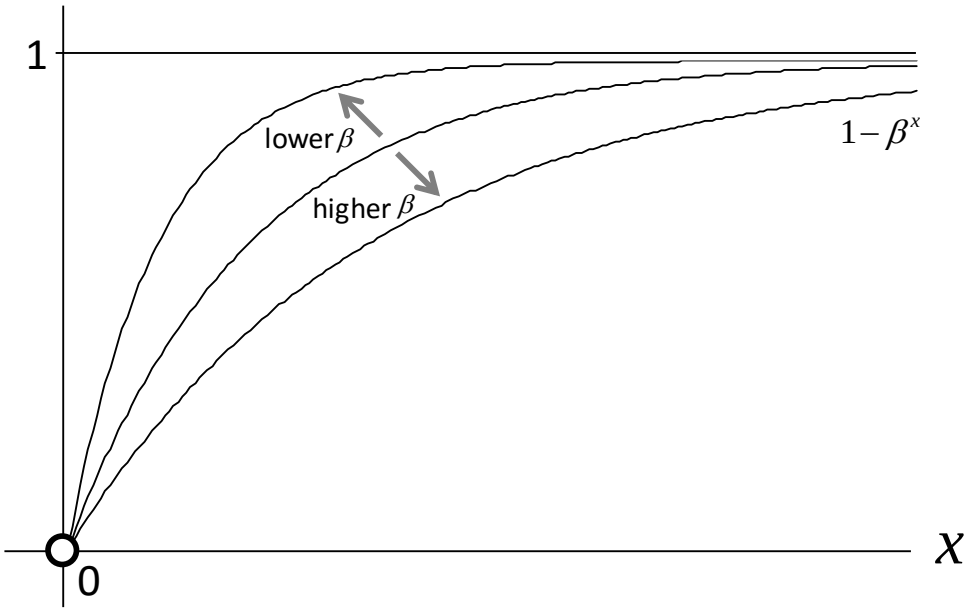

Figure 1. Probability of being caught ($1-\beta^x$)

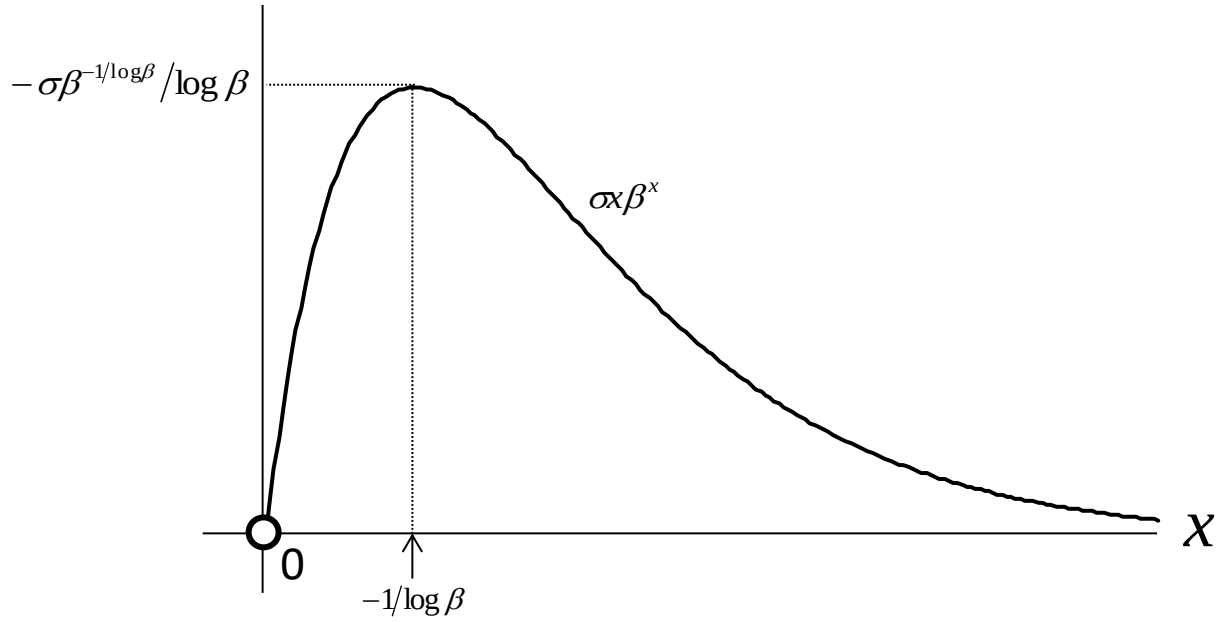

Figure 2. Expected counterfeiting income ($\sigma x\beta^{x}$)

