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Online Markets of Counterfeit Products:

A Comparison Between High-Tech & Low-Tech Products

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Abstract

Nowadays, counterfeiting is becoming a greater threat to the well-known companies and brands. On one hand, technological improvements have let the counterfeiters to imitate almost every product category –from fashion industry to high-tech electronics products. On the other hand, online stores and ecommerce website have provided new channels for counterfeiters in order to sell their illegal products.

This research investigates the differences of counterfeiting in the high-tech products and traditional vulnerable products to counterfeiting on the online market. In particular, it discusses which of the two groups are more exposed to counterfeiting on "Amazon.it", what are the main countries offering counterfeit products, and the differences in the behavior of vendors in terms of offered price for the counterfeit and genuine products.

To reach these goals, this study follows the qualitative analysis of the data by collecting the data about two product categories in the electronics sector and two product categories for the low-tech products. We based our judgment, for identifying the counterfeit products, on the reviews provided by the customers on "Amazon.it".

Our data reveal that low-tech products are more probable to be counterfeited on the "Amazon.it". Moreover, most of the vendors that are selling the counterfeit products are local stores –especially, for the high-tech products. Finally, it seems that well-known ecommerce websites like "Amazon.it" are presenting a deceptive market; thus, the difference in the discounts offered for the counterfeit products and genuine ones is not statistically significant.

Abstract (Italian version)

Oggi, la contraffazione sta diventando una minaccia maggiore per le aziende e i grandi marchi. Da un lato, i miglioramenti tecnologici hanno permesso ai contraffattori di imitare quasi tutte le categorie di prodotti, dall'industria della moda ai prodotti elettronici high-tech. D'altra parte, i negozi online e i siti Web di e-commerce hanno fornito nuovi canali per i contraffattori al fine di vendere i loro prodotti illegali.

Questa ricerca indaga le differenze della contraffazione nei prodotti high-tech e nei prodotti tradizionali vulnerabili rispetto alla contraffazione sul mercato online. In particolare, ha discusso su quale dei due gruppi è maggiormente esposto alla contraffazione su "Amazon.it", quali sono i principali paesi che offrono prodotti contraffatti e le differenze nel comportamento dei venditori in termini di prezzo offerto per i prodotti contraffatti e genuini .

Per raggiungere questi obiettivi, questo studio segue l'analisi qualitativa dei dati raccogliendo i dati relativi a due categorie di prodotti nel settore elettronico e due categorie di prodotti per i prodotti low-tech. Abbiamo basato il nostro giudizio, per identificare i prodotti contraffatti, sulle recensioni fornite dai clienti su "Amazon.it".

I nostri dati rivelano che è più probabile che i prodotti a bassa tecnologia siano contraffatti su "Amazon.it". Inoltre, la maggior parte dei venditori che vendono prodotti contraffatti sono negozi locali, in particolare per i prodotti high-tech. Infine, sembra che i noti siti di e-commerce come "Amazon.it" presentino un mercato ingannevole; pertanto, la differenza tra gli sconti offerti per i prodotti contraffatti e quelli originali non è statisticamente significativa.

1. Introduction

In recent years, internet has affected many aspects of the human lives. Online stores and ecommerce websites are one of the consequences of this revolutionized world. Beside the positive impacts of online markets, they have become a potential channel for selling counterfeit products (Arnold, et al., 2016; Farrand, 2018; Feng, 2017; Li, 2014). Indeed, counterfeiters have the possibility for selling their illegal products through well-reputed websites like "Amazon" which could harm, not only, legitimate jobs and companies' profits; but also, can be a threat to the individuals' health (Tsai & Chiou, 2012; Di Liddo, 2018; Davidson, et al., 2019; Septianto, et al., 2019; Smith, et al., 2019; OECD/EUIPO, 2017).

As a result, combatting counterfeiting has become more challenging. Identifying counterfeits are more difficult as they are being sold through legitimate channels and counterfeiters bear less risk (Treadwell, 2012; Chaudhry, et al., 2011; Farrand, 2018). Moreover, in the case that the host website is not aware of the illegal activity of counterfeiters, the host websites are not responsible for illegal activities of the counterfeiters (Feng, 2017). Therefore, a new market has emerged for counterfeit products.

Counterfeiting is a growing phenomenon. According to OECD/EUIPO report (2016), "trade in counterfeit and pirated goods amounted up to 2.5% of the world trade in 2013". Nowadays, this phenomenon affects almost every industry and is not limited to the fashion industry and low-tech products, anymore (Tom, et al., 1998; Bastia, 2002; Huang, et al., 2015; OECD/EUIPO, 2017). Based on the data about the seizures provided by the customs officials, "Electrical machinery & equip. & parts, telecommunication equip., sound recorders, television recorders" is the second product category that is vulnerable to counterfeiting –after "articles of apparel and clothing accessories" (OECD/EUIPO, 2017).

One of the solutions for dealing with online counterfeiting is the online customer reviews. Potential buyers tend to trust them as they are provided by the other customers rather than sellers (Fresneda & Gefen, 2019; Chen & Xie, 2008). Many researchers have demonstrated that

negative reviews have higher impacts on the purchase behaviors of the customers than the positive ones (Chevalier & Mayzlin, 2006; Ren, et al., 2018).

In this research, we have relied on the customer reviews in order to analyze the differences of the vendors' behaviors, on the online markets, in offering counterfeit products in the electronics sector and traditional vulnerable products to counterfeiting –e.g. sunglasses, shoes, etc.

To do so, we focused on the "Amazon.it" as one of the largest ecommerce websites in Italy. We have chosen two products in the electronics and collected the relative data about them. The two products, in this sector, are "Apple EarPods" and "Beats Headphones". For the other group, we decided to choose the two product categories which are traditionally considered as vulnerable to counterfeiting. "RayBan Aviator" and "Adidas shoes" are the two products for the low-tech sector.

Based on the customers' reviews, we have tried to identify the counterfeit products in each product category in order to address three main questions:

Q1: Are high-tech products more exposed to be counterfeited on the online markets like "Amazon.it"?

Q2: What are the main countries that are offering counterfeit products on "Amazon.it"?

Q3: Are the vendors offering the counterfeits at a lower price or a higher discount in comparison to the genuine ones?

The remaining of the research is organized as follows. Chapter 2.1 provides the definition of counterfeiting, classification of the counterfeiting markets, and the general problems in mapping the phenomenon. Chapter 2.2 is dedicated to the previous researches' findings concerning the scope of the counterfeiting, consumers' behaviors, and implications of counterfeit commerce for genuine producers. Chapter 2.3 discusses about the counterfeiting in e-commerce website by looking at the regulation and impacts of the consumers' reviews. Chapter 3 explains the process of the data collection, as well as, providing information about each product category in this research. Finally, in the chapter 4, we discuss about the results and conclude the paper.

2. Counterfeiting

2.1 Definition and general problems of mapping the phenomenon

Counterfeiting is the infringement of Intellectual Property Rights (IPRs) by illegally producing and selling products which have been copied from established brands (Lai & Zaichkowsky, 1999; Qian, 2014; Penz, et al., 2009). Based on the awareness of the customer about the counterfeit goods, counterfeiting market can be classified into "primary" or "secondary" market. Primary market which is also called "deceptive counterfeiting" is the market of counterfeit goods where the consumers are fully deceived believing the purchased product is genuine. While, the market in which the customers consciously buy the counterfeits because of their lower willingness to pay or other incentives is called "secondary" or "non-deceptive" (Sharma & Chan, 2011; Grossman & Shapiro, 1988). However, there are some researchers who claim that sometimes it is not possible to categorize the products into these two markets as customers are not sure about the product being counterfeit or genuine. For instance, they might have doubts that the lower price of product is due to the product being on sale or being fake (Omeraki Çekirdekci & Baruonu Latif, 2019).

Criminal nature of counterfeiting makes the suppliers and producers to transport counterfeit products through complex routes, relabel and/or repackage them in transit points, ship in small quantities, falsification and misrepresentation of documents, etc.; in order to make the identification and seizure of them as difficult as possible for the authorities (OECD/EUIPO, 2017; Briatta, 2019; Viswanathan, 2016). Thus, it is implausible to have precise information about the size, impacts, or other factors of this market (Briatta, 2019; Fink, et al., 2016; OECD/EUIPO, 2017; Chaudhry & Zimmerman, 2009).

