A model of counterfeiting: A duopoly approach

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ABSTRACT

This paper establishes a duopoly model, which considers consumers' preference exhibits the horizontal differentiation and vertical differentiation simultaneously, to investigate how counterfeiting affects firms' market power and consumer's purchasing behavior. The effects of government enforcement on counterfeiting are also concerned. The findings tell that (1) the market power of the firms is higher than the one when consumers with only the characteristic of horizontal differentiation or vertical differentiation; (2) when the production cost of a genuine product increases, the consumers who originally purchased this genuine product may continue to purchase the genuine one, purchase the genuine of the other brand, or, quite interestingly, purchase the counterfeiting product of the other brand; (3) If government imposes a (stricter) enforcement on counterfeiting, the consumers who do not have a strong preference on a particular brand of product but originally purchased the counterfeit of this brand of product may instead purchase the genuine one or purchase nothing; the consumers who originally purchased its genuine may instead purchase the genuine of the other brand or purchase nothing.

1. Introduction

Benefiting from expedient computer networks and technologies, many counterfeiting firms can easily acquire information on genuine products, which in turn makes the activities of trademark infringement even more flourishing nowadays. The audacious counterfeiting by firms from some developing countries, such as China and Vietnam, has made this issue a major concern in many international conventions. In particular, according to the Bloomberg news in 2006, trademark infringement, such as counterfeit sales, drains about $250 billion in lost sales from U.S. businesses a year. Clothing, handbags, backpacks, and watches accounted for 56% of the $139 million of fake goods seized by U.S. Customs in 2004. The Business Software Alliance estimates software companies are losing as much as $3.5 billion a year to piracy, prompting U.S. lawmakers to threaten retaliatory tariffs on Chinese imports. Besides, Washington-based International Intellectual Property Alliance estimated in 2010 that the unauthorized use of software within businesses has cost U.S. software companies $30 billion. Consequently, it cannot be ignored while we analyze issues in future global trade as the weight of trades in counterfeiting goods is continuously rising.[1]

The past literature related to counterfeiting can be summarized as follows. The earlier researches by Novos and Waldman (1984), Johnson (1985), and Liebowitz (1985) focus on the issue of "photocopying". In the 1990s, the emergence of computer networks caused consumers' decisions to interact interpersonally. It therefore drew concerns from scholars on the impacts of counterfeits with network externality on market structures and social welfare.[2] Nascimento and Vanhonacker (1988), Conner and Rumelt (1991), Takeyama (1994), and Shy and Thisse (1999) conclude that, when the product has a positive network externality, the existence of

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[1] A European Union-funded report on August 29, 2010 declared that it disputes claims that the counterfeiting of luxury brands is funding terrorism and organized crime, and argues there is little public appetite for tough law enforcement measures as consumers enjoy the bargains offered by the illegal trade, which has been estimated to be worth £1.3 billion in the UK. But tourists purchasing counterfeits in other countries can face prosecution. While the UK authorities target those who trade in fake goods, the government has decided against criminalizing consumers who buy them. In France, the maximum fine for buying fake goods is 300,000 euros (£246,000) or three years in jail.

[2] According to Katz and Shapiro (1985), network externality comes from an increase of product value as the number of consumers for the product increases. A typical example of network externality can be the usage of telephone services in which the value of a telephone network increases as more people use telephones to communicate.

counterfeiting product can have positive effects on both profits of the firm of the original product and consumer surplus.

The existing literature, such as Higgins and Rubin (1986), Grossman and Shapiro (1988), and Banerjee (2003, 2006), Banerjee et al. (2008), Kiema (2008), Banerjee and Chatterjee (2010), and Tsai and Chiou (2012), discuss the issues on commercial piracy. Other literature, such as Chen and Png (1999, 2003), Bae and Choi (2006), Belleflamme and Picard (2007), Cremer and Pestieau (2009), Choi et al. (2010) and Harbaugh and Khemka (2010) analyzes the issues on piracy by end-users.[3] However, the existing literature, except Grossman and Shapiro (1988), Banerjee (2003), Banerjee et al. (2008), and Tsai and Chiou (2012) does not pay attention on the issue of governmental enforcement policy toward commercial piracy.[4] Yoon (2002) also discusses the optimal level of copyright protection.

Contrast to the above-mentioned literature focus on the study of monopoly case, The recent literature, such as Park and Scotchmer (2005), Belleflamme and Picard (2007), and Choi et al. (2010), deals with the duopoly case with piracy. Although there exists literature that utilized a duopoly model discuss the issue on counterfeiting, they considers the consumer preference only with vertical differentiation or horizontal differentiation.

All of the existing literature on counterfeiting regardless of monopoly case, except Park and Scotchmer (2005), Belleflamme and Picard (2007) and Choi et al. (2010), apply a model with "vertical differentiation" of quality in differentiating genuine and counterfeits. In this case, consumers with different quality preferences will choose either genuine or counterfeits. When applying vertical differentiation for consumers' preference, the existing literature cannot further solve the problem of "horizontal differentiation", which means consumers could also make choices among several genuine products based on their own preferences. In other words, characteristics of consumers in the market could concurrently display a vertical differentiation between the genuine and counterfeits and a horizontal differentiation among genuine products from different original firms. Since it is uneasy to distinguish horizontal differentiation from vertical differentiation for consumers with the same preference, the setting of the existing literature on counterfeiting cannot exactly catch the realistic phenomenon.

