Counterfeit Buyers Counter Counterfeiters:
Should Chinese Law Enable Private Enforcement against the Sales of Counterfeits?

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Abstract

To discourage counterfeits and compensate affected consumers, the Chinese government implements a compensation policy that stipulates buyers to receive compensation several times greater than the price of the transacted goods. This rule is exploited by "counterfeit hunters," opportunistic buyers who specialize in detecting counterfeits and only purchase them to claim compensation. Using a static game of complete and incomplete information, I determine, from an efficiency perspective, that the law should maintain the overcompensation while disallowing counterfeit hunters. Although allowing counterfeit hunters to benefit from overcompensation leads to improvement in social welfare than the scenario without overcompensation (and hunters), social welfare further improves if overcompensation excludes hunters but, instead, extends its protection only to sophisticated consumers.

JEL codes: K42, L15, L88, C72, D60
Keywords: Private and public enforcement, counterfeit, informed buyer, quality reduction, compensation policy, moral hazard, strategic behavior.

I. Introduction

1. Counterfeit dissuasion through overcompensation

The counterfeit industry is growing dramatically. Decades ago, Grossman and Shapiro (1988A) have noted that the counterfeit industry is "perhaps the world's fastest and most profitable business." Recently, Forbes confirmed their foresight, reporting that "counterfeiting is now the largest criminal enterprise in the world... (and) China produces 80% of the counterfeits" (Forbes, 2018). According to *the 2020 Status Report on IPR (intellectual property right) infringement* conducted by EUIPO (European Union Intellectual Property Office), the estimated intellectual property rights infringement in international trade of 2016 could reach 3.3% of world trade, which was roughly estimated as EUR 121 billion per year and this number was still expected to increase in 2020.

Although China has been receiving massive criticism on its counterfeiting issue, its legal authority has made palpable attempts to dissuade counterfeits, including the implementation of a series of laws and regulations. To ensure that consumers receive satisfactory reparation after discovering themselves deceived by counterfeits, the legal authority promulgated an overcompensation rule, initiated by the double compensation stipulated by the *Law of the People's Republic of China on the Protection of Consumer Rights and Interests* (Jan. 1994).[1]

In the 2004-amended version of this law, the total compensation rose to three times the original sale price. For counterfeits of specific kinds such as food, the law even prescribed 10 times the original sale price as the highest possible compensation.[2] Whether overcompensation is a reasonable policy is one major question this paper seeks to answer.

2. Counterfeit Hunter, a byproduct of overcompensation

Another issue triggered by the increasing magnitude of overcompensation is the emergence and rapid growth of counterfeit hunters. Counterfeit hunters (short noted as hunters subsequently) are essentially informed and strategic buyers that function as private enforcers against counterfeiting. After acquiring the knowledge to detect counterfeits and the skills to pursue overcompensation, they purposedly purchase counterfeits in the market, gain the identity as victims of counterfeits (and eligibility to compensation), and make their fortune taking advantage of the overcompensating judicature that originally intended to support the truly deceived victims.

Counterfeiting per se is a moral hazard from the supply side, which disrupts the normal market operation and causes detriments to victims, the deceived (and cause reduction to social welfare as well). On the other hand, the counterfeit hunting endeavor is by nature counteractive opportunism from the demand side also. Considering that the law originally intends to protect uninformed buyers who have a concrete consumptive motive behind their purchases, the hunters' endeavor, which disguises themselves as the ones deceived by counterfeits to gain eligibility to compensation, is by nature moral hazard driven by the overcompensation as well. Whether the protection that the law intends to provide to true victims from counterfeiting should also be extended to the opportunistic hunters? This is another key question this paper seeks to answer.

3. Conflicting public opinions over counterfeit hunters

Hunters' supporters share the opinion that hunters are a necessary supplement, or even a superb substitute, to the feeble public enforcement against counterfeits. Indeed, Chinese counterfeits have not

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[1] Article 49 of the law states, "*Business operators engaged in fraudulent activities in supplying commodities or services shall, on the demand of the consumers, increase the compensations for victims' losses; the increased amount of the compensations shall be two times the costs that the consumers paid for the commodities purchased or services received.*" That is to say, if the price of the product in question is ***P***, the total compensation received under this rule shall be 2***P***.

[2] See *Article 96*, *Food Security Law of the People's Republic of China*, June 2009. This overcompensation was later applied to transactions over products in general. I will discuss this in demonstrating the osiliating attitude of the Chinese legal authority over counterfeit hunters.

only inundated the domestic market of China but also flown over to the global market and caused substantial infringements of property rights and quality deterioration over the years (a 2018 Forbes report indicates that China contributed 80% of the counterfeits in the world of that year). Given such an ineffective Chinese public enforcement against counterfeiting, hunters seem to be, at least, a necessary supplement.

Public enforcement is known to suffer motivation deficiency due to the prevalent agent-principal problem. Private enforcers who are residual claimants of their own enforcement businesses are normally much more proactive in producing cases. The supportive attitude over hunters was once dominant when the need to restore the normal operation of the market by dissuading counterfeits was of utmost importance.[3]

Lately, the opposing opinion against hunters has gradually taken the lead in the debate as a result of the surging issues caused by hunters' radical pursuit of compensation. Overenforcement and the over-occupation of legal resources therewith, which further aggravates their shortage per se, are not mere issues from hunters. The hopelessly long process time of courts due to the inundation of hunters' overenforcement squeezes out unprofessional compensation-seekers. The unprofessional seekers mainly consist of the victims who are truly deceived, which are the ones that the law primarily intends to protect.

4. The oscillating legal practice over counterfeit hunters in China

The legal practice in China evolves in a path consistent with the change over the attitude toward counterfeit hunters demonstrated above, namely, from support to opposition. For instance, the *No. 2 Intermediate People's Court of Shanghai* estimated that between 2014 and 2016, more than 30% (a considerable proportion) of processed consumer disputes against counterfeits were filed by counterfeit hunters (the Shanghai Daily, June 2017). The local court's acceptance of such a high volume of disputes signified its supportive attitude toward hunters during that period. The Chinese Supreme Court (*the Supreme People's Court of the People's Republic of China*), the central level of the Chinese judiciary, has once supported hunters too (New York Times, December 2016).[4] Typical evidence resides in its promulgation of the *Provisions of the Supreme People's Court on Several Issues concerning the Application of Law in the Trial of Cases Involving Food and Drug Disputes* (effective since March 15, 2014). This code functions as an official explanation that demonstrates the Chinese Supreme Court's supportive attitude over consumers who seek reparation after knowingly purchasing products with quality problems and has once served as the legal basis for the hunters to engage in their private enforcement businesses against counterfeits.[5]

The law has proceeded toward opposing hunters recently in its reform. Although the counterfeit hunters' excessive occupation of legal resources under their overenforcement is the major social issue in the opposers' concern, this is not the key reason that Chinese law disallows them. Instead, the Chinese legal authority disallows hunters for their pure opportunism. That is their lack of true consumptive purposes under their purchases.

November 2016 witnessed the proposal of *the Regulations for Implementation of the People's Republic of China on Protection of Consumer Rights and Interests*. Article 2 states that "*the rights and interests of consumers in purchasing and using commodities or receiving services for daily (or normal)*

[3] That was in the initial stage of Chinese legal explorations on counterfeit forestallment. More explanation on the stages of the legal evolution under the light of the development of the Chinese market can be found in the discussion section of Section VIII.
[4] Note that the Chinese legal system operates largely as the civil law system in which the supreme court's decision and attitude serves as an instruction for the local-level courts to follow in their judiciary practices. Thus, I hereby provide the evidence of supporting hunters from the aspect of practices of some Chinese local courts and the leading spirit of the Chinese supreme court.
[5] The article of the regulation states, "in a dispute arising out of quality problems with food or a drug, the buyer files a claim against the manufacturer or the seller, and the manufacturer or the seller argues that the buyer purchased the food or the drug knowing that it had quality problems, the people's court shall not support the argument." The spirit of the rule to deter poor quality has been applied by the court to quality problems with all sorts of goods.

consumption shall be under the protection of the present Law, or under the protection of other relevant laws and regulations in absence of stipulations in this Law." The same article attempted to abrogate the support for hunters in the former legislation by specifically "*excluding the consumers who knowingly purchase for profits*."[6] This exclusion of buyers that purchase counterfeits specifically purporting for the profits from (the overcompensation) imposes a targeted hindrance on hunters, barring them from benefitting under the overcompensation rule in the future.

The same change takes place in legal practice as well. Although perfect discerning counterfeit hunters from regular buyers is technically inviable (due to buyers' unobservable intention under their purchases), legal officers use the irregularly large number of lawsuits submitted by each buyer to discern if this buyer is a counterfeit hunter.[7] Starting in 2017, some regional courts have started to decline requests for compensation invoking the reason that "the purchases made by counterfeit hunters were malicious and thus unprotected" (the *Epoch Times*, March 2018). As the *Global Times* reported in 2018, the Chinese courts have been giving special (unfavorable) treatments to cases submitted by the identified hunters, different from their protective attitude to real consumers.

5. To resolve the controversy—the goal of this paper

The Chinese legal authority's reverse in attitude toward hunters, though unequivocal, is yet indecisive. Though having started to affect legal decisions of regional courts, the above-mentioned 2016 regulation is still a proposal that has not yet been officially enacted and merely remains a presumptive indicator of the Chinese Supreme Court's intention for the future direction of legal reform. The long wait time before putting this regulation in effect exudes the hesitation, or at least the conservativism, of the legal authority in taking its position between the two opposite opinions, of which each is backed by some sensible or seemingly compelling reasons. This indecisiveness largely establishes the importance and the contribution of this paper, whose primary goal is to figure out whether the reasons that the legal authority favors or opposes counterfeit hunters are sensible from an economic perspective.

Using a simultaneous game, this paper examines the reasonability of the direction that the law reforms. In particular, I determine whether pure opportunism is a legitimate reason to disallow hunters. Moreover, this paper explicitly explores the following questions: Does the overcompensation rule alone enhance social welfare (the total welfare of buyers and sellers)? Does inhibiting counterfeit hunters from taking advantage of the overcompensation rule further improve social welfare? What is the effect of raising the magnitude of overcompensation on counterfeiters and counterfeit hunters? Is there any difference in this effect between the scenario where the law allows hunters and not?

I find that no matter whether the law allows counterfeit hunters, overcompensation is needed to ensure that this society achieves its highest possible welfare.[8] It is to the best of society (from an efficiency perspective) to set the compensation, which also serves as the fine that a counterfeiter should transfer to the victim, to its maximal level. This echoes the maximal fine conclusion by Becker and Stigler (1974), Polinsky and Shavell (2007, 2000, and 1979).

Meanwhile, I find that opposite to the supporters' belief, the relationship between overcompensation (by nature an institutional form of public enforcement) and counterfeit hunters,

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[6] Translated by the author. This draft of code is promulgated by *the State Council of the People's Republic of China*. By nature, this code is a policy made by the executive branch to clarify how to coordinate with the implementation of the *Consumer Protection Law*. This draft was pending public opinion for a month since November 16th, 2016 but the state council has not implemented its official version till now.

[7] This discernment is imperfect though. As hunters know the legal authority changes its attitude to unsupportive, they may use fake identity or agent buyer to avoid disclosure of their profit-seeking incentive under their transactions and lawsuits.

[8] As the law does not allow hunters, I consider another type of informed buyers instead, the sophisticated consumers. They are informed buyers who do not bear a purely opportunistic motive for their transactions. Unlike hunters who only purchase counterfeits for the overcompensation, sophisticated consumers also purchase and consume if encountering genuine products.

(essentially private enforcers) are not supplementary. Rather, higher overcompensation, id est, a more stringent fine on counterfeiters, squeezes out the proportion of private enforcers (hunters) among buyers. Also, the compensation per se is an effective measure against counterfeiting.

I also conduct a comparison over the social welfare and the strategic proportions (the proportions of strategic agents on each side of the market, namely, counterfeiters among sellers and hunters, or hunter-like informed buyers when hunters are disallowed, among buyers) between the scenario where hunters are allowed and disallowed. Also included in the comparison as a reference is the basic model where there is no overcompensation.