Technological developments could enhance the potential of the firms to retaliate with counterfeiting more effectively (Meraviglia, 2018); however, these new technological opportunities along with globalization have been causing the counterfeits to be almost everywhere and let the manufacturers to produce them ranging from low quality products -that

are easily detectable- to high quality counterfeits -which are indistinguishable from the genuine ones (Bupalan, et al., 2019; Meraviglia, 2018; Davidson, et al., 2019). Furthermore, another negative consequence of global improvements is the online selling of fake products over the internet. It is considered as a serious and complicated challenge for firms and relevant authorities since prosecution of criminals is harder with respect to traditional markets (Chaudhry, et al., 2011).

2.2 Literature review on counterfeiting

2.2.1 Overview of the phenomenon

The attention towards counterfeiting have been increasing since it could affect the sales of well-established firms, threaten legitimate jobs, and even more importantly cause serious health problems especially when it comes to fake pharmaceutical and foodstuff products (Smith, et al., 2019; OECD/EUIPO, 2017; Septianto, et al., 2019). The negative impacts of counterfeiting in the electronics sector could be even more serious than other sectors. According to Huang et al. (2015), "The use of electronic counterfeits can cause reduced performance of circuits, such as instability of clock frequency, operating life decrease, a lower storage memory space, or failure of the whole system". Moreover, another critical threat of the counterfeiting is linked to the fact that profits of this business would make criminal organizations -that are involved in the different phases of manufacturing and delivering the products- more powerful and would provide funds for other illegal activities (Davidson, et al., 2019) while debilitating the government due to shrinking incomes coming from taxes (Di Liddo, 2018).

Despite of all developments regarding policies and regulations about IPRs, not only the market of counterfeit products exists but also it is still growing (Park-Poaps & Kang, 2018; Meraviglia, 2018; Septianto, et al., 2019; Amar, et al., 2018; OECD/EUIPO, 2017). It is difficult to have precise estimations about this phenomenon. In fact, the main obstacle is the illegal nature of counterfeiting. It is only feasible to have estimations based on reported seizures by police or other responsible authorities (Chaudhry & Zimmerman, 2009).

The estimation about the global market size of counterfeiting was 60 billion USD in 1985 (Grossman & Shapiro, 1988). While, based on the report of OECD/EUIPO (2017), this market has increased to 461 billion USD in 2013. This counts for around 2.5 percent of global trade. Nevertheless, there is no sign of slowing down of its growth and it is supposed that by 2022 the market of counterfeiting and piracy would reach 4.2 trillion USD (Septianto, et al., 2019). Reduced

costs, technology improvements, high profits, globalization, consumer complicity, etc. are the reasons of this continuous growth (Chaudhry & Zimmerman, 2009).

Counterfeiting is affecting many different product categories and it is not limited to the fashion industry anymore. Nowadays, even the electronics sector is affected by this phenomenon (Tom, et al., 1998; OECD/EUIPO, 2017; Bastia, 2002; Huang, et al., 2015). There are three types of electronic counterfeit products; Legitimate chips re-marked to be sold as higher grade product, re-packaged refurbished or counterfeit products into a branded original box, and duplicated products usually made from inferior materials (Bastia, 2002). The estimation is that around 10 percent of purchased high-tech products are counterfeit which accounts for 100 billion dollar loss for the companies yearly (Huang, et al., 2015).

The non-deceptive market normally include apparel, clothing, shoes, and other similar products as they initiate less health concerns in comparison to pharmaceutical or technical products (Pratt & Zeng, 2019). Moreover, they can be detected by customers easier if they are not genuine (Fink, et al., 2016). Nevertheless, it is claimed that majority of counterfeit goods consumers are buying them unknowingly (Qian, 2014).

However almost every product could be subject to counterfeiting, the vulnerability varies significantly for different industries (Jacobs, et al., 2001; OECD/EUIPO, 2017) –for example, the estimation for US companies in 1986 indicates that counterfeit goods sales were 14.6 percent of legitimate sales in entertainment sector while 0.4% for firms operating in extractive, natural resources, chemical products (Feinberg & Rousslang, 1990). High volume, high tech, high price, prestigious, and famous branded products are more exposed to be counterfeited (Jacobs, et al., 2001).

In 2008, Organization for economic co-operation and development (OECD) has prepared a report whose one of its primary goals was to address the economic impacts and scope of counterfeiting. This study is based on the international trades of counterfeit and pirated products. Hence, it does not take into account the locally produced and consumed counterfeits –which is deemed to be

significant, while only focusing on the data about the seizures provided by the customs officials (OECD, 2008).

Based on the OECD report (2008), the most vulnerable product category to counterfeiting is "articles of apparel and clothing accessories" –around 30.6% of all seizures of counterfeits belong to this category. Other most sensitive product categories based on the percentage of seizures are (OECD, 2008):

- Electrical machinery & equip. & parts, telecommunication equip., sound recorders, television recorders: 26.8%
- Articles of leather, saddlery & harness, travel goods, handbags, articles of guts: 7.9%
- Footwear, gaiters, & the like: 5.4%
- Tobacco & manufactured tobacco substitutes: 5.4%

These five categories account for more than 76% percent of all the seizures happened in 17 reporting countries[1] (OECD, 2008). The other product categories that were recorded in the OECD report and account for the remaining 24% of the seizures are the followings (OECD, 2008):

- Clocks & watches and parts thereof: 4%
- Toys, games & sports equip., parts & accessories: 3.7%
- Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments & accessories: 1.9%
- Paper & paperboard, articles of paper pulp: 1.6%
- Furniture, bedding, cushions, lamps & lightning fittings, illuminated signs, nameplates & the like, …: 1.5%
- Pearls, stones, prec. Metals, imitation jewelry, coins: 1.3%
- Miscellaneous manufactured articles: 1.2%
- Headgear & other parts: 1.2%
- Nuclear reactors, boilers, machinery & mechanical appliances, computers: 1.2%

[1] The reporting economies include: Andorra; Australia; Hong Kong (China); Croatia; Cyprus; Czech Republic; Fiji; Hungary; Latvia; Mauritius; Portugal; Romania; South Africa; Spain; Thailand; TFYR of Macedonia; United States.

- Oils & resinoids, perfumery, cosmetics or toilet preparations: 1%

Nevertheless, these are only rough estimations through the best guess which could not reflect the actual dimensions of the phenomenon. Indeed, they are inferred based on the seizures information of counterfeit products in the 17 reporting countries (Fink, et al., 2016).

Using the same methodology –i.e. analyzing the data about the seizures of counterfeit products, we can have estimates about the possible routes through which the counterfeits are being traded (OECD/EUIPO, 2017). While it is difficult to identify the origin country of counterfeit goods as manufacturers and producers tend to export them through complicated routes (OECD/EUIPO, 2017), according to the OECD/EUIPO report (2017), the conceivable origin countries or transit points would be different for each product category. Based on the available data, it is assumed that China is the main producer of counterfeits –however, its share varies based on the product category (OECD/EUIPO, 2017; Chaudhry & Zimmerman, 2009); which follows by some other countries that are considered as the main sources of fake products such as Hong Kong (China), Singapore, United Arab Emirates (UAE), and Turkey (OECD/EUIPO, 2017).

Regarding the transit points, they are used by counterfeiters in order to falsify the documents and make it more difficult to identify the counterfeits –by relabeling, repackaging, etc. (OECD/EUIPO, 2017). Hong Kong (China), Singapore, and some middle eastern countries –for example, the UAE, Yemen, Saudi Arabia, etc.- are among the important intermediary points (OECD/EUIPO, 2017). The destination of these fake products varies for different product categories. Generally, every country could be a target for counterfeiters; however, developed countries like the United States, Japan, and EU countries would be a typical destination for all different product categories (OECD/EUIPO, 2017).

According to the seizures data, there are different types of shipments which can be used for transferring of counterfeit products. They could be shipped via sea, air, road, rail, or mail (OECD/EUIPO, 2017). The selection of appropriate conveyance method along with the size of shipments –i.e. number of items which have been shipped- are varying according to the product category –for instance, for perfumery and cosmetics, it is more common to ship in small

quantities via mail; while shipments in large quantities through air is used more for counterfeit foodstuff (OECD/EUIPO, 2017).

2.2.2 Consumers' behavior

Analyzing of customers' behaviors towards counterfeiting is essential since the existence of this market is highly linked to the consumer demand (Septianto, et al., 2019). Therefore, it is interesting and crucial to explore why people are motivated to buy counterfeits despite of its criminal nature (Marticotte & Arcand, 2017). For instance, Turunen & Laaksonen (2011) stated that this demand emerges when the genuine products' brands have a significant value for customers, otherwise there would not be any copy of them.