In the benchmark equilibrium, everyone earns income equal to one. Therefore, everyone has an economic incentive to turn to counterfeiting if the expected counterfeiting income ($-\sigma\beta^{-1/\log\beta}/\log\beta$) exceeds one. Hence, it is necessary that

$$\sigma > -\beta^{1/\log\beta}\log\beta \tag{15}$$

for individuals to start counterfeiting. Otherwise, there is no economic gain to be expected from counterfeiting, and counterfeiting does not occur.

Result 1. Given assumptions 1 to 7 above, individuals conduct counterfeiting of the existing brands if σ and β are sufficiently large to satisfy condition (15).

Inspecting the right-hand side of (15), it can be confirmed that

$$-\beta^{1/\log\beta}\log\beta > 0, \quad \frac{d\left(-\beta^{1/\log\beta}\log\beta\right)}{d\beta} < 0, \text{ and } \quad \frac{d^{2}\left(-\beta^{1/\log\beta}\log\beta\right)}{d\beta^{2}} > 0, \tag{16}$$

so Result 1 can be shown diagrammatically as in Figure 3. Result 1 implies that, consistent with intuition, at a given level of σ, the stricter the law enforcement (β), the lower the incentive to counterfeit. Also, at a given level of β, the larger the σ, the higher the incentive to counterfeit.

Recalling that the equilibrium output of each brand is $(\sigma-1)/c$, this means that the larger the output of a brand, the higher the incentive to counterfeit the brand.