The comparison reveals that in both scenarios under overcompensation, the society can achieve higher social welfare than that of the basic scenario through overcompensation. In the meantime, these two scenarios will have lower strategic proportions on both the demand and supply side of the market than those of the basic scenario. I also verify that, compared to the sophisticated consumer scenario, it takes a larger magnitude of overcompensation in the counterfeit hunter scenario to ensure the superiority in social welfare over the basic scenario. That is to say, under the maximal compensation-fine policy, the sophisticated consumer scenario dominates that the counterfeit hunter scenario in social welfare (holding other settings the same). The pure opportunism of hunters, i.e. the avoidance of genuine products in transactions, is the cause for the waste that leads to the reduction in social welfare and hence the inferiority to the sophisticated consumer scenario.

6. Organization of this essay

In Section II, I will introduce the relevant literature and delineate this paper's contribution. I will enunciate the basic setup and assumptions in Section III. I will analyze the case where the overcompensation rule has not been implemented in Section IV, the scenario where the overcompensation rule has been implemented and thereby instigates the hunters' emergence among buyers in Section IV, and the scenario where the overcompensation rule only extends its protection to informed buyers with true consumptive intention (sophisticated consumers) in Section V. In Section VI, I illustrate the timeline of the evolution of laws and related the findings of this paper to this timeline as a conclusion.

II. Relevance and Contribution to the Literature

Grossman and Shapiro (1988 A & B) and Higgins and Rubin (1986) set the theoretic foundation for studies on counterfeit issues. Grossman and Shapiro developed a taxonomy that classifies counterfeiting as deceptive and non-deceptive. Their 1988B paper focused on the non-deceptive cases, which captured the scenario where consumers purchase counterfeits under the knowledge of the products' underlying counterfeiting nature (inferring from their substandard packages or abnormally low prices). The authors found that the non-deceptive counterfeits can provide consumers more flexible options in the price-quality combination and this flexibility improves social welfare, setting aside the accompanying infringement of property rights.

Grossman and Shapiro (1988A) explored deceptive counterfeiting where consumers accept high prices of products claiming themselves to have good quality, are seemingly high-class but are in fact of inferior quality. The consumers are deceived as they are unaware of the real quality of products, which in most cases quality is unobservable to them at the onset of transaction. Such deception also constitutes an infringement on the intellectual property rights of the original brand owners and hurts their goodwill. Higgins and Rubin (1986) studied such impairment on the brand name with a one-shot game.

The counterfeiting studied in this paper is deceptive since deceptive counterfeiting justifies the social needs for the enforcement (at least from an efficiency perceptive). Also, the infringement of counterfeits on the original brand holders' intellectual property rights will not be specifically investigated as being previously studied already by Higgins and Rubin (1986). Furthermore, the

omission of discussion on brand name dilution ensures that this paper focuses on the demand side, hunters and hunter-like buyers in particular.

Recent theoretic scholarships relevant to counterfeiting include Quercioli and Smith (2015), Yao (2005 A & B), and Yao (2015). Quercioli and Smith (2015) investigated the circulation of counterfeiting money, self-forfeit (private enforcement), and confiscation (public enforcement). Yao's 2005 papers investigated a monitoring policy that employs a fine charged against counterfeiters under the respective catalog of deceptive counterfeiting and non-deceptive counterfeiting. Yao explored the effectiveness of such penalizing policy against consumers who intentionally purchase (non-deceptive) counterfeits in his 2015 paper. Though informative and relevant with counterfeiting, these papers have not yet visited expertized private enforcers against counterfeits from the buyer side (counterfeit hunters). This constitutes the unprecedentedness of the subject matter studied by this paper, as well as this paper's contribution to the literature of (enforcement against) counterfeiting.

Empirical studies regarding counterfeits commonly take the form of surveys and case studies due to the limited availability of data. For instance, De Matos, Ituassu, and Rossi (2007) used survey data to explore 400 Brazilian consumers' willingness to purchase counterfeits so as to test the taxonomy of counterfeiting introduced in Grossman and Shapiro (1988 A & B), that is, the proportion of non-deceptive consumers among the observations. Similarly, Cheung and Prendergast (2006) investigated the counterfeit purchasing behavior of 1,152 adult Asians.

Although the above studies indicated some empirical attempts about consumers of counterfeits, it is more strenuous and unrealistic to acquire accurate statistics for the investigation of the pattern in counterfeit hunters against counterfeits. The counterfeiting data is already unavailable due to the counterfeiters' deceptive intention. The data collection is extra onerous as counterfeit hunters conceal themselves for fear of retaliation from counterfeiters. Moreover, their concealing efforts have grown more imperative as the legal authority has turned unsupportive lately. The clandestine nature of counterfeiters and hunters leads to the insurmountable difficulty of empirical studies on their relationship. Facing such limitations, this paper takes the theoretical path.

The other pertinent scholarships are in the area of enforcement. Two major conclusions in this area are what this paper mainly echoes. The first is the maximal fine conclusion, initially proposed by Becker and Stigler (1974), developed in detail by Polinsky and Shavell (1979, 2000, 2007). The idea is that the optimal enforcement over risk-neutral violators entails maximal fines so as to economize on enforcement resources. Although this paper assumes away administrative costs for litigation and judication, the finding still suggests that the legal authority, if benevolent, shall set the compensation to its maximum.

Landes and Posner (1975) explored the difference between public enforcement and private enforcement. Specifically, their paper discovered that the competition among private enforcers leads to excessive apprehension, over-occupation of legal resources, and a reduction in social welfare. The underprovision of the monopolistic public enforcer, nonetheless, avoids the excessive issue of private enforcement and thus is preferable. The primary goal of Landes and Posner (1975) was to reveal from the aspect of legal resources why the US bounty hunters eventually went extinct. This paper, though not explicitly working on apprehension cost, yields the same result. It expands the validity of the finding of Landes and Posner (1975).[9]

[9] Counterfeit hunters seem to be counterfeit-versioned bounty hunters. Nonetheless, the nature of counterfeit hunters differ from the classic bounty hunters (private enforcers) studied in Landes & Posner (1975). In their paper, bounty hunters hunt for criminals and their successful enforcement yields bounty, awarded by the government or the legal institution. Bounty hunters share a sole identity, enforcers. Counterfeit hunters are different. They pretend to be victims of counterfeits to gain the eligibility to the overcompensation. Hunters are thus technically "victims," and the compensation they receive are also penalty to counterfeiters. These dualities render the counterfeit hunter case so peculiar and different from the classic bounty hunter story. Nonetheless, the two conclusions about enforcement still prevails even though administrative costs, namely, occupation of legal

III. Basic Setup and Assumptions

1. Concepts and definitions

Information asymmetry between sellers and buyers is the premise for the profitability of deceptive counterfeiting. The products appearing in this paper thus are those whose quality cannot be easily ascertained by ordinary (uninformed) buyers before and during a purchase. Such products fall under the categories of "search goods", "experience goods" (Nelson, 1970), and "credence goods" (Darby & Karni, 1973).[10] For simplicity, this paper assumes that uninformed consumers have completely no information about product quality in their purchases.

Following Grossman and Shapiro (1988A), this paper assumes away the influence on brand name from counterfeits. Counterfeits are hence simply substandard products, which are deceptive to uninformed consumers.[11] Assuming that one product can only vary in two dimensions with its comparable ones, price and quality, a deceptive counterfeit should possess a quality that is much lower than the standard but sells at the same price. The deception from such counterfeiting is hence detrimental to consumers and also a society for its lowered quality.[12]

2. Assumptions

a. The supply side of the market

The market that this paper focuses on is a "sub-market" after the establishment of the pricing for products with standard quality, say, by the market interaction between the inventor of this product and buyers.[13] Given this established price $\boldsymbol{p}$, all suppliers choose the quality of their supplies between two discrete levels of quality, $\bar{\boldsymbol{s}}$ and $\underline{\boldsymbol{s}}$, which respectively stands for the subquality of the counterfeits and the standard quality.[14] Given that in this submarket, it is the quality each supplier chooses that determines the authenticity of the product, all suppliers will be considered as a counterfeiter if supplying $\underline{\boldsymbol{s}}$.[15] Counterfeiters and genuine suppliers are subject to the same cost function, $\boldsymbol{C(s)}$ where $\boldsymbol{C'>0}$, $\boldsymbol{C''>0}$. The transaction of the genuine product should be profitable to the seller. This means $\boldsymbol{p \geq C(\bar{s}) > C(\underline{s})}$.

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resources by enforcers are assumed away.

[10] According to Nelson (1970) and Darby & Karni (1973), search goods are those consumers purchase to fill their needs while uncertain about whether such goods will perform as hoped or announced. Experience goods are products the consumer has used before and have a predictable outcome. Credence goods are products that are new to the consumer, but the consumer has faith they will perform well, perhaps because the manufacturer has a respected reputation. In all the three categories, buyers can only infer the actual quality of goods from external factors, not from the direct knowledge of the exact quality per se.

[11] Defining counterfeits as substandard products not only has its literature basis, but also has its application in legal practices. In 2011, The *General Administration of Quality Supervision, Inspection, and Quarantine of the People's Republic of China* officially defined counterfeits as products that "use unreal factory names and addresses, trademarks, product names, and markings that mislead consumers to believe these products are authentic" (*Chinese Quality Supervision Law*, No.83, 2011). This clause of the regulation defines that a counterfeit should encompass two features: 1. convey misleading information to the buyers (thus, this definition rules out non-deceptive counterfeiting); 2. The deteriorated quality of the counterfeits that is incommensurate with the price, in which this price-quality mismatch constitutes detriment to the economic surplus of deceived consumers.

[12] The buyer paying a higher price for a product of lower quality seems to be a distributive (equity), rather than an efficiency, issue. However, the lowered quality also shrinks the total economic gain of the society as the net value from the transaction of this counterfeit diminishes than transaction where standard-quality product is supplied.

[13] The price formation has been thoroughly studied by Mussa & Rosen (1978), further developed by Johsnson & Myatt (2003), and applied in Grossman & Shapiro (1988 A &B). This paper does not replicate their work here and hence studies the market after the price establishment, not during the process.

[14] According to Grossman & Shapiro (1988A), even if allowing continuous choice of quality, if the probability of detection in the counterfeiting nature of the product is invariant to the quality, the market equilibrium will end up with the two extreme levels of quality.

[15] Since brand effect has been assumed away, brand name holders can also supply products of inferior quality and considered counterfeiting the original archetype they have built up. A recent example is the Volkswagen (VW) emission scandal in 2015 where VW programmed the computer of their vehicles to only improve emission performance to pass the emission test while in daily driving the environmental performance of their products are substandard. This is a case of self-counterfeiting. In sum, whether a supplier is a counterfeit is only determined by the quality of the very product in question.

Also, suppliers can change their decision on quality per each unit of product. Thus, one supplier can be considered as a counterfeiter when supplying $\underline{s}$ for the last unit, but as a genuine producer for the next unit if supplying $\bar{s}$.[16] Additionally, I do not distinguish retailers from producers (namely, assume away supply chains) and refer to those on the supply side generally as suppliers (sellers) for simplicity. Furthermore, I assume away consumer protections such as the 30-day free return guarantee, the warranty provided by sellers and third parties, and protection extended by the marketplace.[17]

b. The demand side of the market

Since quality information is independent between each unit of product (see Footnote 16), the utility gained from the past consumptions cannot provide ordinary consumers any reliable implication on the product quality in future transactions, even if these products come from the same supplier. Conclusively, such consumers, if having not acquired the information for the imminent transaction specifically, cannot tell the counterfeiting feature of the upcoming product. Also, the time it takes these buyers to learn the actual quality after purchase (from consumption) is much longer than it takes for counterfeiters to exit and thus elude their legal consequences of counterfeiting. As a result, these buyers have no chance to compensation once completing purchases. I subsequently refer to these buyers as uninformed (or genuine) consumers.

The utility of uninformed consumers comes from consuming each product and is thus dependent on its actual quality. The utility of consuming each product is $U=\theta s-p$, where U stands for utility, s the actual quality of the product in question, p the original price, and θ the consumer's preference index. Consuming the genuine product generates positive utility, $\theta\bar{s}-p>0$.