Buying a specific brand is a way that customers are using to convey their desired characteristic and identity (O'Cass & McEwen, 2004). Counterfeit goods usually provide the opportunity for them to experience the high-status and exclusivity perception associated with expensive brands at a lower price (Marticotte & Arcand, 2017). As a result, it might be interpreted that only low income consumers are the target of them; however, even individuals with high income are encouraged to buy high quality fakes –which are difficult to be identified as fake (Pueschel, et al., 2017). In fact, they might use both genuine and counterfeit products to have the possibility to possess more products (Omeraki Çekirdekci & Baruonu Latif, 2019). Consequently, psychological needs of customers to own specific brands would lead them to be tempted in acquiring fakes –which have price advantage comparing to the original ones- in both deceptive and non-deceptive market (Meraviglia, 2018).

An important factor prompting customers to buy counterfeits –knowingly or unknowingly- is their perception about value-price tradeoff. In spite of the fact that fake products usually have inferior quality compared to genuine ones, some buyers might perceive their value higher relative to the price (Tang, et al., 2014). In other words, the likelihood of buying counterfeits is higher for price-conscious consumers who are seeking to maximize the utility of the product (Kim & Karpova, 2010). Indeed, the cheaper price makes the purchase process more pleasant (Penz &

Stöttinger, 2012). Moreover, some extra benefits would also increase the value for the buyer. For example, it is possible for some products to acquire their counterfeits easier with less effort as they are everywhere (Tang, et al., 2014). Besides, counterfeits may make customers feel that they are smart shoppers as they are finding the counterfeit a better deal in comparison to the genuine one (Penz & Stöttinger, 2012). As the consumers are trying to maximize the value, they have the tendency to buy those fakes whose performance can be assessed before the purchase in order to reduce the risk of having under-performed product (Cordell, et al., 1996).

In the deceptive market, it can be claimed that the customers' tendency to knowingly buy counterfeits varies for different product categories –for example, based on national surveys 98% of counterfeit cigar buyers were fooled thinking it was genuine while for footwear only 70% of purchases were made in the primary counterfeiting market (Qian, 2014). Typically, due to their less risk, fashion fake products are more probable to be purchased by customers in comparison with counterfeits which have greater functional components (Tom, et al., 1998).

There are some factors that might increase the inclination of consumers towards fake products in the deceptive market. Indeed, consumers' intentions towards buying fakes increase when also their friends are users of them (Albers-Miller, 1999). Moreover, the ones who have used counterfeits in the past and was satisfied with their experience are more willing to buy them in the future (Tom, et al., 1998). Because of their cheaper price, counterfeits also might be used by consumers in order to try the product before buying it and understand if the original one is worth its price or compare different products (Gentry, et al., 2006).

In spite of the incentives for buying counterfeit products, most of consumers feel guilty and are ashamed of using them along with experiencing fear due to their illegal nature (Penz & Stöttinger, 2012). Thus, they are trying to justify their misbehavior in order to reduce unpleasant feelings (Bian, et al., 2016). To do so, consumers tend to refuse their responsibility believing others –e.g. government- should take care of this situation (Bian, et al., 2016). Furthermore, they use other neutralization techniques by providing excuses in order to pretend that purchasing of counterfeits should not be considered as an unethical behavior which allow them to escape from their sense of guilt (Omeraki Çekirdekci & Baruonu Latif, 2019).

The social and financial risks associated to counterfeits is another significant determinant of consumers' decisions when they are considering fake products (Bian & Moutinho, 2009). Social risks include the risks of losing desired personality if others find out that the purchased product is not genuine and start thinking about the buyer as a cheater (Wee, et al., 1995). While, financial risks are the ones linked to the possibility of malfunctioning the product (Cordell, et al., 1996). As a result, as the perceived risks of a counterfeit product for a person increases, the possibility of buying reduces (Bian & Moutinho, 2009).

To put it in a nutshell, buyers of counterfeits are always facing the trade-off between benefits and drawbacks of purchasing them. Experiencing pleasant feelings of owning branded products without paying their actual price, having the opportunity to better follow the fashion, more enjoyable adventure, and so on are the factors motivating customers in purchasing counterfeits (Marticotte & Arcand, 2017; Tang, et al., 2014; Penz & Stöttinger, 2012; Gentry, et al., 2006). While, financial, social, and performance risks of fake products along with unethical and illegal nature of them might make people to avoid considering them (Bian, et al., 2016; Penz & Stöttinger, 2012; Omeraki Çekirdekci & Baruonu Latif, 2019; Bian & Moutinho, 2009; Cordell, et al., 1996; Wee, et al., 1995).

2.2.3 Implications of counterfeit commerce for genuine producers

Due to the fact that counterfeits damage the customers' trust and reputation of the brand, their existence could lead to reduced sales and profit of genuine products (Tsai & Chiou, 2012; Di Liddo, 2018; Davidson, et al., 2019; Septianto, et al., 2019). It is a challenge for the well-established brands as counterfeits are able to enter the market shortly after the introduction of the product with a lower price (Gao, et al., 2017). In the case of primary or deceptive market –where consumers unknowingly buy fakes, this would be a bigger problem as these customers are potential users of original products (Grossman & Shapiro, 1988; Sharma & Chan, 2011; Liu, et al., 2016). Indeed, counterfeiting market harm the fair competition and also prevent customers to have full and correct information about the products (Goñi-Mendizabal, 2018).

As a result, gradually the existence of counterfeiting market could destroy the perception of customers about the brand which is known as “brand dilution” (Di Liddo, 2018). In fact, the moral disgust resulting from the counterfeit product could also lower the perceived performance of the genuine one (Amar, et al., 2018). Therefore, even informing customers about the existence of the imitated fake products could have a negative impact for the firm (Amar, et al., 2018).

As consumers of a specific product are becoming aware of the existence of the counterfeits, even the perceived value of the genuine one reduces for them (Fink, et al., 2016). As a result, this lowered perceived value could force the companies to decrease the price, enhance the quality of the products, or introduce new products (Grossman & Shapiro, 1988; Qian, 2014). Nevertheless, the improvement of quality requires more investments for the innovation which leads to higher prices –that have a negative impact on the sales (Qian, 2008). However, it is probable that firms decide to work on improving observable characteristics of the products in order to retaliate with counterfeiting rather than enhancing their actual performance (Qian, et al., 2015). This kinds of strategies are more common in situations or countries where there are shortcomings regarding the protection of the IPR. Hence, companies pursue costly self-enforcement tactics (Qian, 2008). Usually, these strategies include focusing on the appearance of the products rather than their actual performance –e.g. innovations about the packaging of the product to be conspicuous, introduction of licensed stores, or obtaining international certificates (Qian, 2008).

By the way, counterfeits could be even helpful for some branded products to increase their sales by attracting consumers’ attention and motivating them to purchase the genuine ones (Wagner, et al., 2019; Qian, 2014; Takeyama, 1994). This positive spillover is more attached to high-end, less-established firms in addition to the new products. In fact, counterfeit products are helping the sales when the product is not pervasive (Qian, 2014). On the contrary, for well-known products and brands, it would be probable for them to suffer from the imitated and fake products resulting in reduced sales and profits (Qian, 2014). Moreover, for the product categories that owning by more individuals let other users to better exploit the utilization, counterfeits could have positive effects for the brands through the so-called “network externalities” (Takeyama, 1994).

2.3 Counterfeiting in e-commerce

2.3.1 Counterfeiting purchased/sold on digital marketplaces

It is obvious that the internet has been changing human lives in recent years. One of its crucial impacts, is the emergence of online market places where customers have the opportunity to purchase different types of products in easy comfortable ways (Arnold, et al., 2016). As a consequence, opportunistic criminals are also attracted to this market. Based on the features of online markets, they are tempted to sell counterfeit goods over the internet (Arnold, et al., 2016; Farrand, 2018; Feng, 2017; Li, 2014). In fact, the digital world is assisting the counterfeiters to sell their products using new and diversified techniques (Treadwell, 2012; Mavlanova & Benbunan-Fich, 2010). As Farrand (2018) claimed that "new business sectors such as online auction sites and pharmacies was leading to an unprecedented increase in opportunities to infringe intellectual property rights offered by the Internet". Counterfeiters leverage on e-commerce and auction-style websites, social networks, search engines results, use of similar domain names with slight difference of the original one in the spelling, etc. in order to advertise and sell their products (Carpineto & Romano, 2017; Farrand, 2018; Raman & Pramod, 2017; Treadwell, 2012).