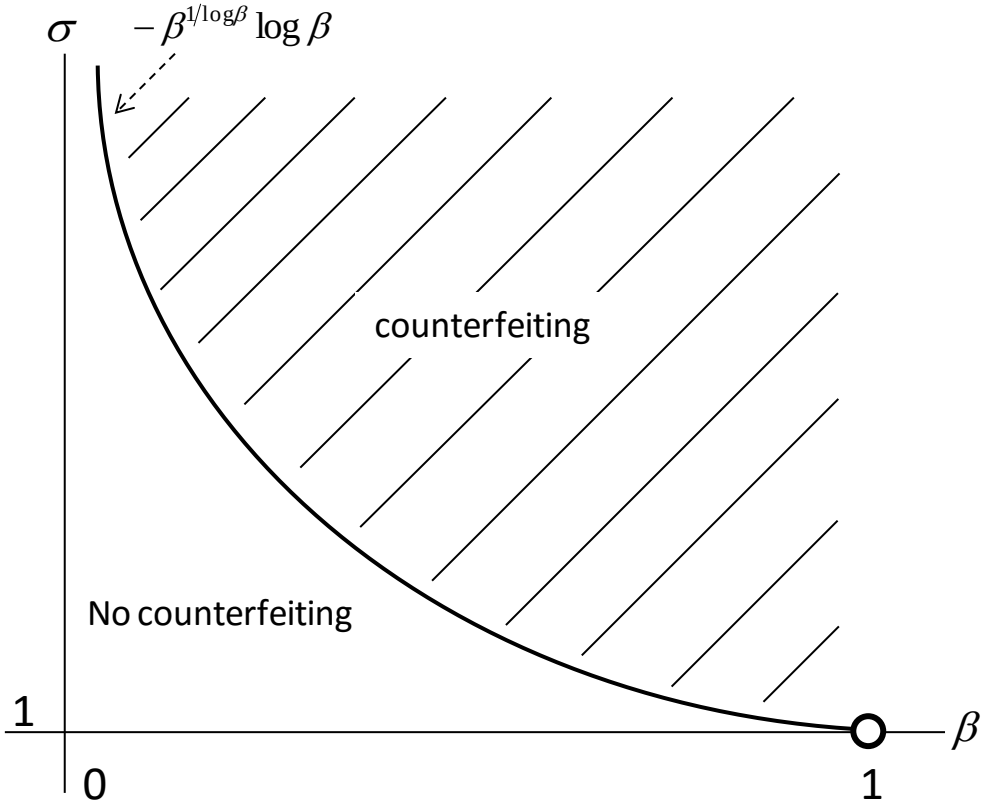

Figure 3. Incentive for counterfeiting

3.2. Counterfeiting equilibrium

Counterfeiters in the counterfeiting economy

As derived in Result 1, if condition (15) is satisfied, then everyone has an economic incentive to counterfeit. However, not everyone can become a counterfeiter because the mass of varieties is limited. Denoting the total mass of brands in the counterfeiting economy as n^*, this implies that in equilibrium the total mass of counterfeiters will also be n^*. (Hereafter, the endogenous variables in the counterfeiting economy that already appeared in the benchmark economy are given asterisks.) Denoting the legitimate supply of each brand as q^*, taking into account the probability of being caught, the expected supply of counterfeits of each brand is $q^* x\beta^x$, where the counterfeiters optimally choose $x=-1/\log\beta$.

Consumers in the counterfeiting economy

The existence of counterfeits for all brands symmetrically means that whichever brands consumers purchase, they have the same probability of purchasing counterfeits, which are assumed to be valueless. Then their expected utilities can be written as

$$E(U)=\left[\int_0^{n^*}\left(\alpha m_i^*\right)^\rho di\right]^{\frac{1}{\rho}} \quad \text{or} \quad \alpha\left[\int_0^{n^*} m_i^{*\rho} di\right]^{\frac{1}{\rho}}, \tag{17}$$

where α $(0<\alpha<1)$ is the share of legitimate products in the total supply including counterfeits of each brand:

$$\alpha=\frac{q^*}{q^*+q^* x\beta^x}. \tag{18}$$

Because the counterfeiters choose $x=-1/\log\beta$,

$$\alpha=\frac{\log\beta}{\log\beta-\beta^{(\log\beta)^{-1}}}. \tag{19}$$

Utility, therefore, is expected to be discounted by a factor of α. Because α is given to the consumers, their utility maximization behavior is the same as in the benchmark case. Demand for each brand is therefore $p^{*-\sigma}G^{*\sigma-1}Y^*$, where p^* is the price, G^* is the price index, and Y^* is the aggregate income in the counterfeiting economy.

Entrepreneurs in the counterfeiting economy

The elasticity of substitution (σ) and correspondingly the price elasticity of demand do not change under the existence of counterfeits. The pricing behavior of entrepreneurs, therefore, does not change: their profit maximizing prices are the same as in the benchmark case, that is,

$$p^*(1-1/\sigma)=c. \tag{20}$$

Equilibrium under counterfeiting

The full employment condition is now

$$L=2n^*+n^*cq^*, \tag{21}$$

and the entrepreneurial profit (π^*) is

$$\pi^*=p^*q^*-cq^*. \tag{22}$$

Substituting (20) into (22), as in the benchmark case, the zero profit condition leads to

$$q^* = (\sigma - 1)/c\,. \tag{23}$$

Substituting (23) into (21), it is found that

$$n^* = L/(\sigma + 1). \tag{24}$$

This result is confirmed to satisfy the market clearing condition, which is

$$q^* + q^* x\beta = p^{*-\sigma} G^{*\sigma-1} Y^*, \tag{25}$$

where Y^*, the aggregate income in the counterfeiting economy, is the sum of the entrepreneurial profits, the workers' wage income, and the counterfeiters' income, that is, $Y^* = n^*\pi + c(L - 2n^*) + n^* p^* q^* x\beta^x$. Using (22) to substitute for π^*,

$$Y^* = n^* p^* q^* \left[1 + x\beta^x\right]. \tag{26}$$

In the counterfeiting economy, the expected (indirect) utility of entrepreneurs and workers in the counterfeiting equilibrium is

$$E(U_{LE}) = \alpha / G^*\,, \tag{27}$$

where subscript LE stands for 'legitimate'. For convenience, denoting a typical counterfeiter's expected income as $E(I_{CF})$, we have, using (20) and (23),

$$E(I_{CF}) \equiv p^* q^* x\beta^x = -\sigma\beta^{-(\log\beta)^{-1}} (\log\beta)^{-1}. \tag{28}$$

Then the expected (indirect) utility of counterfeiters in the counterfeiting equilibrium is

$$E(U_{CF}) = E(I_{CF})\alpha / G^*\,, \tag{29}$$

where subscript CF stands for 'counterfeit'. The two equilibria are shown in Table 1. In comparison to the benchmark equilibrium, in the counterfeiting equilibrium, the prices (p) and outputs (q) of the individual goods are unchanged. However, there are fewer brands (n) in the counterfeiting equilibrium, which itself is welfare decreasing for everyone.