The alternative identity on the demand side of the market is the informed buyer. Each buyer has to cover the cost I to learn the counterfeiting nature of the product before its impending transaction. The buyer hence becomes informed (for this particular transaction because information acquisition is independent across transactions of each product). Assume I is constant across products and is public information. The identity of the buyer (informed or not) in each transaction is dependent solely on whether they have covered I. I assume away the costs needed to pursue compensation after discerning the counterfeiting nature of the product in question.[18]

I also assume away error in the information acquired. Also, if the informed buyer discerns and reports a counterfeiter, this counterfeit has to compensate as regulated. But counterfeiters are allowed to re-enter the market without other limitations and costs.

3. Setups

The legal authority considers counterfeits as socially bad as they cause a reduction in social welfare due to the lowered quality, not just because they harm the buyers' utility while charging them an unreasonably high price. In math terms, this socially bad condition is that $\theta\bar{s}-c(\bar{s})$ being significantly larger than $\theta\underline{s}-c(\underline{s})$. I will refer to this condition as the "significant social harm" assumption over counterfeits.[19]

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[16] Therefore, if some buyers can acquire information in advance, the information they acquire is independent between each unit of product. Buyers cannot infer the quality of the next unit of product based on the quality of the product supplied in the past or the identity of the supplier. In other words, economies of scale in information acquisition does not exist. Buyers, if acquiring information for products in impending transactions, have to acquire information on a case-to-case basis.That is because the suppilier's identity may vary per each unit if they change the quality supplied.

[17] Liu and Weigngast (2014) has investigated the effectiveness of the Chinese online shopping platforms' countermeasures against counterfeiting. For simplicity as well as practical reason to be explained in the timeline of acts against counterfeiting in the Conclusion Section, such protections over buyers from their marketplaces are assumed away.

[18] This is the apprehension cost in Landes & Posner (1975). Having discerned the product just purchased as a counterfeit, the informed consumer needs to report to the relevant official, go through due process, and may have to outlay litigation costs before finally receiving compensation. Such costs are assumed away (or can be considered as incorporated in I if assuming such costs to be unchanged across products too).

[19] Note that the sign of $\theta\underline{s}$ can be undetermined. In practice, $\theta\underline{s}$ can be negative. For instance, under-quality food can cause health

The market has two sides, demand (buyers) and supply (sellers). Participants on each side cannot switch over to the other (buyers cannot become sellers, vice versa). Participants on each side are homogenous before making their respective choices (on investment in information for buyers and product quality for suppliers).[20] The choice of the participant on one side of the market by default is not observable to that of the other unless informed buyers specifically acquire the one-time information.

The legal authority functions as a market supervisor. By regulating the distribution of liability and the respective compensation if a counterfeiting deception takes place, the legal authority aims to maximize the aggregate welfare of the demand side and the supply side of the market, namely, social welfare. I assume the legal authority to be benevolent, operating as a social planner. It only intervenes in the market via stipulating institutional settings on the compensation rule. I assume away other active enforcement against counterfeiting as a public enforcer such as confiscation.[21]

4. The 4 stages of each round of transaction[22]

A complete round of the transaction contains the following four stages (also see the chart in the appendix that illustrates the information set of each buyer and seller in every stage). In the first stage, the market establishes the standard price, $\boldsymbol{p}$. That is the price of products with the standard quality. The legal authority has also determined a compensation level, $\boldsymbol{T}$, which is to be transferred to those buyers who report themselves as victims of counterfeiting deceptions from the reported counterfeiters. According to the legal studies in Introduction, $\boldsymbol{T}$ is significantly larger than $\boldsymbol{p}$ (normally several times of $\boldsymbol{p}$) under an overcompensation rule and $\boldsymbol{T>p}$ is public information.

The second stage is when participants on each side of the market choose their respective strategies (which determines their identities in this transaction). Buyers choose between staying uninformed and becoming informed by investing $\boldsymbol{I}$. Meanwhile, sellers choose to supply the product with the standard quality or the substandard quality. Participants on each side hold rational anticipation of the opposing side when making their choices.

The third stage is when transactions take place. In this stage, each buyer encounters each seller over a transaction of one unit of product where the seller extended to the buyer a take-or-leave-it offer. Each encounter is random, separate, and independent from other encounters. This setting implies that even if the buyer is capable of telling the authenticity of this product, this information is only applicable for this very unit of the product.[23] Also, given the randomness of the encounter, the proportion of the strategic participants on the opposing side equals the probability of encountering them.[24]

The final stage is the consumption and compensation stage. Now that the transaction is complete, the uninformed consumer will consume the product and acquire the utility according to the counterfeiting feature of the product encountered. The informed buyer will gain overcompensation if the rule stipulates so. On the opposite side of the market, the seller supplying standard-quality products will collect regular profits if encountering an uninformed buyer. This genuine seller may sell or fail to sell if encountering an

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issue, which is then a bad not a good. It can be positive too. Although a counterfeiting *Rolex* watch does not deserve its price, namely, $\boldsymbol{\theta \underline{s} - p < 0}$, it still can function to report time. Hence, $\boldsymbol{\theta \underline{s}}$ is positive in this case. In this paper, I consider $\boldsymbol{\theta \underline{s}}$ positive with minimal magnitude. Namely, counterfeit is still of minor use but much lower than the genuine.

[20] That is, each buyer is identical other than their choice of whether acquire the expertise, or information, of the product liability. Each seller is identical other than their choice of which quality level they have decided for the product.

[21] This assumption can seem too strong and unrealistic. Nonetheless, this assumption is inspired and justified by the hunter supporters' argument on feeble public enforcement. This paper thus explores an extreme setting where there is completely no public enforcer (but the institutional public enforcement measure, the compensation rule) to verify whether the argument of hunter supporters is sensible.

[22] See Appendix 10 for the game tree and the flow chart that demonstrate the stages of the game.

[23] This comes from the assumption where the information acquired for each product is independent and separate.

[24] For a buyer, the chance of encountering a counterfeiter equals the share of counterfeiters among all sellers, noted as $\boldsymbol{f}$ (standing for fake). For a seller, the chance of encountering an informed buyer equals the share of informed buyers among all buyers, noted as $\boldsymbol{h}$ (standing for hunter or hunter-like informed buyers).

informed buyer depending on this buyers' strategy given a specific compensation rule. A counterfeiter, a supplier of substandard-quality products, will accumulate excessive profit by deceiving the uninformed consumer if encountering one.[25]

The transaction of each product takes a complete round.[26] As each round is separate and independent, buyers and sellers can change their strategy in the second stage of each round. In the subsequent section, I will explore the equilibria where buyers' choice stabilizes between uninformed and informed and suppliers' choice stabilizes between counterfeiting and genuine.

IV. Basic Scenario—No Compensation

In the basic model, the legal regulation implements no protection over buyers deceived by counterfeits. It is the special case where compensation is null, i.e., $\boldsymbol{T=0}$. The payoff matrix of this scenario that captures a single round of the game is the following.

Buyer \ Supplier	Authentic *1-f*	Counterfeit *f*
Informed *h*	$(\theta\bar{s}\text{-}p\text{-}I,\ p\text{-}c(\bar{s}))$	$(\text{-}I,\ \text{-}c(\underline{s}))$
uninformed *1-h*	$(\theta\bar{s}\text{-}p,\ p\text{-}c(\bar{s}))$	$(\theta\underline{s}\text{-}p,\ p\text{-}c(\underline{s}))$

Table 1. Payoff matrix of the basic scenario

Under this setting, an uninformed buyer's utility is purely reliant on the chance of encountering a genuine producer. The best an informed buyer can do is to avoid purchasing a counterfeit, which is to be detected by this informed buyer for certain. Anticipating the buyer's pure or mixed decision, a supplier decides on the quality provided for the product to be transacted. Recall that by construction, $\boldsymbol{\theta\bar{s}\text{-}p>0}$, $\boldsymbol{\theta\bar{s}\text{-}c(\bar{s})>0}$, $\boldsymbol{\theta\bar{s}\text{-}c(\bar{s})>\theta\underline{s}\text{-}c(\underline{s})}$.

1. Possible Equilibria

Depending on different magnitudes, this basic scenario may reach a pure-strategy or a mixed-strategy Nash equilibrium.

a. Pure strategy Nash Equilibrium (***PSNE***)

If $\boldsymbol{I>p-\theta\underline{s}}$, the ***PSNE*** occurs as {uninformed, counterfeit}. The inequality indicates that the cost of becoming informed is too high. Buyers would be better off staying uninformed. Having extrapolated that consumers stay uninformed, producers will certainly supply products with the lowest possible quality. As

[25] The rational strategy of informed buyers varies per regulation. If encountering an informed buyer, the counterfeiter may sell the product that brings them a revenue $\boldsymbol{p}$ but is then subject to punishment as the law stipulates. Or this counterfeiter may not sell and hence will not need to compensate if the best strategy for the informed buyer is to circumvent the purchase.

[26] A market with $\boldsymbol{n}$ products sold is viewed as replicating the seller-buyer encounter by $\boldsymbol{n}$ times. Bulk purchase where a buyer can purchase multiple units in one transaction and bulk sale where a supplier sells multiple products to different buyers at one time are not discussed here. However, if bulky purchase and law suit takes place, it is equivalent to lowering the information cost $\boldsymbol{I}$ averaged on each unit of product.

a result, the market is inundated by counterfeits.[27, 28] The social welfare of this equilibrium is $W_P^B=\theta\underline{s}-c(\underline{s})$.[29]

b. Mixed strategy Nash Equilibrium (***MSNE***)

Mixed equilibrium occurs as $I<p-\theta\underline{s}$. Here, the information cost I is low enough to make becoming informed a potentially viable option for the buyer. Under this condition, no pure strategy dominates the others completely. Ergo, both strategies coexist for buyers as well as sellers. Both possibilities, h and f, are in the domain of (0,1). The two equations below define the possibilities in the mixed strategy equilibrium.[30]

Suppliers:
$$p - c(\bar{s}) = (1-h)p - c(\underline{s}) \tag{1}$$

Buyers:
$$(1-f)(\theta\bar{s} - p) - I = (1-f)\theta\bar{s} + f\theta\underline{s} - p \tag{2}$$

From these two equations, the two possibilities in the equilibrium are[31]
$$h^* = \frac{c(\bar{s}) - c(\underline{s})}{p} \tag{3}$$
$$f^* = \frac{I}{p - \theta\underline{s}} \tag{4}$$

The above expressions have economic meanings. The reduction in an uninformed buyer's utility from encountering a counterfeit (compared to consuming a genuine product) is $\theta(\bar{s}-\underline{s})$. This reduction becomes $\theta\bar{s}-p$ if this buyer is informed. Thus, the denominator of f is the avoidance of loss by becoming informed. Combined with the cost it takes to become informed I, the fraction of f is in essence the cost-benefit ratio of getting informed.

Likewise, if a seller chooses to counterfeit, the extra gain is the saved cost of production, $C(\bar{s})-C(\underline{s})$. The potential loss is p when the product cannot be sold as encountering the informed buyer. The cost-benefit ratio of counterfeiting determines the proportion of the informed among all buyers, h. The influences of the exogenous parameters, I, θ, p, $\underline{s}$, and $\bar{s}$, over the two proportions (possibilities) are shown in the illustration below. The economic explanation is in Appendix 2.

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[27] This equilibrium may seem insensible. However, it is consistent with the rationality assumed on buyers. Note that as $\theta\underline{s}-p>-I$, buyers will not be better off by becoming informed. As a result, the upper row of the payoff matrix collapses. Anticipating that buyers will stay uninformed for sure, the most profitable strategy for producers is to counterfeit.

[28] If assuming negative utility from consuming counterfeits, namely, $\theta\underline{s}-p<0$, the condition for ***PSNE*** to hold may not be satisfied. Buyers need to trade off between getting informed (paying I to be able to avert from counterfeits) and stay uninformed (and suffer disutility from counterfeits). If $-I<U(\underline{s})$, in other words, becoming informed is still too strenuous compared to the disutility suffered from counterfeits, ***PSNE*** still holds. Otherwise, ***PSNE*** will not hold since {uninformed, counterfeit} will not be an acceptable and stable outcome. Buyers, realizing the market is inundated by detrimental counterfeits, will choose not to purchase at all. This may push cognitive producers to supply genuine products. Nonetheless, {uniformed, genuine} is definitely not a stable outcome due to the tempting extra profits by counterfeiting. Thus, in the case where $-I>U(\underline{s})$, no pure strategy equilibrium exists.