Some researchers have argued that counterfeiters are nowadays more willing to sell the fake and imitated goods in the online world rather than through traditional channels (Carpineto & Romano, 2017; Raman & Pramod, 2017). In other words, the online markets have some seductive advantages for these criminals. First of all, it is easier for sellers of counterfeit goods to hide their actual identity which could help them to escape from the prosecution (Li, 2014; Raman & Pramod, 2017; Treadwell, 2012). Treadwell (2012) in his research has interviewed some criminals who have sold counterfeits on the "eBay" website and all of them have mentioned that the internet has reduced the risk of selling counterfeits. Indeed, identification and seizure of the counterfeits which are sold over the internet is much more difficult for the relevant authorities (Farrand, 2018; Chaudhry, et al., 2011; OECD/EUIPO, 2017). Secondly, as trust in the seller is a highly attached to the purchase decision of the customers, criminal sellers can take advantage of the credibility of the host website –for example, Amazon or eBay- and deceive the customers

easier; making them believe that the product is authentic (Mavlanova & Benbunan-Fich, 2010; Treadwell, 2012). Moreover, selling over the internet does not require much time while it also reduces dramatically the costs since a physical store is not needed (Mavlanova & Benbunan-Fich, 2010; Treadwell, 2012). In addition, using the internet, counterfeiters are not limited to a specific region and could advertise and sell their products all most everywhere in the world (Farrand, 2018). Moreover, the detection of a counterfeit product in one website or online channel, does not ban the illegal seller to find other sales channels in internet, as it takes little effort for a returning customer to find a vendor that moved to a new channel (Arnold, et al., 2016).

According to Mavlanova and Benbunan-Fich (2010), "advanced product presentation has a positive influence on user perceptions of the authenticity of products and increases user willingness to buy on-line". Therefore, criminal sellers of counterfeit products in the deceptive market try to sell them using two different tactics. One of the common methods that they use to deceive the customers in the online market places, is called "bait-and-switch" strategy. To do so, sellers put the pictures and descriptions of the genuine product on the website; hence, the customers would think the item is authentic while after the purchase the counterfeit would be delivered to them (Arnold, et al., 2016; Li, 2014; Mavlanova & Benbunan-Fich, 2010; Raman & Pramod, 2017). It is a common case since a certain product cannot be inspected by customers before the delivery (Miao, et al., 2018; Mavlanova & Benbunan-Fich, 2010). Indeed, they should make the decision based on the provided information on the websites (Mavlanova & Benbunan-Fich, 2010). For example, one of illegal sellers of counterfeit products in the research of Treadwell (2012) has mentioned: "What I do is I get a good photograph of an authentic bag that is the copy of the one you are selling. Nowadays, you can take a few photos in a shop on your mobile, go into Selfridges and that, easy. It makes it look even more real, fucking sneaky eh, and then I'll use that to sell fakes and they [eBay] don't delete your listings".

The other strategy of counterfeiters for selling fake products in the deceptive market is based on hiding of the crucial information from the customers. In this case, the seller does not provide any wrong information, and instead intentionally deceives the customers by omitting information or

data that would help the customers understanding that the product is not genuine (Mavlanova & Benbunan-Fich, 2010).

According to Grazioli & Jarvenpaa (2003), “deceivers select their tactics as a function of their victim as well as their purported identity Sellers”. Specifically, they select one of the two abovementioned tactics for the sale of counterfeits in the deceptive market based on the characteristics of the transaction, product, and user (Mavlanova & Benbunan-Fich, 2010).

2.3.2 Regulations

On the one hand counterfeiting over the internet is becoming rather pervasive (Carpineto & Romano, 2017; Feng, 2017) and on the other hand most of the previous actions and regulations have failed to achieve considerable results because it is a new complicated problem which includes a large number of websites and users involved (Farrand, 2018; Arnold, et al., 2016; Mavlanova & Benbunan-Fich, 2010). For example, the two proposed laws in the United States regarding the infringements on IPRs which were “Preventing Real Online Threats to Economic Creativity and Theft of Intellectual Property Act” and “Stop Online Piracy Act” have been rejected before their implementation due to the public disagreement (Jones, 2015). Another reason which makes combatting with criminals difficult is the fact that counterfeiting is not limited to a specific region as a user is able to sell a fake product in multiple countries (Farrand, 2018). Also, the detection of fakes on the internet is more difficult since counterfeiters are able to copy the official web shops or sell them through legitimate e-commerce websites (Farrand, 2018).

Therefore, there is still the need to discover how it is possible to limit the illegal activities of the counterfeiters in the digital world in an effective way (Farrand, 2018; Feng, 2017; Li, 2014). Nevertheless, the lack of data about the size of the market and difficulties in identifying counterfeit goods sold on the internet, makes it intricate to coming up with an applicable solution (Farrand, 2018).

More specifically, one of the open discussions in the field of digital counterfeiting is related to the sale of counterfeit products by online stores over the e-commerce websites. Based on the current regulations, in the case of infringement of the IPRs by an online store in an e-commerce website like Amazon, usually, the host website is not responsible while the illegal activities of the infringer would help the website to make profit (Feng, 2017). Feng (2017) has mentioned in his research that according to American and European law, "Internet Service Providers (ISP) have no obligation to actively monitor information uploaded or published by internet service users, because such an obligation would be overly onerous for ISPs and thus be detrimental to the development of internet-related industries". Indeed, they are only asked to take an action when they have discovered a user is violating the regulations (Farrand, 2018).

Feng (2017) has claimed as e-commerce platform service providers are -directly or indirectly- profiting from the activities of their users along with the fact that they have the power to control and monitor these activities, they should be also liable for these illegal action. In fact, they should be liable as they are facilitating these illegal activities (Feng, 2017). Hence, the possible solution is to actively monitor the activities of third parties by the service providers (Arnold, et al., 2016). In other words, their role should be defined in a clearer way that eradicates ambiguity (Farrand, 2018).

However, even in the absence of regulations which would force the service providers to monitor the activities of the online seller, yet it is essential for them to do so. In fact, the presence of counterfeits which would be sold to customers, could damage their trust to a specific website and reduce the sales (Farrand, 2018; Miao, et al., 2018). The reduced number of demand from customers means the reduced activities of the sellers –legitimate or illegitimate ones (Farrand, 2018; Miao, et al., 2018). On the contrary, the monitoring and controlling the activities of the vendors are costly for the companies (Miao, et al., 2018). This puts service providers in a dilemma. According to Miao et al. (2018), platforms should find the optimum amount of efforts to put for monitoring the sellers and detecting infringers –for example, by focusing on the sellers with high transactions. It is assumed that their cooperation with responsible authorities would increase the possibility of their success in this battle (Miao, et al., 2018; Farrand, 2018).

To put it in a nutshell, it is perceived that the websites and channels are not very concerned about the detection of illegal sellers since they are gaining proceeds from their wrongful activities (Treadwell, 2012). Even the customers are less suspicious about the products offered on well-known e-commerce and auction-style websites like Amazon and eBay since they trust these channels (Mavlanova & Benbunan-Fich, 2010). One of the interviewees –who is a seller of illegal products on eBay- in the research of Treadwell (2012) has explained his experience as: "When I was market trading and that, when you sold knock off, some people would ask you, is this above board, well you never say 'no' do you, I wasn't going to say, 'it came off the back of a lorry this morning love', but on the net, people just don't ask them kind of things. Because it's off eBay, they don't suspect at all". As a result, it is crucial to make people aware of different aspects of counterfeiting over the internet and educate them about its negative effects for the market and society (Li, 2014).

2.3.3 Consumers reviews in online markets: importance / impact on sales

Consumer reviews in online market places were emerged as a consequence of this revolutionized world. Based on Chen and Xie research (2008), "Amazon.com began offering consumers an option to post their comments on products on its website in 1995. Currently, Amazon.com has about 10 million consumer reviews on all its product categories, and these reviews are regarded as one of the most popular and successful features of Amazon" (Chen & Xie, 2008). Indeed, online reviews are considered as one of the different types of electronic world of mouth (eWOM) (Fresneda & Gefen, 2019; Moriuchi & Takahashi, 2018). According to Hennig-Thurau et al. (2004), eWOM is defined as "any positive or negative statement made by potential, actual, or former customers about a product or company, which is made available to a multitude of people and institutions via the Internet".