$E(U_{LE})$ and $E(U_{CF})$ can be compared with the level of utility in the benchmark equilibrium, U_0. Then it is found that

$$E(U_{LE})/U_0 = \alpha\left(\frac{\sigma}{1+\sigma}\right)^{1/\sigma-1} < \alpha < 1\,. \tag{30}$$

Result 2a. All (legitimate) entrepreneurs and workers lose in the counterfeiting equilibrium compared to the benchmark equilibrium where there is no counterfeiting.

The result that all legitimate people lose can be explained in more detail by inspecting (30). The first term, α, is the expected share of legitimate products or the probability of 'successful' purchase. The second term represents the increase in the price index due to reduction in the total mass of brands. The total mass of brands decreases in the counterfeiting equilibrium because some people quit legitimate occupations and turn to counterfeiting. In other words, some of the resource is used in counterfeiting, which leads to a reduction in the total mass of brands. The welfare loss, therefore, comes from two sources: one is from counterfeiting itself reflected in the first term of (30), and the other is from the reduction of brands reflected in the second term of (30): the lower the α and/or the lower the σ, the larger the welfare losses of the legitimate people. That is, as the probability of purchasing counterfeits increases and/or the love of variety strengthens, the welfare loss in the counterfeiting economy becomes larger compared to the benchmark.

Eq. (30) is also diagrammatically shown in Figure 4, as the dotted upward sloping curve. $E(U_{LE})/U_0$ increases with σ (because the larger the σ, the smaller the love of variety, and therefore reduction in variety matters less), but it is always lower than α (the horizontal line at α is the asymptote) and clearly lower than one, indicating that the legitimate people never gain in the counterfeiting equilibrium compared to the benchmark.

Next, by comparing $E(U_{CF})$ and U_0, it is found that

$$E(U_{CF})/U_0 = \alpha\left(\frac{\sigma}{1+\sigma}\right)^{1/\sigma-1} E(I_{CF}). \tag{31}$$

Result 2b. Whether counterfeiters gain or lose in the counterfeiting equilibrium depends on the level of the elasticity of substitution between the brands, σ. Counterfeiters lose when σ is small and sufficiently close to $\beta^{(\log\beta)^{-1}}\log\beta$.

The first and the second terms in (31) are the same as in (30). However, in the case of counterfeiters, they expect to earn $E(I_{CF})$, which, from Result 1, must exceed one. Therefore, counterfeiters can gain from their acts in the counterfeiting equilibrium if $E(I_{CF})$ is sufficiently large, and $E(I_{CF})$ is positively related to σ. The intuition is as follows. σ also represents the sizes, that is, the equilibrium outputs of legitimate brands as derived in (23): the larger the σ, the

larger the output of each brand. This means that the counterfeiters' production is also proportionally larger and their expected income from counterfeiting is larger. Hence, larger σ implies higher expected income from counterfeiting. In contrast, counterfeiters lose if σ is sufficiently close to $-\beta^{(\log\beta)^{-1}}\log\beta$.

Eq. (31) is also diagrammatically shown in Figure 4, as the upward sloping curve. It is shown that at higher levels of σ, $E(U_{CF})/U_0$ exceeds one, but at lower levels of σ, it is less than one. This result and Result 2a together imply that it is possible that nobody gains in the counterfeiting equilibrium.

Result 3. If the level of the elasticity of substitution between the brands (σ) is sufficiently low, then everyone (including the counterfeiters) loses in the counterfeiting equilibrium.

Further, comparing (30) and (31), at any level of σ larger than $-\beta^{(\log\beta)^{-1}}\log\beta$, $E(U_{CF}) > E(U_{LE})$. It can also be confirmed in Figure 4 that $E(U_{CF})/U_0$ always exceeds $E(U_{LE})/U_0$ whenever counterfeiting is conducted. Therefore, no counterfeiter finds it profitable to quit counterfeiting and return to legitimate occupations.

Result 4. The counterfeiting equilibrium is stable.

Result 4 means that once counterfeiting spreads in an economy, there is no individual incentive that eliminates counterfeiting. In other words, the economy is locked-in to counterfeiting prevailing.