[29] Subsequently, W stands for social welfare. The superscript B stands for the basic scenario. The subscript P stands for ***PSNE***.

[30] Consistent with game theory in general (introduced in Mas-Collel et al. 1995), the mixed strategy of one party is determined by the payoffs of its opponent. Take h for instance. This is the proportion of informed buyers among all buyers. This proportion is determined by the payoffs of the suppliers, specifically, the cost difference between the two quality levels.

[31] See the corroboration on both h and f are in (0,1) in Appendix 1.

parameter / possibility	I	θ	p	$\underline{s}$	$\bar{s}$
h	**0**	**0**	-	-	+
f	+	+	-	+	**0**

Chart 1. Exogenous parameters' influences on possibilities[32]

2. Welfare analysis

Obviously, ***PSNE*** is an unideal scenario.[33] ***MSNE*** is then the only possibility for higher social welfare. Recall that the social welfare of ***PSNE*** is $W_P^B=\theta\underline{s}-c(\underline{s})$. The social welfare of ***MSNE***, W_M^B is

$$W_M^B = (1-f)[\theta\bar{s} - c(\bar{s})] - hI + (1-h)f\theta\underline{s} - fc(\underline{s}) \quad (5)$$

MSNE dominates ***PSNE*** in welfare as f is small, the deduction of total welfare is large, or the cost reduction is relatively small.[34]

V. The Counterfeit Hunter Scenario

This section captures the scenario where the legal authority implements an overcompensation rule ($T>p$) whose protection is intended to cover all buyers, regardless of their strategies. I assume that the suppliers of counterfeits will have enough assets to pay the compensation even if it exceeds the original price of the product. Therefore, the dissuasion effect from overcompensation is not reduced by the bankruptcy of counterfeiters or protective laws such as judgment-proof.[35]

The informed buyers in this scenario are counterfeit hunters, whose purchases come from the mere purpose of generating profits through overcompensation. Nonetheless, since uninformed consumers are unable to discern counterfeits, counterfeit hunters are, in fact, the only buyers that can benefit from the compensation rule. Note that hunters need to purchase the product and surrender it as evidence for compensation. Thus, this hunter does not retain this product if it is a counterfeit. Also, hunters are purely opportunistic, meaning that they have no consumptive needs. Hence, if encountering genuine products, they will not purchase. Note that assumptions such as the profitable authentic product and positive utility from consuming the authentic still hold. The payoff matrix is below.

[32] **0** indicates no relationship indicated by the equations. – and + respectively indicate a negative and a positive influence.
[33] Recall that in ***PSNE***, the supply side of the market is solely counterfeits while the demand side is solely uninformed consumers. Any transaction takes place must be a deception. The other possible pure strategy equilibrium {uninformed, genuine} is with the highest possible welfare $\theta\bar{s}-c(\bar{s})$. But as discussed in Footnote 27, this equilibrium is unstable and hence arguably non-existent.
[34] Refer to Appendix 3 to see detailed math proof and explanation.
[35] The defenders are judgment-proof when having insufficient assets to pay the victim's damages (Shavell, 1986). In this case, since the penalty is technically capped and cannot increase with the severity of damage or with the decision of the court, the dissuasion is weakened.

Seller / Buyer	Authentic *1-f*	Counterfeit *f*
Hunter *h*	$(-I, -c(\bar{s}))$	$(T-p-I, p-c(\underline{s})-T)$
Uninformed *1-h*	$(\theta\bar{s}-p, p-c(\bar{s}))$	$(\theta\underline{s}-p, p-c(\underline{s}))$

Table 2. Payoff matrix of the counterfeit hunter scenario

1. Possible Equilibria

Two versions of pure-strategy Nash equilibrium and one mixed-strategy equilibrium are possible.

a. ***PSNE*a**: {uninformed, counterfeit}

The provision of this pure strategy equilibrium is $\boldsymbol{T<\theta\underline{s}+I}$. The inequality indicates that compensation is too low to induce private enforcement against counterfeit.[36] This equilibrium is identical to ***PSNE*** in the basic scenario except for the interpretation of the provision. Social welfare of ***PSNEa*** is $\boldsymbol{W_{Pa}^{H}=\theta\underline{s}-c(\underline{s})}$.

b. ***PSNE*b**: {hunter, counterfeit}

If $\boldsymbol{p+c(\bar{s})-c(\underline{s})>T>\theta\underline{s}+I}$, the pure strategy equilibrium, noted by ***PSNEb***, is {informed (hunter), counterfeit}. This set of inequalities indicates that the compensation is high enough to induce the consumer to become a counterfeit hunter, but not stringent enough as a penalty to eliminate counterfeiting. Under such a setting, suppliers, although aware that they encounter hunters for sure, will still choose to counterfeit. This is because even if suppliers undergo a penalty (have to transfer compensation to consumers), their net gain from counterfeiting still dominates that from supplying standard-quality products.[37] The social welfare of ***PSNE*b** is $\boldsymbol{W_{Pb}^{H}=-I-c(\underline{s})}$.

c. ***MSNE***

MSNE holds when $\boldsymbol{T-I-p<\theta\underline{s}-p}$, *and* $\boldsymbol{p-c(\underline{s})-T<-c(\bar{s})}$. This suggests that the compensation $\boldsymbol{T}$ lies under the domain as an intersection between $\boldsymbol{T>\theta\underline{s}+I}$ and $\boldsymbol{T>p+c(\bar{s})-c(\underline{s})}$. Here, the compensation is high enough to make hunter a viable option for buyers (as the former inequality reveals) and strong enough as a penalty to dissuade counterfeiting. Hence, ***MSNE***, where the compensation achieves its intended results completely, is non-trivial (unlike the 2 trivial ***PSNE***s above). Both sides of the market under ***MSNE*** have no dominant pure strategy.

Suppliers:
$$(1-h)p-c(\bar{s})=p-c(\underline{s})-hT \tag{6}$$

Buyers:
$$f(T-p)-I=(1-f)\theta\bar{s}+f\theta\underline{s}-p \tag{7}$$

[36] Recall that the provision for ***PSNE*** in Section IV is interpreted as too expensive ***I***.
[37] This scenario corresponds to the case where the Chinese legal authority first attempted to eliminate counterfeiting but the magnititude of penalty (compensation) was too mild. The consequence is that hunters' activities intensified while counterfeiting still suffused the market.

The probabilities of encountering strategic buyers (hunters) ***h*** and strategic sellers (counterfeiters) ***f*** are therefore[38]

$$h = \frac{c(\bar{s}) - c(\underline{s})}{T - p} \tag{8}$$

$$f = \frac{I + \theta\bar{s} - p}{T - p + \theta(\bar{s} - \underline{s})} \tag{9}$$

· Analysis of parameters

The illustration below summarizes how exogenous variables together with an endogenous variable (compensation ***T***) affect the proportions (possibilities), ***h*** and ***f***. The analyses over exogenous variables and interpretations are similar to those in Section IV under subsection 1.2.[39] Nonetheless, an additional parameter, the endogenous policy variable ***T***, enters into play in this scenario. Since ***T*** only appears at the bottom of both ***h*** and ***f***, raising the compensation level deters both counterfeit hunters and counterfeiters. This finding produces the following proposition.

parameter / possibility	***I***	***θ***	***p***	$\underline{s}$	$\bar{s}$	***T***
h	**0**	**0**	**-**	**-**	+	**-**
f	+	**?**	**-**	+	+	**-**

Chart 2. Parameters' influences on proportions

Proposition 1.
a. the institutional public enforcement (the overcompensation) is effective in deterring counterfeits;
b. the overcompensation, instead of being mutually complementary, squeezes out the private enforcement (of counterfeit hunters).

Here are the interpretations of the above results. Both ***h*** and ***f*** decrease with ***T***. The latter is because, with a raised compensation level, the expected profit of counterfeits decreases due to an increase in loss from each case of detection by hunters. This increase in fine deters suppliers from counterfeiting. Its derivative effect is that counterfeit hunters may decrease as the probability of successfully hunting counterfeits decrease with fewer counterfeiters available. The weakened counterfeit hunting may cause ***f*** to bounce back but the mathematic result indicates that the direct dissuading effect from raising ***T*** on counterfeiting dominates the derivative decrease in the probability of being detected. Therefore, the expected gain from counterfeiting decreases under a higher ***T***.

The effect of ***T*** on ***h*** is less straightforward. Raising ***T*** seems to make counterfeit hunting more profitable for each successful detection. However, the effective dissuasion of ***T*** on counterfeiting vastly diminishes the opportunity of hunting. The result that ***h*** decreases with ***T*** suggests that the decrease in the probability of counterfeit hunting dominates in magnitude over the direct increase in the return from each successful case. Therefore, raising compensation level decreases the expected return from counterfeit hunting, not increases.

[38] See Appendix 4 for corroboration where both ***h*** and ***f*** are in their reasonable domain, (0,1). See Appendix 5 for the positive relationship between ***h*** and ***f***.
[39] Refer to Appendix 6 for the mathematical demonstration of the non-straightforward influences of exogenous variables over ***h*** and ***f***. "?" means undetermined.

· The legal authority's decision on $\boldsymbol{T}$

The benevolent legal authority sets the compensation to obtain the optimal social welfare as stated below.

$$\max_{T} W_M^H = (1-f)h[-I-c(\bar{s})] + fh\left[-I-c\left(\underline{s}\right)\right] + (1-f)(1-h)[\theta\bar{s}-c(\bar{s})] + f(1-h)[\theta\underline{s}-c(\underline{s})] \tag{10}$$

The first-order derivative over $\boldsymbol{T}$ is

$$\frac{\partial W}{\partial T} = \frac{\partial h}{\partial T}\left[-I-f\theta\underline{s}-(1-f)\theta\bar{s}\right] + \frac{\partial f}{\partial T}\{\left[(1-h)\theta\underline{s}-c(\underline{s})\right]-[(1-h)\theta\bar{s}-c(\bar{s})]\} \tag{11}$$

Recall that $\boldsymbol{T}$ influences both $\boldsymbol{h}$ and $\boldsymbol{f}$ negatively. Thus, $\boldsymbol{\partial h/\partial T<0}$, $\boldsymbol{\partial f/\partial T<0}$. The square bracket after $\boldsymbol{\partial h/\partial T}$ is obviously negative. Since the consumer surplus from consuming a counterfeit is lower than that from a genuine product, the term multiplied by $\boldsymbol{\partial f/\partial T}$ is negative as well. Consequently, $\boldsymbol{\partial W_M^H/\partial T>0}$. This suggests a corner solution as optimal compensation (fine).[40] That is, raising the level of compensation to the buyers who encounter counterfeits, which is by itself also the penalty level to counterfeiters, enhances social welfare.

Proposition 2.

Maximal fine, i.e., overcompensation, optimizes social welfare.

This result echoes the finding of Becker and Stigler (1974) and Polinsky and Shavell (2007, 2000, 1979), which suggested that "optimal enforcement over risk-neutral violators entails maximum fines in order to economize on enforcement resources." Their maximal-fine conclusion clearly prevails for the counterfeit hunter scenario.[41] This finding vindicates the Chinese legal authority's efforts in continuously raising the compensation level while counterfeit hunting business germinated at the same time.

Meanwhile, raising the compensation dissuades both counterfeiters and counterfeit hunters. This finding suggests that compensation per se, serving as institutional public enforcement, is effective against counterfeiting. This is opposite against the belief held by supporters for counterfeit hunters where the feeble public enforcement calls for support from private enforcers.

Also, the compensation is exclusive to that of counterfeit hunters. To optimize social welfare, a benevolent social planner should raise the compensation to its highest possible level, meaning reducing counterfeit hunters to its minimal level. This inference supports the opposing opinion against hunters and is consistent with the finding of Landes and Posner (1975) where they preferred public enforcement over private enforcement as well.[42]

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[40] In the current practice of Chines law, $\boldsymbol{T=10p}$.

[41] The counterpart to Landes and Posner's apprehension cost is extent in this scenario. When the genuine product encounters a counterfeit hunter, the hunter avoids purchasing genuine products due to pure opportunism (targeting only on acquiring the compensation). Thus, allowing hunters to operate is costly. In contrast, enhancing the institutional form of public enforcement, i.e., raising compensation, is considered to be of no cost in this paper. In practice, to push the institution to change their policy can incur some cost, but the cost should be negligible in a society where its policy operates by central plan and order where the guiding spirit is to settle counterfeiting problems.