Nowadays, the attention of the e-commerce websites is also increasingly directed to consumers' reviews as a new trend; since they are willing to show their customers that they care about their experience (Moriuchi & Takahashi, 2018; Li, et al., 2018; Zhu & Zhang, 2010). As a result, it is

possible to find online reviews about different types of product categories that would give insights to the customers (Chen & Xie, 2008). According to Elwalda et al. (2016), "e-vendors who provide OCRs –online customer reviews- seem to be trustworthy, regardless of whether the reviews are positive or negative". However, like any other trend, leveraging on consumer online reviews is not a competitive advantage anymore. Currently, it is an essence for them to keep competing with other players (Moriuchi & Takahashi, 2018).

According to Fresneda and Gefen (2019), users in the online markets typically are able to express their feedbacks in three ways. First of all, they can show their overall satisfaction by grading the product and their experience in a quantitative way, usually through the number of stars. Secondly, there is the possibility for customers to describe their feelings and quality of the product qualitatively by writing textual reviews. Finally, they have the option to rate the reviews provided by other consumers which implies the usefulness of that specific review (Fresneda & Gefen, 2019).

Generally, in order to make a purchase decision, potential customers tend to focus on the written reviews to obtain more detailed information (Chevalier & Mayzlin, 2006). They are considered as a valuable source of information for customers and have considerable influence in affecting their purchasing decisions (Fresneda & Gefen, 2019; Zhu & Zhang, 2010; Chen & Xie, 2008). Indeed, Customers tend to trust to the online reviews as they are provided by other consumers, rather than the producers or sellers of the products which are directly benefited by the sales (Fresneda & Gefen, 2019; Chen & Xie, 2008). Moreover, consumer reviews provide information about the experience of users and the actual performance of the product by considering users' expectations. While the sellers usually explain the technical features and performance of the product, consumer-generated information are especially helpful for understanding the uses of a product. Thus, they could have informative power to customers that are in search of a desired product (Chen & Xie, 2008).

Chen and Xie (2008) in their research have explained the relationship between the consumers generated information –i.e. consumer reviews- and the information provided by the sellers. The two sources of information could be complementary or substitutive depending on the

characteristics of the product and market. When the customers are experts and/or the product price is cheap, the information would complete each other. However, if the product is expensive with less sophisticated customers, the two source would be substitutable (Chen & Xie, 2008).

Some researchers have studied the impacts of online reviews on the sales. They speculated that, on the one hand, the amount of sales depends on the consumers' reviews, but on the other hand, more sales would lead to more reviews –both positives and negatives (Ren, et al., 2018). According to Forman et al. (2008), consumer reviews could affect the sales since they provide further information for potential customers who are evaluating the options to buy a product. Therefore, it is assumed that reviews are more important for the products that are unknown to the customers (Zhu & Zhang, 2010). As a result, this kind of information has a higher positive effect on the new products (Rosario, et al., 2016).

Generally, it is claimed that negative reviews could reduce the sales while positive ones would lead to higher sales (Ye, et al., 2009). According to Chevalier and Mayzlin (2006), however the share of positive reviews is higher in comparison to the negative ones, negative reviews have a higher impact on the sales. In other words, positive reviews would not cause a significant increase in the sale of an item. The research of Ren et al. (2018) has also confirmed the higher presence of positive reviews than negative ones and the fact that negative reviews are more powerful in affecting the decision of the consumers; nevertheless, on the contrary, they have concluded that negative reviews could have positive effects on the sales.

Berger et al. (2010) have found that the effect of negative reviews depends on the awareness of consumers about the product. Based on their research, negative reviews harm the sales of the well-known products; however, they could help unknown products to become visible to customers and thus increase their sales. The findings of Rosario et al. (2016) corroborate this view. According to these researchers, "negative eWOM is not linked to a decrease in sales, except for mature products and products with low financial risk (e.g., books, DVDs)".

More specifically, the reviews which are perceived as helpful by customers would have significant impacts on their purchase decision (Fresneda & Gefen, 2019). Elwalda et al. (2016) in their

research have found that reviews which are perceived as useful by customers increase their trust towards the e-vendors. As a consequence of this trust, the likelihood of the purchase would also increase. Based on their research, other features of the online reviews that have a positive effect on the sales are “perceived ease of use, perceived enjoyment, and sense of control resulting from online customer reviews” (Elwalda, et al., 2016).

Schindler and Bickart (2012) have studied the characteristics of online reviews that lead customers to perceive them as helpful. Based on this research, longer reviews are perceived as more valuable than short ones in the eyes of customers, but only up to a certain point (Schindler & Bickart, 2012). Similarly, Jiménez and Mendoza (2013) have found that for physical products, more detailed reviews would increase the customer purchase intention; while, they did not observe such relationship for the experience products –e.g. hotels. Moreover, limited positive statements in a review also make customers to perceive a review as useful; however, too much positive information would cause them to be suspicious about the purpose of the writer and consequently reduce the trust in the review. The last but not least, using informal language in writing a review seems to make it more trustful for the readers (Schindler & Bickart, 2012).

An important factor which could increase the effectiveness and helpfulness of a review is the identity of the reviewer. Forman et al. (2008) have argued that the existence of the information about reviewer’ identity has a positive effect on the perceived helpfulness of a review and consequently on the sales. They have mentioned that “In particular, reviewer disclosure of identity-descriptive information is a stronger predictor of perceived helpfulness when reviews were more equivocal than when they were unequivocal. However, when community members scan multiple reviews from multiple reviewers (as is likely when members make product purchase decisions), source characteristics predicted sales, but message content had less impact” (Forman, et al., 2008).

In conclusion, the impacts of reviews on the sale varies depending on different situations (Rosario, et al., 2016). Indeed, based on the characteristics of products and consumers, the online reviews could have different effects on the sales of e-commerce websites (Zhu & Zhang, 2010).

3. DATA ANALYSIS

The purpose of the data collection was to observe the online sales of counterfeits both in product categories that are traditional targets of counterfeiting and in product categories that have been increasingly targeted in recent years, such as products in the electronics sector. Concerning the former, we have chosen to collect the data about two well-known branded product categories: “RayBan Aviator sunglasses” and “Adidas shoes”. Concerning the latter, we have gathered data about “Apple EarPods” and “Beats headphones”.

As we have been collecting these data in Italy, we assumed that “Amazon.it” is a wise choice for observing the online sales of these four different products since it is among the websites that are most used in Italy. Consequently, for each of these products, we have searched the item on the search bar of “Amazon.it” and collected the relevant information.

For example, for collecting the data for “RayBan Aviator” product category, we run a string search in the Amazon.it search bar of “RayBan Aviator”. In the results, it was possible to find Rayban Aviator sunglasses, in different variants of color, size, etc. and the related accessories –e.g. cases. Excluded are sunglasses of other brands that recall or imitate the shape of the RayBan Aviator, but are not branded as such. The same procedure was performed for the other three product categories. The search string for these are respectively “Apple EarPods”, “Beats headphones”, and “Adidas scarpe”.

For each result that fitted the criteria of inclusion, we coded a set of information. First of all, we have the information about each specific item. “Official Product Name” and “Product Name on Amazon.it” are the very first two columns. Moreover, the website “link” through which it is possible to find each item and the “date” that the item is listed on the Amazon are provided in the data set. Secondly, there are information about the price of the product. “Official Price” in Euros is the price that the item could be purchased directly from the official website of the company. We have put “Price on Amazon” –which is the price that potential customers would have paid at the time of data collection to buy that specific item- as well as “Price on Amazon without discount” –that is indicating if the item is on sale at the time of data collection on

Amazon.it or not. We coded if the product is “on sale”. The data about the vendors are included in the data set –i.e. the “vendor” that has put the item for selling, the “Vendor Address”, and the “Country” where the vendor is located.

We were interested at knowing the authenticity of the products on sale, or otherwise if the product could be counterfeit. This poses considerable methodological problems, since, as stressed before, counterfeiting is an illegal activity, for which we cannot count on explicit or official recordings. In order to cope with this problem, our strategy was to look customers’ reviews, i.e. reports of former customers who believe that the item they had received was in fact ‘fake’. We call these “Counterfeit report”. The strategy has limitations. First, reports from customers could be uneven. Second, very well-made replicas could not be detected. Third, customers who were aware of purchasing a fake, would not necessarily report. Fourth, customers’ Counterfeit report could be correct or incorrect, and done in good or bad faith, and we have no way to ascertain this. All these problems cause some degree of unmeasurable error and noise. Despite so, we trust that the measurement error would apply randomly to the data. Furthermore, we collect the number of Counterfeit reports recorded over the total. Specifically, in the data set, we have the “Number of Total Reviews” that the product has received from the customers as well as, “Average Customer Review” which is the average rating given by the customers on the scale of 1 to 5. Furthermore, we have defined the “Number of Critical Reviews” as the ones which have got a rating from 1 to 3 by the customers. Lastly, we have read the reviews one by one and found how many of reviews mentioned or had doubts about the authenticity of the specific item. We coded these as “Counterfeit report”, and recorded the number of such reports.