Table 1: Comparison of equilibria

Benchmark economy	Counterfeiting economy
$p_0 = \frac{\sigma c}{\sigma - 1}$	$p^* = \frac{\sigma c}{\sigma - 1}$
$q_0 = \frac{(\sigma - 1)}{c}$	$q^* = \frac{(\sigma - 1)}{c}$
$n_0 = \frac{L}{\sigma}$	$n^* = \frac{L}{\sigma + 1}$
$G_0 = \left(\frac{L}{\sigma}\right)^{\frac{1}{1-\sigma}} \frac{\sigma c}{\sigma - 1}$	$G^* = \left(\frac{L}{\sigma + 1}\right)^{\frac{1}{1-\sigma}} \frac{\sigma c}{\sigma - 1}$
	$U_{LE} = \frac{\alpha}{G^*}$
$U_0 = \frac{1}{G}$	$U_{CF} = \frac{-\alpha\sigma\beta^{-(\log\beta)^{-1}}(\log\beta)^{-1}}{G^*}$

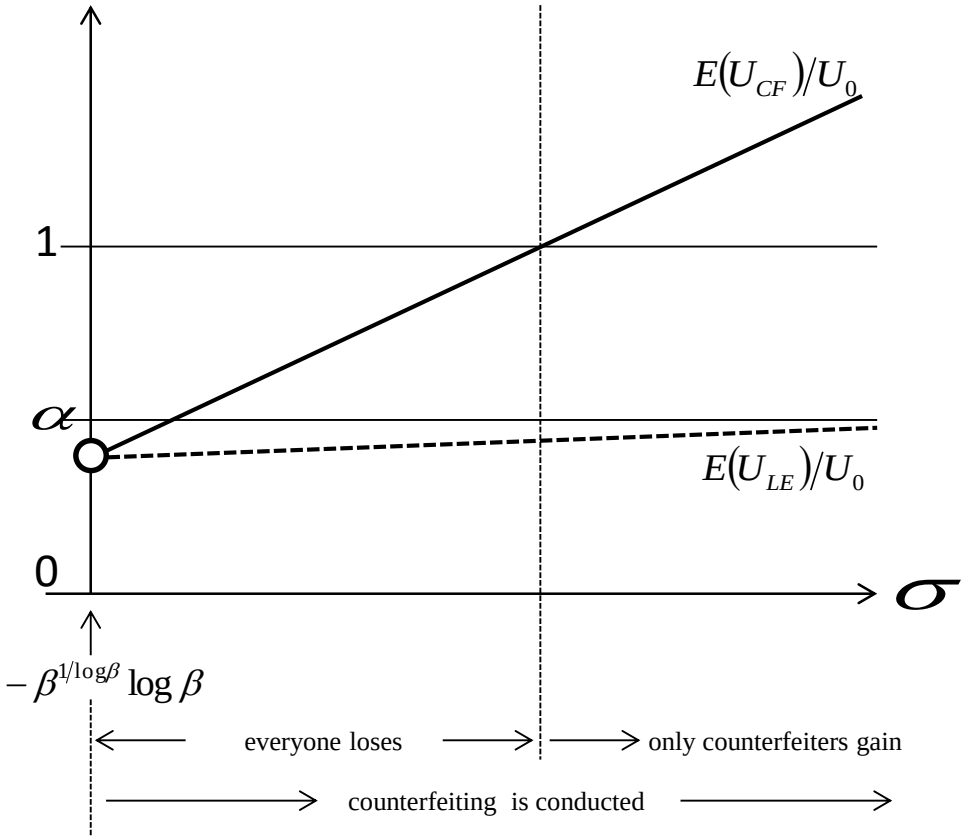

Figure 4: Welfare in a counterfeiting economy

Changes in the level of law enforcement

How would stricter IPR law enforcement work to change the situation? The effect of changes in the level of law enforcement on the counterfeiting economy can be analyzed by the following comparative statics. Consider stricter law enforcement, that is, reduction in β from β to $\tilde{\beta}$. This reduces the probability of consumers' purchasing counterfeits, which raises the level of α. As shown in Figure 5, the increase in α implies an upward shift of the $E(U_{LE})/U_0$ curve.[2] On the other hand, the lower β reduces the counterfeiters' expected income, $E(I_{CF})$. Therefore, the $E(U_{CF})/U_0$ curve shifts downward, which is also shown in Figure 5.[3] Then, as illustrated in Figure 5, when σ is within range A, then $E(U_{CF}) < E(U_{LE})$, so counterfeiters find it profitable to quit counterfeiting and return to legitimate occupations, which will restore the benchmark equilibrium. However, if σ is larger (range B), then $E(U_{CF}) > E(U_{LE})$ still holds, so counterfeiters will stay as counterfeiters.