[42] Landes and Posner (1975) explored why bounty hunters, as a typical form of private enforcers, extincted in the U.S. under the change of time and legal environment. They argued that the lack of supply of cases by a public enforcer (a monopoly) alleviates the over-occupation in apprehension if under a competitive market of private enforcers. This paper reaches the same conclusion despite approaching from a different angle. Although counterfeit hunters are by nature identical to bounty hunters if considering compensation as the bounty, the differences are the following two points. One is that compensation has also the duality as a penalty whereas assumed in Landes and Posner (1975) as a private decision of the monopoly or the no-excessive profit outcome under perfect competition. The other difference is that in this paper, the deduction of social welfare due to the circumventation of consuming genuine products by counterfeit hunters (instead of apprehension costs by enforcers in Landes & Posner, 1975) are the reason why counterfeit hunters should be disallowed.

2. Welfare analysis

The social welfare of ***PSNEa*** ($\boldsymbol{\theta\underline{s}-c(\underline{s})}$) is higher than that of ***PSNEb*** ($\boldsymbol{-I-c(\underline{s})}$) given positive information cost ($I>0$). It makes intuitive sense that the welfare of ***PSNEa*** exceeds that of ***PSNEb***. Intuitively, the transaction in the former equilibrium at least generates some utility, though significantly lower than the genuine products. This is an improvement compared to the latter equilibrium where there are merely hunters' legal attempts for redistribution.[43]

Further improvement in social welfare is possible. Recall that under ***PSNEa***, {uninformed, counterfeit}, transactions are purely deceptions of counterfeiting. Under ***MSNE***, although there is a chance of pure loss from a combination of {hunter, genuine}, chances also hold for consumption of the genuine product by a real consumer, {uninformed, genuine}. The ***MSNE*** is presumptively a preferable equilibrium than the pure-strategy ones from an efficiency consideration. The condition where $\boldsymbol{W_M^H}$ surmounts $\boldsymbol{W_{Pa}^H}$ comes from $\boldsymbol{W_M^H>W_{Pa}^H}$.[44] This inequality yields:

$$I + c(\bar{s}) < [1-(1-h)f]\{[\theta\bar{s} - c(\bar{s})] - [\theta\underline{s} - c(\underline{s})]\} \quad (12)$$

Since $\boldsymbol{\theta\underline{s}-c(\underline{s})}$ is significantly smaller than $\boldsymbol{\theta\bar{s}-c(\bar{s})}$ (assumed significant reduction in social welfare by counterfeiting) and $\boldsymbol{1-(1-h)f}$ is relatively close to one, the above inequality can hold even for a relatively large left-hand side.[45] In other words, as long as the information cost combined with the production cost for the genuine products are not too high, it is rather likely that ***MSNE*** dominates the other two pure strategy equilibria in respect of social welfare.

3. Policy implication

Per the demand side of the market, the two options, uninformed consumer and counterfeit hunter, have distinct preferences. From an efficiency perspective, the counterfeit hunter is the socially undesirable option since both {hunter, genuine} and {hunter, counterfeit} yield sub-optimal social welfare, $\boldsymbol{-I-c(s)}$. The hunters' exclusive targeting on purchasing counterfeits to take advantage of the overcompensation, namely, their pure opportunism, brings forth detriments to social welfare.

Note that in the exploration above, the adverse selection that counterfeit hunters' excessive enforcement and over-occupation of legal resources squeeze away uninformed consumers is assumed away. Yet still, hunters are not favored for their pure opportunism under the maximal compensation rule. This justifies the reasonability of the Chinese legal authority in its attempt to disallow hunters for judging their opportunism as "disturbing the normal operation of the market."[46]

For individual buyers, it is not rational to stay uninformed since {uninformed, genuine}, though the first best combination to them, is unattainable. Also, all buyers taking the option to become hunters is undesirable to society (as discussed above, if this is the case, transactions will all come from redistribution purposes and generate no economic gains to society). The second-best scenario is to have a combination of both of these two types of buyers. That is to say, from an efficiency consideration, the legal authority should ensure ***MSNE*** via setting $\boldsymbol{T}$ sufficiently high (under the intersection of $\boldsymbol{T>\theta\underline{s}+I}$ and $\boldsymbol{T>p+c(\bar{s})-c(\underline{s})}$).

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[43] For instance, a buyer consumes a counterfeit of a *Rolex* watch. Though the counterfeit deprived the buyer of their utility from consuming goods of the luxury brand, the counterfeit watch can still serve well the role as a generic watch. Thus, though unworthy the counterfeit is for its price, the transaction of ***PSNEa*** still yields a higher total welfare than ***PSNEb***, in which the buyer purchases only to seek compensation, namely, purely out of a purpose of redistribution, not for its use at all.

[44] Recall that the social welfare of MSNE: $\boldsymbol{W_M^H=-I-c(\underline{s})+\theta\bar{s}-c(\bar{s})-(1-h)f\{\theta(\bar{s}-\underline{s})-[c(\bar{s})-c(\underline{s})]\}}$.

[45] Because $\boldsymbol{h}$ and $\boldsymbol{f}$ are positively related, the multiplication of $\boldsymbol{(1-h)}$ and $\boldsymbol{f}$ shall produce a relatively small number.

[46] Purchasing for consumption is the normal operation of the market. Even when consumers are deceived by counterfeits, the social welfare ($\boldsymbol{\theta\underline{s}-c(\underline{s})}$) is higher than any situation where buyers take the strategic option (the respective social welfare is $\boldsymbol{-I-c(\underline{s})}$).

As to the supply side of the market, the most profitable combination for a producer is {uninformed, counterfeit}. This is a trivial equilibrium that is not necessarily the socially optimal outcome too. From considering both sides of the market, a social planner, or a benevolent legal authority, should set compensation level to induce ***MSNE***, which possibly enables an improvement (at least Kaldor-Hicks) in social welfare.

Recall that the maximization of social welfare under ***MSNE*** calls for setting the compensation to its maximum. Throughout the evolutionary path of relevant laws and regulations, the Chinese legal authority has constantly raised compensation. The above discussion provides an explanation and justification for such legal reforms.

VI. The Sophisticated Consumer Scenario

To further investigate the reasonability of disallowing hunters, this section captures the scenario where the hunter-like informed consumers now have c consumptive intention behind purchases. As the law disallows hunters, the strategic buyers with pure opportunistic intention, the option remains for the informed buyers to become "sophisticated consumers."

The sophisticated consumers are informed buyers whose purchases come from consumptive intention but also know how to utilize the compensation rule to self-protect. Therefore, they consume when encountering genuine products and acquire compensation when encountering counterfeits. They still have to invest ***I*** before each impending transaction to gain the ability to discern a counterfeit if encountering one. And they have to surrender the product when seeking compensation. The two options on the supply side of the market remain unchanged. Below is the respective payoff matrix.

Supplier / Consumer	Authentic *1-f*	Counterfeit *f*
Sophisticated *h*	($\theta\bar{s}$-*p*-*I*, *p*-*c*($\bar{s}$))	(*T*-*I*-*p*, *p*-*c*($\underline{s}$)-*T*)
Uninformed *1-h*	($\theta\bar{s}$-*p*, *p*-*c*($\bar{s}$))	($\theta\underline{s}$-*p*, *p*-*c*($\underline{s}$))

Table 3. Payoff matrix of the sophisticated consumer scenario

1. Possible equilibria

The same as the counterfeit hunter scenario in Section V, this scenario also has 2 pure strategy equilibria and a mixed strategy equilibrium. The 2 pure strategy equilibria are mostly identical to those in the counterfeit hunter scenario.

a. ***PSNEa***:{uninformed, counterfeit}

This PSNE holds when $\boldsymbol{T<\theta\underline{s}+I}$. Social welfare of is $\boldsymbol{W^S_{Pa}=\theta\underline{s}-c(\underline{s})}$. This equilibrium and its interpretation are identical to ***PSNE*****a** in Section V.

b. ***PSNEb***:{sophisticated, counterfeit}

PSNEb holds when $\boldsymbol{c(\bar{s})-c(\underline{s})>T>\theta\underline{s}+I}$. Social welfare is $\boldsymbol{W^S_{Pb}=-I-c(\underline{s})}$. This equilibrium is identical to ***PSNE*****b** in Section V but for a slight difference in the domain of ***T***.

c. ***MSNE***

MSNE holds if $T \in \{T > \theta\underline{s} + I\} \cap \{T > c(\bar{s}) - c(\underline{s})\}$. The probabilities of encountering the strategic opponent, namely, the proportion of participants who take the strategic move (becoming sophisticated or counterfeiting) are defined by the condition where neither of their strategies dominates the other in terms of the expected profit.

Producer:
$$p - c(\bar{s}) = p - c(\underline{s}) - hT \tag{13}$$

Consumer:
$$fT - p - I + (1-f)\theta\bar{s} = (1-f)(\theta\bar{s} - p) + f(\theta\underline{s} - p) \tag{14}$$

These can be rewritten as
$$h = \frac{c(\bar{s}) - c(\underline{s})}{T} \tag{15}$$
$$f = \frac{I}{T - \theta\underline{s}} \tag{16}$$

· Analysis of parameters

Both ***h*** and ***f*** belong to the domain (0,1).[47] The chart below illustrates how they are affected by the parameters.

parameter / possibility	***I***	***θ***	***p***	$\underline{s}$	$\bar{s}$	***T***
h	**0**	**0**	**-**	**-**	+	**-**
f	+	+	**-**	+	**0**	**-**

Chart 3. Parameters' influences on proportions

The findings in Proposition 1 still hold. The rise in the level of compensation ***T***, which itself is a penalty with greater stringency, deters strategic identities on both sides of the market (counterfeiters on the supply side and sophisticated consumers on the demand side).[48] The finding's implication also prevails: 1. the institutional form of public enforcement (the compensation rule) is able to dissuade counterfeiting; 2. This public enforcement also dissuades sophisticated consumers although they are not purely strategic. The latter proves a substituting, competitive, and exclusive relationship the public enforcement has over private enforcement. This again refutes the complementary relationship that the favoring party invoked as a supportive reason for hunters or hunter-like private enforcers.

Also, the two proportions, ***h*** and ***f***, are still positively correlated to each other, the same as they are in Section V.[49] The social welfare of ***MSNE*** increases with compensation too.[50] These results once again corroborate that the findings of classic law and economics literature, specifically, the maximal fine and the preferable public enforcement to private enforcement conclusions, hold.

[47] The discussion is similar to the respective subsection in Section V and is left in the appendix to avoid repetition. See the demonstration of how other factors affect ***h*** and ***f*** in Appendix 7.
[48] I hereby note sophisticated consumers are semi-strategic buyers due to their similarity to counterfeit hunters in their ability of taking advantage of the overcompensation (the strategicness) as well as their true consumptive intention when encountering genuine products (the non-strategicness).
[49] See Appendix 8.
[50] See Appendix 9.

2. Welfare analysis

The two pure strategy equilibria are conceptually trivial due to ineffective compensation.[51] For the same reason stated in the welfare analysis of Section V, ***PSNEa*** {uninformed, counterfeit} and ***PSNEb*** {sophisticated, counterfeit} are not ideal from an efficiency perspective while the former dominates the latter given non-negative information cost. ***MSNE*** is the possible equilibrium to attain higher social welfare. This calls for the social welfare of MSNE to be at least higher than $\boldsymbol{W_{Pa}^S}$. $\boldsymbol{W_M^S > W_{Pa}^S}$ if

$$hfT < (1-f)\{[\theta\overline{s} - c(\bar{s})] - [\theta\underline{s} - c(\underline{s})]\} \tag{17}$$

This inequality will hold under the maximal compensation (fine) policy. Given the assumption that counterfeits bring significant harm to social welfare, the braced term on the right-hand side of the inequality should be of a relatively large scale. As $\boldsymbol{T}$ reaches a high level, $\boldsymbol{f}$ approaches 0. Hence, $\boldsymbol{(1-f)}$ approaches 1 from less. The left-hand side of the inequality can be rewritten into $\boldsymbol{[c(\bar{s})-c(\underline{s})]*I/(T-\theta\underline{s})}$ after replacing $\boldsymbol{h}$ and $\boldsymbol{f}$ with Equations 15 and 16. Under the maximal fine policy, the value of this multiplication approaches 0, which, combined with the large right-hand side, ensures this inequality.