We further coded information about the vendor. Specifically, we retrieved:

3.1 RayBan Aviator

For the first product category, “RayBan Aviator”, the data was collected from the last days of April 2019 till the first half of May 2019. We found 248 different items fitting the criteria of

inclusion. These items include different models of RayBan aviator, or similar – e.g. RayBan Clubmaster, RayBan Wayfarer, etc., and also RayBan accessories –e.g. cases, lenses, etc.

By adding up the reviews of the different items, in total we have 3773 reviews. 115 items have received at least 1 review (46.4%); while the remaining 133 items have no review at all. Among the total reviews, 281 reviews have mentioned concerns about the authenticity of the purchased product. It means that for this product category, the counterfeit report percentage is 7.45% - total number of counterfeit reports over the total number of reviews. Moreover, in the time of data collection, 94 items had been "on sale" based on the vendors' claim.

Number of items	248
Number of items with at least 1 review	115
Number of items "on sale"	94
Number of total reviews	3773
Number of counterfeit reports	281
Counterfeit report percentage	7.45%

Table 1: *Incidence of Counterfeit reports in RayBan Aviator product category*

For all the models of RayBan sunglasses, the official price is available on the company's official website. However, there is no information about the official price for some of the accessories that are in the data set –which are sunglasses' lenses and arms. These items are probably being sold in what is known as "secondary market", because the products are using the brand's name while they are not available on the RayBan official website (Sharma & Chan, 2011; Grossman & Shapiro, 1988). As a result, the customers might be aware that they are not RayBan's production and still are interested in buying them.

As one of the most important factors in our analysis is the comparison of the price offered by vendors on "Amazon.it" with official price of the product, we have decided to also look at the items that the official price is available separately to have a deeper understanding about them. We were able to retrieve prices for 203 products in the RayBan Aviator category. Of these, 104

have at least one review and 57 items have received Counterfeit report by customers. Finally, 94 items out 203 were “on sale” at the time of data collection.

To understand if potential counterfeit products in the data set are being offered by vendors from specific countries, we have extracted the information about the locations of the vendors which have received counterfeit reports by the customers. To do so, we have only considered the items that their official price is available. The figure 1 geographically shows the location of vendors that at least have received one review questioning the authenticity of their products, i.e. counterfeit report. On the table 2, it is possible to find information about the number of vendors that have counterfeit reports in those countries, the total number of vendors in that specific location, the share of vendors with counterfeit report; while table 3 includes information about the number of items that were being sold –a comparison between the items that have counterfeit reports with the total items offered in that country.

Country Name	Number of vendors with counterfeit report	Number of total vendors	Share of vendors with counterfeit report
Italy	10	26	38.5%
Spain	3	6	50%
Germany	2	3	66.7%
Israel	1	1	100%
India	1	1	100%
Czech Republic	1	1	100%
United Kingdom	1	2	50%
N.A	2	3	66.7%

Table 2: *Countries that have counterfeit reports in RayBan data set (comparison of the number of vendors)*

Country Name	Number of items with counterfeit report	Number of total items	Share of items with counterfeit report
Italy	38	129	29.5%
Spain	4	15	26.7%
Germany	2	13	15.4%
Israel	5	9	55.6%
India	2	2	100%
Czech Republic	1	1	100%
United Kingdom	3	11	27.3%
N.A	2	11	18.2%

Table 3: *Countries that have counterfeit reports in RayBan data set (comparison of the number of items)*

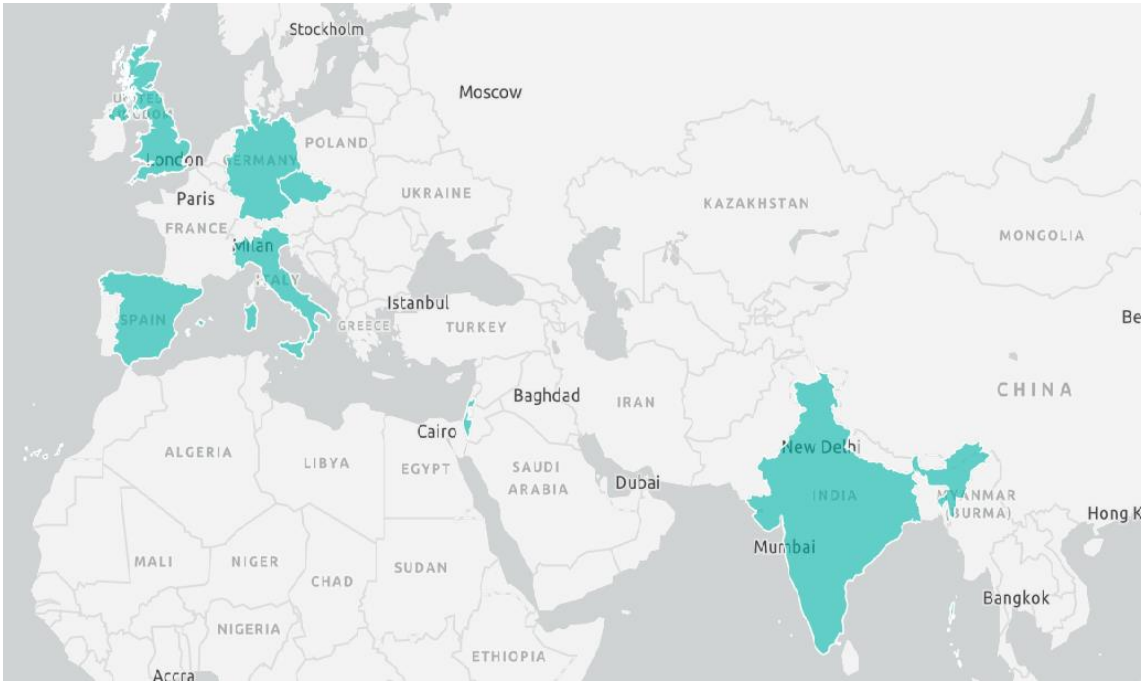

Figure 1: *Countries with counterfeit reports in RayBan data set*

Additionally, we would like to understand if there is any relation between the price offered by the vendors and the likelihood of the product to be counterfeit. To do so, in the “table 4”, it is

possible to find and compare the percentage of discount offered by the vendors for the products with counterfeit report and the ones that have never received any counterfeit report. For this calculation, we have defined "suspicious products" as the ones which their counterfeit report is equal or more than 5 percent of all reviews. In fact, we think if the number of counterfeit reports is too low compared to the total number of reviews of an item, it could be a result of misjudgment by the customers. Moreover, we have only taken into account the items that at least have received one review. There is no possibility for us to evaluate the authenticity of the items without any review; and thus, they are eliminated for this calculation.

	Mean	Standard deviation	Observations
Discount offered by all vendors	27.8%	20.76	104
Discount offered by vendors with no counterfeit report (less than 5% of total reviews)	25.7%	24.67	54
Discount offered by vendors with counterfeit report (5% or more of total reviews)	30%	15.4	50
Difference discount (No counterfeit – counterfeit)	4.3		

Table 4: *Average discount of Ray-Ban aviator offered by the vendors on Amazon.it*

We have decided to also put a graph which would help us to visually observe the price distribution of the items which have received negative reviews concerning their authenticity and have a comparison with the price range offered for the items without counterfeit report. As the price of different models could vary significantly, for showing the price distribution, we have decided to focus on the most frequent model in the data set which is the RayBan Aviator "RB 3025". This model is categorized into "polarized" and "non-polarized" sunglasses. Considering both of them –and also the ones that we have no information about the polarization, there are 100 items in

the data set (10 polarized sunglasses, 32 non-polarized, and 58 items with no information about polarization).

For this model, an obvious outlier whose price on Amazon is equal to EUR 2,750 is removed because it could affect the average price significantly.