In this sense, therefore, stricter law enforcement, that is, lower β, does not always work to stop counterfeiting. If σ is small and law enforcement is not sufficiently strengthened, it will have no effect on the amount of counterfeit conducted. Only sufficiently strict enforcement works to eliminate counterfeiting.

Result 5. Strengthening of IPR law enforcement has no effect on the amount of counterfeiting conducted unless it is strengthened enough to totally eliminate counterfeiting.

Less strict enforcement, that is, higher β, works oppositely. The $E(U_{LE})/U_0$ curve shifts downward, while the $E(U_{CF})/U_0$ curve shifts upward. Less strict enforcement, therefore, always worsens the situation in the sense that it lowers the welfare of legitimate people by increasing their probabilities of purchasing counterfeits, and raises the welfare of counterfeiters. This also means that economic inequality between the legitimate people and counterfeiters increases.

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[2] Using (19), $d\alpha/d\beta = -e/\beta(e - \log\beta)^2 < 0$.

[3] Using (29), $\partial E(I_{CF})/\partial\beta = \sigma/e\beta(\log\beta)^2 > 0$.

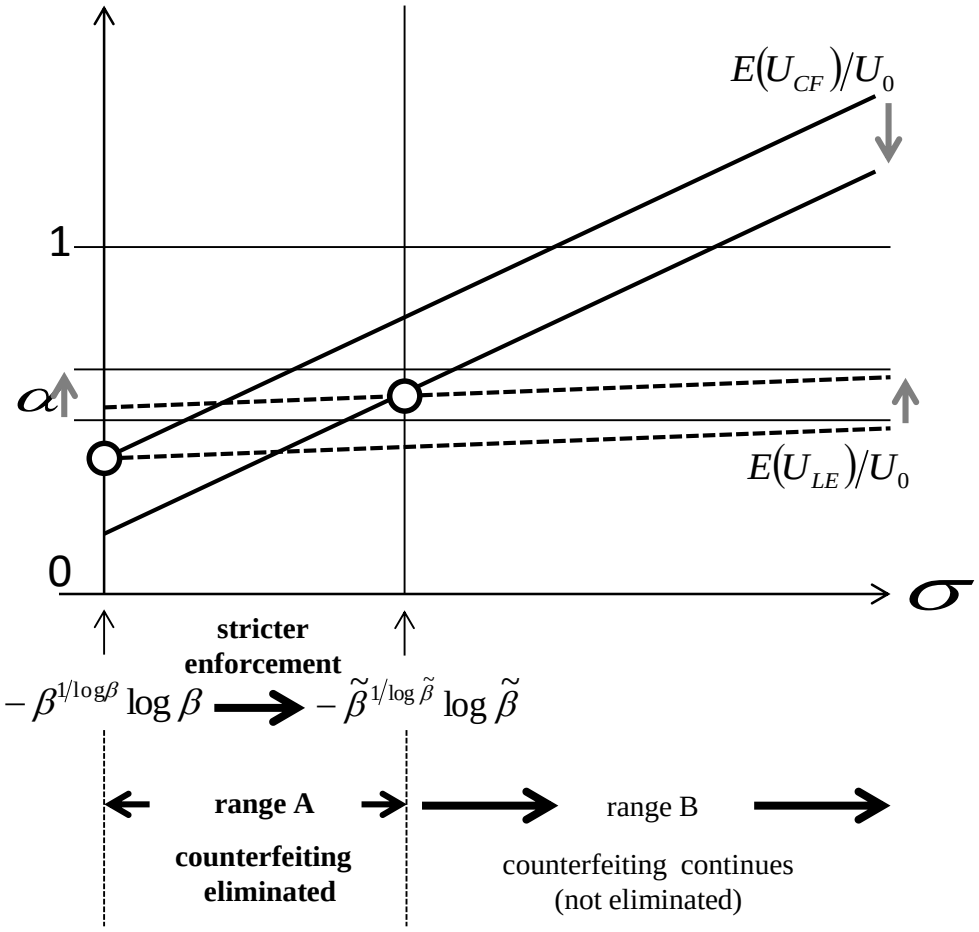

Figure 5. Enforcement and elimination of counterfeiting

5. Conclusion

Applying the entrepreneur formulation of monopolistic competition, this paper analyzed counterfeiting in primary markets, that is, deceptive counterfeiting, in general equilibrium. It first showed that counterfeiting occurs when the elasticity of substitution between existing brands was sufficiently large and/or IPR law enforcement was lax (Result 1). By studying the counterfeiting equilibrium in which all brands were counterfeited by 'shadow' entrepreneurs, it was shown that all 'legitimate' people lose (Result 2a), while the counterfeiters can gain if the outputs of the brands they counterfeit are sufficiently large (Result 2b). Otherwise, nobody gains in the counterfeiting equilibrium (Result 3). There were two sources of welfare loss. One was, of course, the possibility of purchasing counterfeits that offer no utility. The other was the reduction in the mass of varieties available, as a result of people turning to the counterfeiting business. Regardless of whether counterfeiters gain, the counterfeiting equilibrium was found to be stable, implying

that once counterfeiting spreads, it prevails (Result 4). This was because, in relative terms, the expected utilities of the counterfeiters always exceed those of the legitimate people. Finally, it was shown that incremental strengthening of IPR law enforcement may not work to eliminate counterfeiting (Result 5).

The analysis helps to describe the basic economic situation of a society damaged by deceptive counterfeiting, and explains persistent counterfeiting as reported by OECD (2008) as well as the difficulty of eliminating counterfeiting.