Inequality 17 seems to define an upper bound for $\boldsymbol{T}$. This is apparently contradictory to the maximal fine conclusion. Nonetheless, this inequality in fact defines a lower bound after replacing $\boldsymbol{h}$ and $\boldsymbol{f}$ with Equations 15 and 16.

$$T > I + \theta\underline{s} + \frac{I \cdot [c(\bar{s}) - c(\underline{s})]}{[\theta\overline{s} - c(\bar{s})] - [\theta\underline{s} - c(\underline{s})]} \tag{18}$$

Inequality 14 shall be an attainable range under ***MSNE*** for being a legitimate subset of $\boldsymbol{\{T>\theta\underline{s}+I\}\cap\{T>c(\bar{s})-c(\underline{s})\}}$.[52] Here, though whether Inequality 18 is a necessary condition for $\boldsymbol{T>c(\bar{s})-c(\underline{s})}$ remains undetermined, setting compensation $\boldsymbol{T}$ at a substantiative level ensures the above three inequalities hold. Maximal compensation hence guarantees ***MSNE*** to be superior to any of the two pure strategy equilibria from the efficiency perspective and therefore secures an improvement in efficiency. This finding justifies why the Chinese law has not abrogated the ten-time compensation rule after starting to disallow counterfeit hunters. It also further solidifies the importance of implementing maximal fines, which in the meantime implicitly validifies the public enforcement over private enforcement conclusion.

VII. Comprehensive comparison of MSNE across three scenarios

Recall that the pure strategy equilibria in each scenario are trivial for their ineffective compensation. Also, the social welfare of the pure strategy equilibria is lower than that of the mixed strategy equilibrium under maximal compensation. To obtain optimal social welfare, within each scenario, the benevolent legal authority should attempt to achieve ***MSNE***. The question remains as the ***MSNE*** of which scenario is of the highest social welfare. In this section, I will compare the ***MSNE***s between the three scenarios. The purpose is to discover the scenario of optimal social welfare assuming the same exogenous parameters. The finding will verify if the attempt of the Chinese legal authority to disallow counterfeit hunters, namely, switching from the counterfeit hunter scenario to the sophisticated consumer scenario, is sensible.

1. The strategic proportions (probabilities) on both sides of the market

Recall that the proportion of the strategic suppliers, counterfeiters, $\boldsymbol{f}$ is also the probability for a buyer to encounter such a strategic supplier in a transaction. Similarly, the possibility for a seller to encounter a

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[51] In ***PSNEa***, the compensation is not strong enough to deter counterfeiting as a punitive measure and to incentivize buyers to become informed (sophisticated consumers). In ***PSNEb***, the compensation is only able to motivate sophisticated consumers, not stringent enough as a punitive measure to deter counterfeiting.

[52] It is obvious that if Inequality 14 is a subset of $\boldsymbol{T>\theta\underline{s}+I}$. For Inequality 14 to be a subset of $\boldsymbol{T>c(\bar{s})-c(\underline{s})}$, it calls for $\boldsymbol{\frac{\theta\underline{s}+I}{c(\bar{s})-c(\underline{s})} > 1 - \frac{I}{[\theta\overline{s}-c(\bar{s})]-[\theta\underline{s}-c(\underline{s})]}}$.

strategic buyer in a transaction, $\boldsymbol{h}$ refers to the proportion of informed consumers on the demand side, that of counterfeit hunters under the hunter scenario, and that of the sophisticated consumers under each of their respective scenarios. In all three scenarios, lower $\boldsymbol{h}$ and $\boldsymbol{f}$ lead to higher social welfare. The comparison of the strategic proportions in the chart below provides an indirect reference for the ranking of the three scenarios over social welfare.

Scenario / Prob	Basic	Counterfeit hunter	Sophisticated consumer
h	$\frac{c(\bar{s}) - c(\underline{s})}{p}$	$\frac{c(\bar{s}) - c(\underline{s})}{T - p}$	$\frac{c(\bar{s}) - c(\underline{s})}{T}$
f	$\frac{I}{p - \theta\underline{s}}$	$\frac{I + \theta\bar{s} - p}{T - p + \theta(\bar{s} - \underline{s})}$	$\frac{I}{T - \theta\underline{s}}$

Chart 4. The probabilities of strategic behaviors from the three scenarios

The results of comparisons and their explanations are the following.

a. $\boldsymbol{h^S < h^H, f^S < f^H}$.[53]

The comparison between $\boldsymbol{h^S}$ and $\boldsymbol{h^H}$ is obvious since they share the same numerator while the former one has a smaller denominator. As per the comparison between $\boldsymbol{f^S}$ and $\boldsymbol{f^H}$, $\boldsymbol{f^H}$ has an extra term, $\boldsymbol{\theta\bar{s}-p}$, in both its denominator and numerator than $\boldsymbol{f^S}$, and is hence greater than the latter. Given that a higher probability (or proportion) in strategic behavior (from either side of the market) causes a reduction to social welfare, the sophisticated scenario dominates the counterfeit hunter scenario in terms of efficiency.

b. $\boldsymbol{h^S < h^B, f^S < f^B}$, if $\boldsymbol{T > p}$.

This result of the comparison is straightforward as each of $\boldsymbol{h}$ and $\boldsymbol{f}$ under the sophisticated consumer scenario shares a similar expression to their respective counterparts in the basic model. Under the same logic as Subsection a, the sophisticated consumer scenario is strictly preferred to the basic scenario. This conclusion further supports why the legal authority still maintains the overcompensation after starting to disallow counterfeit hunters while implicitly allowing sophisticated consumers only.

c. $\boldsymbol{h^H < h^B, f^H < f^B}$, if $\boldsymbol{T}$ is much greater than $\boldsymbol{p}$.

The result of the comparison is the same as b. The strategic proportions in the basic scenario are higher than their counterparts in the counterfeit hunter scenario under maximal compensation. The only difference is the condition to ensure lower proportions of strategic agents on each side of the market under the hunter scenario: it calls for a larger difference between $\boldsymbol{T}$ and $\boldsymbol{p}$. Ensuring $\boldsymbol{h^H < h^B}$ needs $\boldsymbol{T-p>p}$, i.e. $\boldsymbol{T>2p}$ (while it only takes $\boldsymbol{T>p}$ to have $\boldsymbol{h^H < h^B}$). The comparison between $\boldsymbol{f^H}$ and $\boldsymbol{f^B}$ is less straightforward, but note that even when $\boldsymbol{T=2p}$, $\boldsymbol{f^H}$ with an extra term, $\boldsymbol{\theta\bar{s}-p}$, appearing in both the denominator and numerator of $\boldsymbol{f^H}$ compared to $\boldsymbol{f^B}$ is still larger than the latter. However, since $\boldsymbol{f^B}$ is a fixed value while $\boldsymbol{f^H}$ decreases in $\boldsymbol{T}$, as $\boldsymbol{T}$ is high enough, $\boldsymbol{f^H < f^B}$ can be ensured.[54] This explains why the Chinese legal authority kept enlarging the scale of overcompensation while allowing counterfeit hunters but ceased to expand the overcompensation after disallowing hunters.

[53] Note that the superscript stands for the scenario each proportion belongs to. ***B*** stands for the basic scenario, ***H*** the hunter scenario, and ***S*** the sophisticated consumer scenario.

[54] The threshold value to ensure $\boldsymbol{f^H < f^B}$ is $\boldsymbol{T=2p-\theta\bar{s}+(\theta\bar{s}+\theta\underline{s}-p)\cdot(p/I)-\theta\bar{s}\cdot\theta\underline{s}/I}$.

Proposition 3.

a. In both the counterfeit hunter scenario and the sophisticated consumer scenario, the strategic proportions are lower than those of the basic scenario (no compensation);

b. The strategic proportions in the sophisticated consumer scenario are lower than their counterparts in the counterfeit hunter scenario.

c. Compared to MNSE of the sophisticated consumer scenario, it takes a higher compensation level for MSNE of the counterfeit hunter scenario to ensure higher welfare than the basic scenario.

2. Comparison over social welfare

Recall the benevolence assumption over the legal authority. That is to say, the legal authority decides the stipulation out of the purpose for maximizing social welfare. It functions as an economic-sense social planner. To complete the comparison and to verify the implications over social welfare across the three scenarios discovered in the proceeding section (under the sophisticated consumer scenario, the society can reach the highest possible welfare), I exhibit the social welfare of ***MSNE*** from the three scenarios in the chart below.[55]

Scenario	Social welfare
Basic	$(1-f^B)[\theta\bar{s}-c(\bar{s})]-Ih^B+\theta\underline{s}(1-h^B)f^B-c(\underline{s})f^B$
Hunter	$-I-c(\bar{s})+(1-f^H+h^Hf^H)[\theta\bar{s}-c(\bar{s})]+(1-h^H)f^H[\theta\underline{s}-c(\underline{s})]$
Sophisticated	$(1-f^S)[\theta\bar{s}-c(\bar{s})]-Ih^S+\theta\underline{s}(1-h^S)f^S-c(\underline{s})f^S$

Illustration 5. Comparison of social welfare across three scenarios

Since the ***MSNE***s of the baseline scenario and the sophisticated consumer scenario are in the same form, the superiority (which ***MSNE*** yields greater social welfare) completely depends on the values of $\boldsymbol{h}$ and $\boldsymbol{f}$. As found out in the last section that both strategic proportions are lower in the sophisticated consumer scenario ($\boldsymbol{h^S<h^B}$, $\boldsymbol{f^S<f^B}$) under a maximal compensation-fine policy, the social welfare of the sophisticated consumer scenario is, therefore, higher than that of the basic scenario. That is $\boldsymbol{W_M^S>W_M^B}$.[56]

Since the proportions, $\boldsymbol{h}$ and $\boldsymbol{f}$, of the sophisticated consumer scenario are lower than their respective counterparts under the counterfeit hunter scenario, the difference between the two social welfare is higher than the outcome of the difference below.

$$W_M^S - W_M^H > (1-h)I + c(\bar{s}) - hfc(\underline{s}) - hf[\theta\bar{s} - c(\bar{s})] \quad (19)$$

Under the maximal fine (compensation), both $\boldsymbol{h}$ and $\boldsymbol{f}$ are minimal. Consequently, the right-hand side approaches to $\boldsymbol{I+c(\bar{s})}$, which is definitely positive. This suggests that the sophisticated consumer scenario is superior to the counterfeit hunter scenario as the legal authority holds the maximal fine (compensation). This finding once again justifies the correctness of the Chinese legal authority's attempts where it has not abrogated the overcompensation stipulations but started to limit the coverage of the protection of such overcompensation to exclude the purely strategic counterfeit hunters but to only support sophisticated consumers who have concrete consumptive needs.

[55] For the same reason illustrated in Footnote 52, ***PSNE***s in all the three scenarios lack practical meaning due to either insufficient deterrence against counterfeiting or insufficient incentive to motivate informed buyers. Moreover, ***MSNE***s arguably yield more social welfare under the maximal compensation policy over ***PSNE***s.

[56] Recall that the superscript stands for the scenario and the subscript stands for the equilibrium (***M*** for ***MSNE***, ***S*** for the sophisticated consumer scenario, and ***B*** stands for the basic scenario).

VIII. Discussion and Conclusion

1. Discussion: The development of the Chinese market and counterfeiting[57]

There are three important periods: the early 1980s to the early 1990s, the early 1990s to the mid-2010, post-2015.

a. The early 1980s to the early 1990s

The early 1980s witnessed the germination of the commodity economy in China. Before 1979, the exchange of commodities had to operate under the plan of government or collective authorities. The *Reform and Opening-up* policy, implemented in 1979, set the tune for allowing the commodity economy to sprout in China. Exchanges of commodities, counterfeits included, started to intensify.