As we mentioned earlier, both horizontal differentiation and vertical differentiation commonly exist in the real world. We develop a duopoly framework to deal with such co-existence in this paper in order to discuss the behavior of counterfeiting more appropriately fitted in the real world case. Contrast to Belleflamme and Picard (2007) and Choi et al. (2010), this paper focus on the commercial piracy and consumers with both characteristics of horizontal and vertical differentiation. The following issues are discussed in this paper. Since market concentration rate is an important index for measuring the degree of competition in a market, we first investigate the impact on firms' market power in the case of consumers with both characteristics of horizontal and vertical differentiation. That is, we compare the market concentration rates between the market for consumers with both characteristics of horizontal and vertical differentiation and the one for consumers with only the characteristic of horizontal differentiation. Second, we like to answer the question

of whether the consumers with brand loyalty will continue to purchase the genuine while the counterfeiting emerges in the market. Furthermore according to the findings of past literature, which utilize monopoly models, there are effects on consumers' behavior when a government starts to use some policy instruments in preventing piracy. As Grossman and Shapiro (1988) and Banerjee (2003), consumers originally purchasing genuine products could either continue to purchase the genuine products or instead purchase nothing anymore after the government policy, while consumers originally purchasing counterfeits could continue to purchase the counterfeits, change to purchase genuine products, or purchase nothing anymore. We would like to see whether the above effects still hold under a duopolistic setting.

The model in this paper assumes, under Bertrand competition, that there are two original firms and many counterfeiters who can enter/exit the market without barriers. Different from the related literature, our model more appropriately considers the co-existence of horizontal and vertical differentiation to describe consumers' preference.

This paper is organized as follows: Section 2 describes our basic model. The consumers' behavior is explored by using the setting of co-existence of horizontal and vertical differentiation and then the market demand function is derived afterwards. In Section 3 we discuss the consumers' behavior under the case that counterfeiting exists in the market and make a comparison with the results in Section 2. Section 4 analyzes the impacts of government enforcement on consumers' behavior. Section 5 concludes.

2. The model

We first describe the assumptions on the demand side in our model and discuss the consumers' behavior. The analysis of market competition among firms and the impacts of the variation of production cost on market competition then follow.

Assume there are two firms, A and B (thereby A and B for their respective products), in the market as shown in Fig. 1. Firms A and B stand at the two end points, 0 and 1, of the horizontal axis in Fig. 1 respectively. We also assume that there is a horizontal differentiation between A and B for consumers with different preferences. There is a continuum of consumers indexed by x, $x \in [0,1]$, where x is assumed to follow a uniform distribution. The preferences to A and B are $1 - x$ and x, respectively, for a type x consumer. When x is at the point 0 (1), that means the consumer prefers A (B) most.

Since consumers who purchase products not only consider the brand of the product but also the quality, we also assume there is a continuum of consumers' preferences to quality indexed by θ, where $\theta \in [\underline{\theta}, \bar{\theta}]$ and follows a uniform distribution. The closer the consumers' preference to θ ($\underline{\theta}$) is, the more (less) utility the consumers gain from purchasing the product for a given quality. For the purpose of illustrating consumers' simultaneous preferences on horizontal differentiation and vertical differentiation more clearly, we develop an $x - \theta$ plane with x in the horizontal axis and θ in the vertical axis, as shown in Fig. 1.

For a particular consumer x on the horizontal axis represents the degree of preference to B, while θ represents the degree of preference to quality. By assumption, the horizontal differentiation is uniformly distributed at [0,1] and vertical differentiation is also uniformly distributed at $[\underline{\theta}, \bar{\theta}]$. As a result, all consumers are uniformly distributed in the $x - \theta$ plane, while each consumer has a single preference over a combination of x and θ, assuming only one unit of product is purchased. A point in the $x - \theta$ plane moving in a northwesterly direction indicates that the consumer has a higher level of satisfaction on both purchasing A and a certain quality of product.

As shown in Fig. 1, points I, II, and III represent preferences from three different consumers. The consumer I has the same degree of

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[3] Furthermore, there are studies on the government role in controlling piracy, such as Grossman and Shapiro (1988), Banerjee (2003, 2006), Banerjee et al. (2008) and Chen and Png (2003), while some others, such as Higgins and Rubin (1986) and Chen and Png (1999), analyze the original firm's role in preventing piracy through various instruments. Peitz and Waelbroeck (2006) provide a critical overview of the theoretical literature that addresses the economic consequences of end-user copying.

[4] Contrast to Grossman and Shapiro (1988) or Banerjee (2003, 2006), Banerjee et al. (2008) discuss the case that the counterfeiting good is a perfect substitute of the original one.