In contrast to existing studies that cover secondary counterfeiting markets, since the focus of this study is on deceptive counterfeiting, unsurprisingly all legitimate agents lose from counterfeiting. However, the general equilibrium analysis points out that the counterfeiters themselves can lose, and shows the difficulty of combating counterfeiting both because there is no individual incentive to stop counterfeiting once it is conducted, and because strengthening of IPR law enforcement will have no impact on counterfeiting unless it is strengthened enough to totally eliminate counterfeiting.

The limitations of the analysis should also be noted, however. First, the subject of the analysis is deceptive counterfeiting in primary markets, which is a particular kind of counterfeiting observed today. Second, a long list of assumptions is necessary to generate the counterfeiting equilibrium. In particular, the counterfeiting equilibrium in the present analysis requires a kind of an entry barrier to counterfeiting, since it is assumed that once a brand is counterfeited no other agent can counterfeit the same brand. Third, monopolistic competition, on which the analysis is built, is a particular type of market structure. Fourth, the agents in the model are risk-neutral.

References

Clemens, Christiane (2006) "Monopolistic competition and entrepreneurial risk-taking" *Economics Letters* **93**, 68-74.

Clemens, Christiane (2008) "Imperfect competition and growth with entrepreneurial risk" *German Economic Review* **9**, 180-206.

Dixit, Avinash K. and Joseph E. Stiglitz (1977) "Monopolistic competition and optimum product diversity" *American Economic Review* **67**, 297-308.

E. Kwan Choi (2008) ”Mixed markets with counterfeit producers” in Chapter 15, *Handbook of International Trade*, Volume 2.

Forslid, Rikard and Gianmarco I.P. Ottaviano (2003) “An analytically solvable core-periphery model” *Journal of Economic Geography* **3**, 229-240.

Frank, Jeff (1990) “Monopolistic Competition, Risk Aversion, and Equilibrium Recessions” *Quarterly Journal of Economics* **105**, 921-938.

Grossman, Gene M. and Carl Shapiro (1988a) “Foreign counterfeiting of status goods” *Quarterly Journal of Economics* **103**, 79-100.

Grossman, Gene M. and Carl Shapiro (1988b) “Counterfeit-product trade” *American Economic Review* **78**, 59-75.

Higgins, Richard S. and Paul H. Rubin (1986) “Counterfeit Goods” *Journal of Law & Economics* **29,** 211-230.

Organization for Economic Cooperation and Development, OECD (2008) *The Economic Impact of Counterfeiting and Piracy*, OECD Publishing.

World Health Organization, WHO (2006) “Counterfeit medicines” *Fact Sheet* #275.