The counterfeiting industry first developed along the Southeast coast of China (Guangdong and Fujian Provinces) as an immigrating business from Taiwan and Japan.[58] The inexperienced consumers, tardiness of the Chinese legal authority in enacting adequate consumer protection policies (since the attempt of the commercial economy was merely tentative then), combined with the emerging counterfeiters gradually brought Chinese society to the ***PSNE*** of the basic scenario (counterfeits inundated the market while consumers, still adapting to the commercial economy, were uninformed).[59] As consumers gradually accumulate richer experience in the commodity exchanges, their ability to discern sub-quality products increased. Accordingly, their cost of ***I*** dropped. When ***I*** fell under the threshold, ***MSNE*** of the basic scenario took over (a mixture of strategies on both sides of the market).

b. The early 1990s to the mid-2010

The 14th National Congress of the Communist Party of China, 1992 announced the decision to establish a (socialist) market economy system. Not long after that, the first version of the *Consumer Protection Law* was implemented in 1994. These all signified the determination of the Chinese administration to ensure an orderly market.

Per counterfeiting, with the above protective laws implemented, the overcompensation rule was first introduced. However, the evolutionary path of the laws and regulations (of keeping raising the compensation level) indicates that the original compensation (***T*=2*p***) was too low. A series of laws, regulations, and policies followed up to raise the compensation to 10 times. The drastically increasing profit margin led to the rapid growth of the counterfeit hunting industry. Meanwhile, counterfeiting has been rampant despite the incrementally stringent overcompensation (penalty).

Given such an observation, it is reasonable to surmise that the Chinese market has started from ***PSNEa*** of the counterfeit hunter scenario where the compensation was too mild as a punishment so the market was still inundated by counterfeits, and it was not effective to incentivize counterfeit hunters either. As the compensation increased, the market transitioned through ***PSNEb*** (compensation was strong enough to incentivize counterfeit hunters but not strong enough to deter counterfeiting) in which a barbaric growth of counterfeit hunters occurred while counterfeiting was still prevalent. Eventually, the market stabilized at MSNE as the compensation is high enough to deter counterfeiting besides incentivizing hunters.[60]

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[57] For this section, I referred to Lin (2008) and Lin (2010).

[58] As Grossman & Shapiro (1988A) first discussed the counterfeiting business, the center of counterfeiting in their perception was still Taiwan and Japan, not yet, mainland China as it is perceived nowadays.

[59] Note that even though the products are substandard, they were still of some use value. Considering the awareness of brand was non-existant and the commodities were of great scarcity in the outset of the establishment of market economy, counterfeits were acceptable to consumers despite their shortcomings.

[60] After massive social turmoil in 1989, the center of the Communist party has been shifted to maintain the stability of the society and its solid control of power. It is reasonable to believe that the administration will not be satisfied if the market is in a complete chaos (***PSNEa*** and ***PSNEb***) where consumers can only expect to purchase counterfeit. Also, the participation of China P.R. to the WTO in 2000 added some impetus from external surveilience. The need of expanding international trading led by the Chinese administration determined its urgence to diminish the difference alleviate the counterfeiting issue. Therefore, the ***MSNE*** should

c. Post mid-2015

As Chinese society gradually experienced and realized the virtue and vice of the purely opportunistic counterfeit hunters, the legal authority has made another attempt, yet undecisive, to disallow hunters while implicitly allowing sophisticated consumers to be the option for the informed buyers. Note that the compensation level that was raised in the counterfeit hunter scenario is still enough to ensure ***MSNE*** in the sophisticated consumer scenario. The maximal fine theory determines that although the overcompensation from the counterfeit hunter scenario (Period 2) is more than necessary, the fine (compensation) is higher the better from the perspective of social welfare. Hence, it is reasonable to see that the Chinese legal authority and administration has not yet attempted to abrogate any of the overcompensation laws, regulations, and policies enacted in period 2.

2. Revisit the independent information assumption[61]

Recall the assumption that the information acquisition for the quality of the product in each transaction is separate and independent. Under the traditional in-person transactions (mainly in period 1 and period 2 in the subsection above), the ineffective public enforcement and the unideal management of the market enabled counterfeiters to avert their legal responsibility by exiting the market and reentering into the market of a different region.[62] This made it necessary for buyers to discern the counterfeiters quickly enough so as to catch counterfeiters before they fled.

The easiness for counterfeiters to escape from legal penalties dramatically increases as it proceeds into the e-commerce era since the mid of 2000s.[63] On one hand, the booming e-commerces aggravated the ineffectiveness of public enforcement against counterfeiting. For instance, as the volume of imports, mainly in the form of just-in-time and small packages, skyrocketed, effective market supervision and strong deterrence to counterfeiters from confiscating their products became impossibly strenuous. This difficulty reached such an extent that both the U.S. and the E.U. admit their failure to effectively eliminate counterfeits (See the reports issued by the U.S. *CBP* and *OECD* in Footnote 62). Since these are the countries and jurisdictions which provide the best intellectual property rights protection it is reasonable to infer that ineffective public enforcement against counterfeits prevails across the globe, China included.

In addition, interdicting counterfeiting became an impossible mission in particular for enforcers in areas to which counterfeits are exported, usually developed countries. This inter-jurisdiction feature of counterfeiting enforcement, as reported by the EU in their 2017 report, has led to "a widely perceived low interdiction risk and less severe consequence if interdicted". By hiding in a remote country where the jurisdiction of victims from counterfeits cannot reach, counterfeiters can easily escape punishment while continuously making illegitimate profits via exporting.[64]

The above facilitation of counterfeiting in the e-commerce era aggravates the difficulty of the respective enforcement. As a result, it takes expertise for informed buyers to discern the counterfeiting feature and act quick enough so that they can acquire compensation while the counterfeiters are still traceable. Due to the easiness for counterfeiters to change their identities to reenter the market without a bad reputation, the discernment of informed buyers should be on a case-by-case basis.

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be a reasonable target. To ensure ***MSNE*** was the underlying reason that prompted the administration and legal authority of China to keep raising the compensation level over the years.

[61] For this section, I referred to Zimmerman & Chaudhry (2009 A & B, 2013) and Chaudhry & Zimmerman (2013).

[62] Corruptions between counterfeiters and the administration even made their business safer and weakened their needs to frequently escape.

[63] According to the *U.S. Customs and Border Protection* (noted as *CBP*), the quick growth of E-commerce provides good soil for the counterfeiting industry. The *European Union* held the same view in its *2017 Situation Report on Counterfeiting and Piracy in the European Union* (noted as the *EU report*). Therefore, e-commerce is a non-negligible context for contemporary counterfeiting issues.

[64] These justifies the assumption away of active public enforcing agents.

3. Conclusion

With game theory, I explored the equilibria of a market where the overcompensation rule made counterfeit hunters a profitable option that buyers can take against counterfeiters. In the mixed strategy equilibrium, an elevation of compensation brings an increase to social welfare. Meanwhile, it causes the portions of strategic agents, namely counterfeiters and counterfeit hunters, to decrease. Therefore, society is better off with a reduction in both by setting compensation to the maximal level. Also, I verified that in this scenario where the informed buyers act as counterfeit hunters driven by overcompensation, the mixed strategy equilibrium dominates other pure strategy equilibria in social welfare and the effectiveness of dissuasion.

Additionally, I explored the sophisticated consumer scenario, which captures the case where the law disallows counterfeit hunters from the protection of the overcompensation rule. I found the above maximal-fine and the public enforcement over private enforcement conclusions still hold. Also, for reference, I investigated the basic scenario where society implements no compensation and informed buyers can only avert from counterfeits.

I compared the proportions of strategic agents on each side of the market together with social welfare across the three scenarios. The comparison indicates that the sophisticated scenario is of the highest social welfare with the lowest portions of strategic agents. I also find that it takes a greater magnitude of compensation to ensure the dominance of (the mixed strategy equilibrium of) the counterfeit hunter scenario over (the ***MSNE*** of) the basic scenario than (the ***MSNE*** of) the sophisticated consumer scenario. Therefore, I offer the economic perspective as a support to the current, yet undecided, overcompensation policy. Although holding overcompensation while permitting it to enable hunters leads to improvement in efficiency over the basic scenario, it is optimal to hold the overcompensation with counterfeit hunters disallowed, which *de facto* supports sophisticated consumers.

This paper has investigated enforcement against counterfeiting that has not been previously visited in the literature. The seminal papers (like Landes & Posner, 1975, Becker & Stigler, 1974) in enforcement all analyzed from different angles, such as apprehension costs and the occupation of legal resources. This paper expands the application of their findings (optimal fine, and that public enforcement dominates private enforcement from the efficiency consideration) in a new context (counterfeit hunter).

As per policy implication, this paper vindicates the legal authority's reason for disallowing counterfeit hunters (for their pure opportunism disturbs the normal operation of the market) from an economic perspective. It supports this undecisive legal attempt that was originally oriented from the formality reason with an efficiency justification. This paper also supports the legal authority to maintain the overcompensation. Combined with a review of the formation and development of the Chinese market economy, this paper explained the evolutionary path of counterfeiting, counterfeit hunter, and counterfeiting-related laws and policies with equilibria found in the three scenarios.

Appendix

Appendix 1. h and f in the basic scenario are both in the (0,1) domain

Since $p>0$, $C(\bar{s})>C(\underline{s})$, $h>0$. Also, since $p>C(\bar{s})$, $h<1$. Thus, the possibility that a supplier encounters an informed buyer (also the proportion of informed buyers on the demand side) h belongs to the domain **(0,1)**. On the other hand, since $U(\underline{s})=p-\theta\underline{s}<0$, the denominator of the expression for f is positive. Combined with a positive I, $f>0$. Also, the provision of this equilibrium, $\theta\underline{s}-p<-I$, gives that $I<p-\theta\underline{s}$. Accordingly, $f<1$. Thus, the possibility that a buyer encounters a counterfeiter (also the proportion of counterfeiters on the supply side) f belongs to the domain **(0,1)**. Both h and f defined by the above equations are in their feasible domains.

Appendix 2. How exogenous parameters affect h and f in the basic scenario

a. Information cost

Since the information cost I only appears in Equation 4, this cost only affects the proportion of counterfeiters among suppliers. The higher it costs for a buyer to become informed, the more counterfeiters will be among suppliers (equivalently, the more likely it is for a buyer to encounter a counterfeiter in a transaction).

Notably, this cost does not enter Equation 3, the equation that determines the proportion of informed buyers on the demand side. Note that an increase in information cost may have two opposite effects for an informed buyer. These effects are 1. More costly to become informed, which dissuades buyers from being informed; 2. More profitable by being informed, as indicated above, a higher I leads to a higher f. This strengthens the necessity for buyers to equip themselves with information to avert counterfeits that are more likely to encounter. The result that the cost of I does not affect the proportion of informed buyers indicates that these two effects cancel completely with each other.

b. Preference index

Similarly, the consumer's preference over quality θ only appears in the mathematical determination for f (the supplier's inclination for counterfeiting), not h (the buyer's inclination for becoming informed). The interpretation of the former is that the higher θ is, the more the surplus ($\theta\bar{s}-p$) is from consuming a genuine product. This larger consumer surplus creates a vaster room for a supplier to seek more profits by counterfeiting. Thus, higher θ tempts more suppliers to counterfeit.

To buyers, two opposite effects coexist as well. On one hand, more counterfeiting increases the need of becoming informed. On the other hand, higher θ reinforces the gains from regularly consuming this product since the extra saving from being informed, $p-\theta\underline{s}$, diminishes. That θ does not enter into the determination of h indicates that these two opposite effects perfectly cancel each other.

c. Price of the standard-quality product

Both h and f decrease with p. Starting with the demand side, the reduction in the payoff of encountering a counterfeit compared to that of encountering a genuine product for an informed buyer is $\theta\bar{s}-p$, for an uninformed consumer, $\theta(\bar{s}-\underline{s})$. Hence, chance in p only affects the informed buyer by decreasing the payoff reduction from running into a counterfeit. This effect alone makes becoming an informed buyer a more attractive option to buyers. However, the decreased probability f weakens the necessity of becoming informed. The mathematical result that h decreases with p suggests the latter effect dominates the former**.**

On the supply side, an increase in p, although seems to enable a counterfeiter to collect more "undue" revenue from each successful deception, its increased incentive is outrun by the following effect. The extra profit from counterfeiting by nature is the save of cost by supplying lower quality. The increase in price renders such a saving less significant. This disincentivizes a supplier from counterfeiting as producing a genuine product and making stable legal income becomes a more viable option. The mathematical result vindicates the conclusion where the latter effect (safer income by producing standard quality) dominates the former (make extra revenue by counterfeiting).

d. Quality

The standard quality $\bar{s}$ only plays a (mathematical) role in the determination of h. Holding other factors unchanged, the buyer anticipates a higher proportion of counterfeiting with an increase in the difference in the cost of production due to the high standard of the genuine product. As a result, the proportion of buyers choosing to be informed will increase. As per the supplier, though extra revenue increases for counterfeiting, the possibility to be avoided as counterfeiter increases as well (due to the increased h). The mathematical result that $\bar{s}$ does not enter the determination for f suggests that the above two opposite effects cancel with each other perfectly.