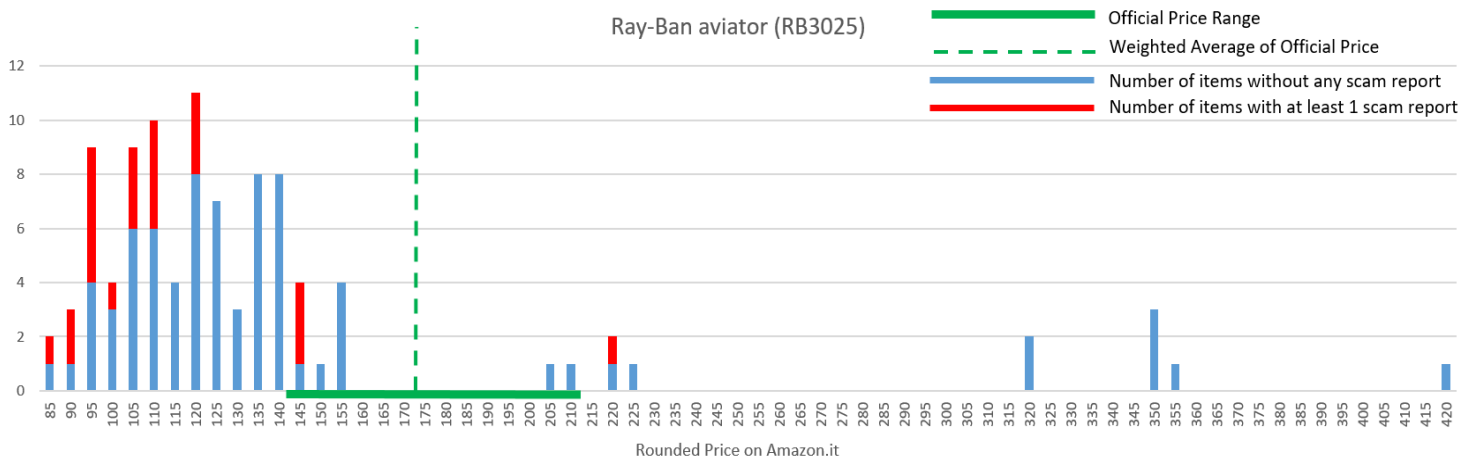

Figure 2: *Price distribution of RayBan aviator RB3025*

The information about price distribution of this most frequent model of RayBan Aviator (RB3025) is summarized in the following table. By considering standard deviation and the price range for the two groups- items with counterfeit reports and the ones without any counterfeit report, it is obvious that vendors offered items without any counterfeit report in more diversified prices. The minimum price of both groups are close, however, the maximum price offered for the ones without counterfeit report is considerably higher. Therefore, the mean price for this group is also higher.

	Minimum price (EUR)	Maximum price (EUR)	Mean price (EUR)	Standard deviation
Items with counterfeit reports	85.08	218.9	112.74	28.8
Items without any counterfeit report	84.52	421.54	148.07	71.07

Table 5: *Price distribution of RayBan aviator RB3025 on "Amazon.it"*

As a conclusion, for RayBan Aviator product category, 21 out 49 vendors have received counterfeit reports which accounts for 43% of all the vendors offering the products. The most common location for offering suspicious products is Italy. Spain and Germany are the other countries with more than one vendor offering products with counterfeit reports.

For understanding if the prices offered by vendors are statistically different for the items with counterfeit reports and the others, we have decided to focus on the average discount offered by the vendors. In fact, as result of the presence of different models and also accessories in the data set, it is not possible to compare their prices since the official price could vary dramatically from product to product. For the RayBan Aviator product category, the average discount offered by vendors with counterfeit reports equal or more than 5% is 30 percent; and the average discount offered by vendors with no (or less than 5%) reports of counterfeit is 25.7%. Overall, the mean difference discount of the two groups is 4.3%, thus rather small. We run a two tailed unpaired T-test to see if this difference is statistically significant. The null hypothesis –the mean difference of the discounts offered by the two groups (4.3) equals zero- is not rejected (P-value=0.285).

In terms of interpretation, the result suggests that the average discount offered by vendors in Amazon that have many reports of counterfeit is rather small and not statistically different from the average discount offered by vendors in Amazon that did not have reports of counterfeit. This leads to two plausible interpretations. A first interpretation fits the case in which reports of counterfeits by customers capture rather well the actual situation of counterfeit. In this case, we would conclude that the sale of counterfeit goods is likely to be deceptive, because the customers of counterfeit items purchased the items at virtually the same price of the genuine ones. A second interpretation fits the case in which reports of counterfeits by customers are inaccurate or wrong. In this case, our data would be inconclusive.

3.2 Apple EarPods

For the “Apple EarPods”, the collection of data was done in the last week of the July 2019. Similar to other products, for the collection of data, the keyword was the product name which is “Apple Earpods”. Among the results, there were Apple Earpods and other Apple’s products –which are “AirPod”, “charging case for AirPod”, and “Headphone”- along with other brands’ products. We have decided to go on by collecting information about all the Apple’s products which had appeared by the searched keyword.

Among the four product categories, this is the smallest one with only 22 items in the data set. However, the accumulated number of reviews for all the items is relatively high. There is not any product without review in this section. The basic information about this data set is summarized in the table 6:

Number of items	22
Number of items with at least one review	22
Number of items “on sale”	10
Number of items with at least one counterfeit report	12
Number of total reviews	5485
Number of counterfeit reports	97
Counterfeit report percentage	1.77%

Table 6: *Incidence of counterfeit reports in Apple EarPods product category*

In this dataset, all the vendors that were offering the collected products are located in Italy. There were only 7 vendors that has put 22 products on “Amazon.it”. 6 vendors out of them have received counterfeit reports. In the tables below, the summary about these vendors is provided:

Country Name	Number of vendors with counterfeit report	Number of total vendors	Share of vendors with counterfeit report
Italy	6	7	85.7%

Table 7: *Countries that have counterfeit reports in Apple EarPods data set (comparison of the number of vendors)*

Country Name	Number of items with counterfeit report	Number of total items	Share of items with counterfeit report
Italy	12	22	54.5%

Table 8: *Countries that have counterfeit reports in Apple EarPods data set (comparison of the number of items)*

Figure 3: *Countries with counterfeit reports in Apple EarPods data set*

By considering the official price of items in the Apple EarPods data set, the average discount offered by the vendors is 2.2 percent which is not significant compared to the other product categories. There is also not a considerable difference between the average discount of the suspicious products –the ones which a counterfeit report more than 5 percent- and the others.

	Mean	Standard deviation	Observations
Discount offered by all vendors	2.2%	11.73	22
Discount offered by vendors with no counterfeit report (less than 5% of total reviews)	2.1%	12.6	19
Discount offered by vendors with counterfeit report (5% or more of total reviews)	2.3%	3.98	3
Difference discount (No counterfeit – counterfeit)	0.2		

Table 9: *Average discount of Apple EarPods offered by the vendors on Amazon.it*

In this data set, the most frequent item is "Apple Earpods" itself, containing eight items. It has two different models, which are "EarPods with Lightning Connector" and "EarPods with 3.5 mm Headphone Plug". However, both models have the same official price. Therefore, we have decided to put the price distribution of these two together in one single graph:

Figure 4: *Price distribution of Apple EarPods*

For the most frequent model in this data set (Apple EarPods), the price range offered by the vendors for the items that have received counterfeit reports and the ones without any counterfeit report are close to each other. The price range of items without counterfeit reports are a bit more diversified based on the standard deviation –however, it is negligible.

	Minimum price (EUR)	Maximum price (EUR)	Mean price (EUR)	Standard deviation
Items with counterfeit reports	27	29	28.33	1.15
Items without any counterfeit report	24.99	29	28.2	1.79

Table 10: *Price distribution of Apple EarPods on "Amazon.it"*

For the Apple EarPods, all the vendors that offer the products are Italian. 86% of them have received counterfeit reports (6 out of 7 vendors). For the price comparison, we have considered the average discount offered by the vendors. The average discount is similar for the items with counterfeit report equal or more than 5% and the ones with less than 5% counterfeit report (2.3% and 2.1% respectively for each product). Indeed, the mean difference of discount of the two groups is negligible; which is consistent with the result of two tailed unpaired T-test emphasizing that there is not any significant difference in the average of these two groups (P-value=0.965). Therefore, based on the customers' reviews, we can conclude that "Amazon.it" is a deceptive market for counterfeits of "Apple EarPods". However, there is the possibility of the misjudgment of the counterfeit reports by customers.