The low quality of counterfeits $\underline{s}$ does affect both f and h. For the same reason stated above, the decreased lower quality enlarges the extra revenue from counterfeiting. With such anticipation, buyers will be more likely to become informed. As a result, $\underline{s}$ negatively impacts h. Also, the reduction of loss by becoming informed is less significant. Expecting buyers' weaker incentive to become informed, suppliers tend to counterfeit more.

Appendix 3. When ***MSNE*** dominates ***PSNE*** in the basic scenario

Compare the two total welfares by subtraction (combined with (4)):

$$W_M^B - W_P^B = (1-f)\{\theta\bar{s} - c(\bar{s}) - [\theta\underline{s} - c(\underline{s})]\} - hp \tag{A.1.1}$$

Replace h from formula (3):

$$W_M^B - W_P^B = (1-f)\theta(\bar{s} - \underline{s}) - (2-f)[c(\bar{s}) - c(\underline{s})] \tag{A.1.2}$$

By intuition, ***PSNE***a is a less desirable scenario. As a result, I am interested in finding the condition where ***MSNE*** dominates. That is when the above subtraction yields a positive difference. It gives the inequality below

$$(1-f)\{\theta(\bar{s} - \underline{s}) - [c(\bar{s}) - c(\underline{s})]\} > c(\bar{s}) - c(\underline{s}) \tag{A.1.3}$$

Note that the second term on the left-hand side is the deduction to social welfare from a counterfeit. The right-hand side is the cut in cost from lowering the quality, i.e. counterfeiting. The inequality will hold if f is small, the deduction of total welfare is large, or the cost reduction is relatively small. Recall that f is negatively affected by I. As information cost decreases (consumers' awareness of counterfeits awakens, or goods homogenize so that I dwindles on average), ***MSNE*** is likely to dominate ***PSNE***. Also, as society abominates counterfeit more (the term in the braces on the left-hand side enlarges), or the cost-saving by counterfeiting is not as significant (the right-hand side diminishes), ***MSNE*** is also likely to dominate.

Appendix 4. Both h and f are in the (0,1) domain

Both h and f shall lie under the domain of (0,1) for this mixed strategy equilibrium to hold. By construction, $c(\bar{s})-c(\underline{s})>0$. The overcompensation rule guarantees that $T-p>0$. Hence, $h>0$. Also, the rule works as an effective deterrence to counterfeiting gives that $p-c(\underline{s})-T>-c(\bar{s})$. This ensures that $h<1$. As per f, a positive utility from consuming the authentic means that $\theta\bar{s}-p>0$. Together with a non-negative information cost I, the numerator of f is positive. Also, overcompensation and the quality reduction of the counterfeit ensure a positive denominator. Thus, $f>0$. The inequality $T-I-p>\theta\underline{s}-p$ ensures that the denominator is greater than the numerator. This ensures $f<1$.

Appendix 5. The positive relationship between h and f

Combine Equation 8 and 9,

$$\frac{I+\theta\bar{s}-p}{f}+\theta(\bar{s}-\underline{s})=\frac{c(\bar{s})-c(\underline{s})}{h} \tag{A.1.4}$$

Total differentiation yield,

$$\frac{dh}{df}=\frac{(I+\theta\bar{s}-p)h^2}{[c(\bar{s})-c(\underline{s})]f^2} \tag{A.1.5}$$

Both the denominator and numerator are positive by construction.

Appendix 6. How other parameters affect h and f in the counterfeit hunter scenario

The other parameters' influence on h and f are straightforward. The ones that need explanations are $\bar{s}$ on f, p on f, and θ on f. The first two are for the same reason. $\bar{s}$ positively influences f as this is a common addition that both the numerator and denominator of the expression of f share. p negatively influences f since p is the common term that is deducted from both the numerator and the denominator of f.

To determine the sign of θ on f, I rearranged the expression of f.

$$f=\frac{I+\theta\bar{s}-p}{T-p+\theta(\bar{s}-\underline{s})}=1+\frac{I-T+\theta\underline{s}}{T-p+\theta(\bar{s}-\underline{s})} \tag{A.1.6}$$

The partial derivative is

$$\frac{\partial f}{\partial\theta}=\frac{\bar{s}\left[T-p+\theta\left(\bar{s}-\underline{s}\right)\right]-\left(\bar{s}-\underline{s}\right)(I-T+\theta\underline{s})}{[T-p+\theta\left(\bar{s}-\underline{s}\right)]^2} \tag{A.1.7}$$

The denominator is indubitably positive and the numerator is simplified into

$$\text{numerator}=-\left(\bar{s}-\underline{s}\right)I-\underline{s}p+\bar{s}T \tag{A.1.8}$$

The sign of the numerator is undetermined as the first two products are negative while the last product is positive. However, the first two negative terms are fixed values, but in the last positive term, T is multiplied by the largest multiplier among the three terms, $\bar{s}$, and T itself shall reach a high level under the maximal fine (overcompensation) policy. So, it is highly likely that $\partial f/\partial\theta$ is positive.

Appendix 7. Demonstration of both h and f lying under the (0,1) domain under the sophisticated consumer scenario

By construction, $h>0$, also from $p-c(\underline{s})-T<p-c(\bar{s})$, $h<1$. The denominator of f is greater than **0** given $T-I-p>\theta\underline{s}-p$ and with a positive information cost I, $f>0$. The same inequality $T-I-p>\theta\underline{s}-p$ also ensures that $f<1$. Therefore, both h and f are in the feasible domain ensuring a mixed strategy equilibrium provided $T\in\{T>\theta\underline{s}+I\}\cap\{T>c(\bar{s})-c(\underline{s})\}$ under the sophisticated consumer scenario.

Appendix 8. The positive relationship between h and f in the sophisticated consumer scenario

Convert Equations 15 and 16 (from the main text) as represented by T and thus establish a new equation as below.

$$\frac{I}{f}+\theta\underline{s}=\frac{c(\bar{s})-c(\underline{s})}{h} \tag{A.1.9}$$

Total-differentiate with $\boldsymbol{h}$ and $\boldsymbol{f}$,

$$\frac{\partial h}{\partial f} = \frac{Ih^2}{[c(\bar{s}) - c(\underline{s})]f^2} \tag{A.1.10}$$

It is obvious that $\boldsymbol{\partial h/\partial f>0}$.

Note that from Equation A.1.9,

$$h = \frac{c(\bar{s}) - c(\underline{s})}{\frac{I}{f} + \theta\underline{s}} \tag{A.1.11}$$

This functional form between $\boldsymbol{h}$ and $\boldsymbol{f}$ is the same as that of the counterfeit hunter scenario. Thus, the stability of equilibrium still holds.

Appendix 9. The optimal compensation under the sophisticated consumer scenario

The social welfare of ***MSNE*** is

$$\begin{aligned} W_M^S &= (1-f)h[-I + \theta\bar{s} - c(\bar{s})] + fh\left[-I - c(\underline{s})\right] \\ &+(1-f)(1-h)[\theta\bar{s} - c(\bar{s})] + f(1-h)[\theta\underline{s} - c(\underline{s})] \end{aligned} \tag{A.1.12}$$

Note, this is of the same form as MSNE in the baseline scenario.

Take derivative over T,

$$\frac{\partial W}{\partial T} = \frac{\partial h}{\partial T}\left(-I - f\theta\underline{s}\right) + \frac{\partial f}{\partial T}\{-h\theta\underline{s} + [\theta\underline{s} - c(\underline{s})] - [\theta\bar{s} - c(\bar{s})]\} \tag{A.1.13}$$

Because counterfeits bring significant harm to social welfare, the term multiplied with $\boldsymbol{\partial f/\partial T}$ is negative. The term that follows $\boldsymbol{\partial h/\partial T}$ is evidently negative as well. Besides, known that $\boldsymbol{\partial h/\partial T}$ and $\boldsymbol{\partial f/\partial T}$ are both negative. Thus, $\boldsymbol{\partial W/\partial T>0}$.

Appendix 10. Game tree and flow chart

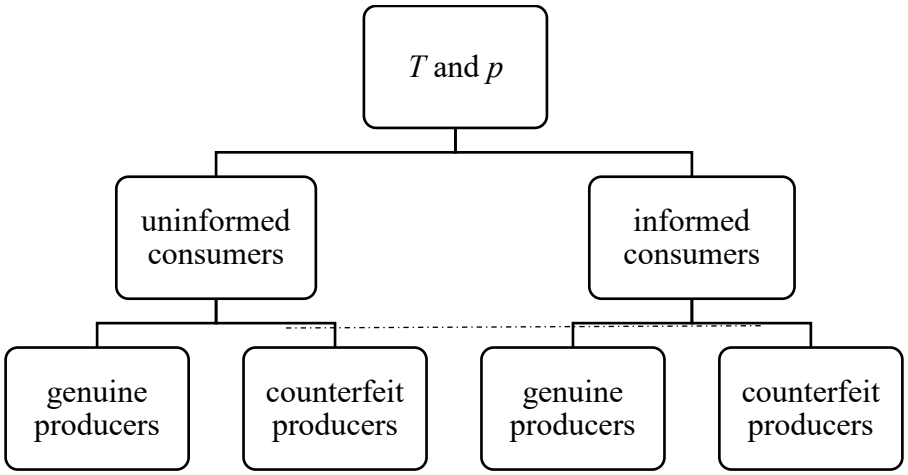

Illustration a. Information sets for market components

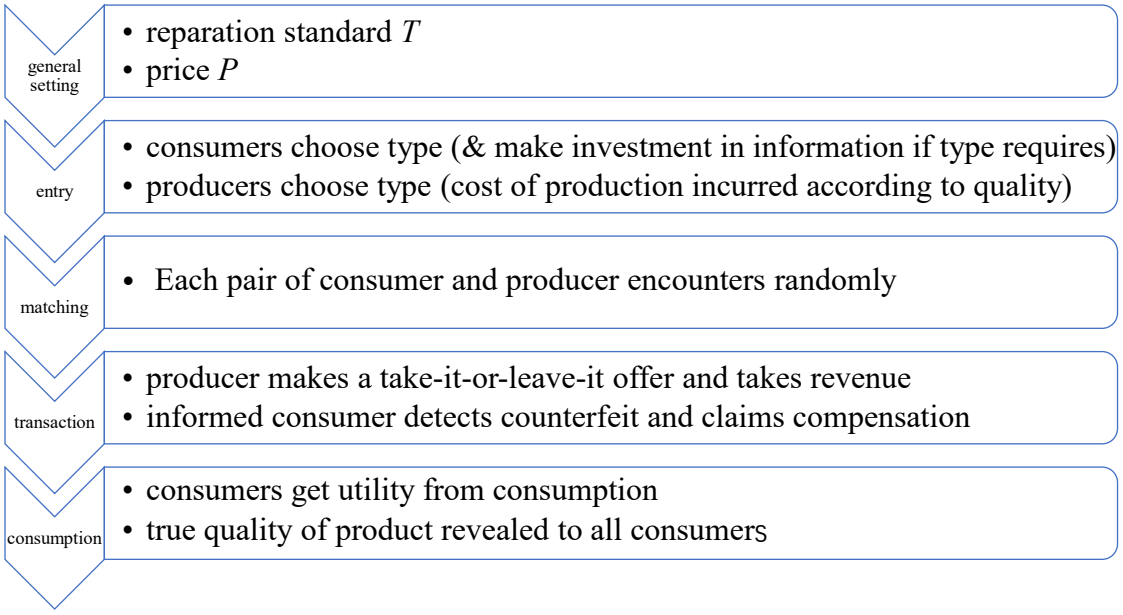

Illustration b. Flow chart of the game

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