3.3 Beats Headphones

The second product in the electronics sector is the "Beats Headphones". We have collected the data in a two-week period –starting from the last days of July 2019 till the mid of August 2019.

The keyword used for collecting the information about this product is “Beats headphone”. The results include 91 items of 9 different models of Beat headphones and earphones. “Table 11” summarizes basic information about this data set:

Number of items	91
Number of items with at least one review	76
Number of items “on sale”	54
Number of items with at least one counterfeit report	40
Number of total reviews	6264
Number of counterfeit reports	83
Counterfeit report percentage	1.33%

Table 11: *Incidence of counterfeit reports in Beats Headphones product category*

Among the four product that we have chosen for this study, “Beats headphones” had received the smallest percentage of counterfeit report (1.33%). There were 6 different vendors whose products were suspicious to customer. Italy and China are the two countries that were offering these products. However, the number of suspicious items that were offered by Italian vendors are much higher compared to the Chinese ones.

Country Name	Number of vendors with counterfeit report	Number of total vendors	Share of vendors with counterfeit report
Italy	3	3	100%
People’s Republic of China	3	4	75%

Table 12: *Countries that have counterfeit reports in Beats Headphones data set (comparison of the number of vendors)*

Country Name	Number of items with counterfeit report	Number of total items	Share of items with counterfeit report
Italy	37	84	44%
People's Republic of China	3	5	60%

Table 13: *Countries that have counterfeit reports in Beats Headphones data set (comparison of the number of items)*

Figure 5: *Countries with counterfeit reports in Beats Headphones data set*

For comparing the average discount offered by the vendors for products that had received counterfeit reports with the ones without counterfeit report, we have eliminated the items without any review. In other words, for such comparison we would like to consider only those that we have information about them. As it is shown in the "table 14", the average discount of those which have received counterfeit reports are conspicuously higher:

	Mean	Standard deviation	Observations
Discount offered by all vendors	6.4%	21.05	76
Discount offered by vendors with no counterfeit report (less than 5% of total reviews)	5.6%	18.63	66
Discount offered by vendors with counterfeit report (5% or more of total reviews)	11.5%	33.97	10
Difference discount (No counterfeit – counterfeit)	5.9		

Table 14: *Average discount of Beats Headphones offered by the vendors on Amazon.it*

In this data set, 32 out of 91 items are "Beats Solo 3 Wireless" model. So, we have put the price distribution of this model in order to have a better insight about it. Surprisingly, most of vendors tend to sell this specific model of Beats Headphone at a higher price than its official price.

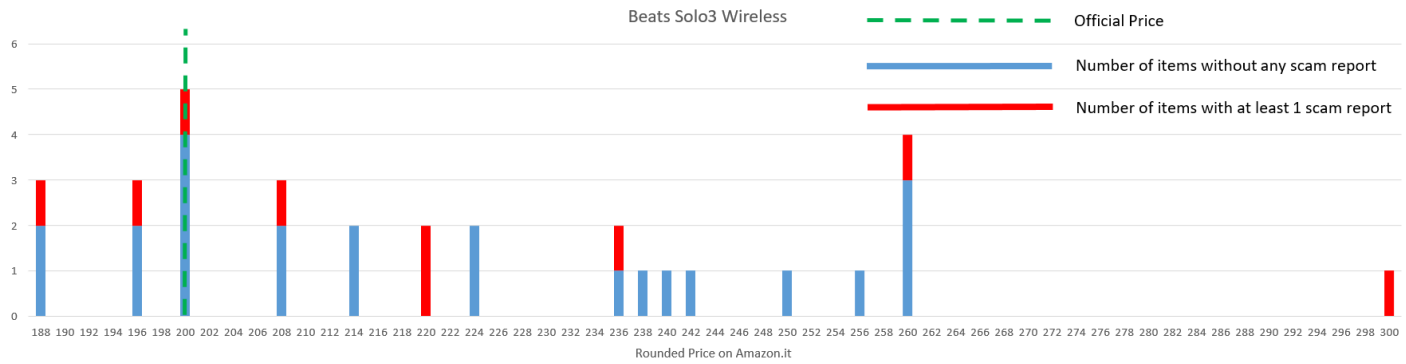

Figure 6: *Price distribution of Beats Solo3 Wireless*

For the "Beats Solo3 Wireless" model as the most frequent model in this product category, the minimum price for both groups of items with counterfeit reports and without any counterfeit report are the same (EUR 189). The maximum price, mean price, and standard deviation are

higher for the items with counterfeit reports suggesting that they have been offered in a wider price range by the vendors.

	Minimum price (EUR)	Maximum price (EUR)	Mean price (EUR)	Standard deviation
Items with counterfeit reports	189	299.95	225.18	35.48
Items without any counterfeit report	189	259.99	222.01	24.64

Table 15: *Price distribution of Beats Solo3 Wireless on "Amazon.it"*

In the Beats Headphones data set, the products are offered from 3 different countries –Italy, China, and United Kingdom). Among them, 6 vendors located in Italy and China have received counterfeit reports by the customers which accounts for 75% of all the vendors.

For price comparison of suspicious items –counterfeit report equal or greater than 5%- and the others, we have considered the average discount offered by the vendors as official prices could change significantly for different models. The average discount offered are respectively 11.5% for the suspicious products and 5.6% for the items without any counterfeit report. To understand if this difference is statistically significant we have performed two tailed unpaired T-test. Based on the result of T-test (P-value=0.604), we were not able to reject the null hypothesis –the means of the two group are equal. As a result, it can be claimed that the discounts offered by the two groups are not statistically different which could suggest two possible scenarios. On the one hand, it can be claimed that "Amazon.it" is a deceptive market for selling the counterfeit products; thus, the vendors tend to offer counterfeit products in a price similar to the genuine ones. On the other hand, it is possible that customers were not able to identify and report the counterfeits properly.

3.4 Adidas Shoes

The last product that we have chosen for this study is “Adidas shoes”. The data has collected during the November 2019. By searching this term on “Amazon.it”, most of the results were Adidas shoes; however, there were some other brands’ shoes among the result. Similar to other product categories, we have put all the different models of Adidas shoes (that have appeared using the searched keyword) and have ignored the other brands’ products. By doing so, we have collected the information for 572 different items of 85 models of Adidas shoes. The “table 16” summarizes the information about this data set:

Number of items	572
Number of items with at least one review	557
Number of items “on sale”	209
Number of total reviews	28559
Number of counterfeit reports	710
counterfeit report percentage	2.49%

Table 16: *Incidence of counterfeit reports in Adidas Shoes product category*

However, we have only collected the information about the Adidas shoes that have appeared in the results, the official price of some these items were not available on the Italian version of Adidas official website. This could have two reasons. Firstly, some items that have been available on the “Amazon.it” are among the old models of shoes which are not being sold anymore by Adidas. The others are models that were not available in Europe and could only be founded in some specific countries –e.g. USA. As a result, there are 558 items for which we could retrieve the official price in the European market and 205 items among them were “on sale” on the “Amazon.it” website at the time of data collection. 543 items out 558 items with available official price have received at least one review by the customers and 141 items have received at least one counterfeit report questioning their authenticity.

Considering the items that their official price is available, we have highlighted the countries where the vendors have received counterfeit reports. In the “table 17” and “table 18”, it is possible to find information about the different countries and vendors that have offered these suspicious products. Like all the other product categories, the majority of the vendors are located in Italy, which is not surprising as the source of data is “Amazon.it”.

Country Name	Number of vendors with counterfeit report	Number of total vendors	Share of vendors with counterfeit report
Italy	39	115	33.9%
Germany	12	26	46.2%
Spain	9	26	34.6%
France	5	11	45.5%
United Kingdom	6	10	60%
Poland	2	4	50%
United States	1	2	50%
Bulgaria	1	1	100%
Lithuania	1	2	50%
Austria	1	1	100%
N.A	4	7	57.1%

Table 17:*Countries that have counterfeit reports in Adidas Shoes data set (comparison of the number of vendors)*

Country Name	Number of items with counterfeit report	Number of total items	Share of items with counterfeit report
Italy	78	301	25.9%
Germany	18	75	24%
Spain	10	43	23.3%
France	8	33	24.2%
United Kingdom	7	24	29.2%
Poland	3	12	25%
United States	2	6	33.3%
Bulgaria	8	29	27.6%
Lithuania	1	2	50%
Austria	1	1	100%
N.A	6	21	28.6%

Table 18: *Countries that have counterfeit reports in Adidas Shoes data set (comparison of the number of items)*

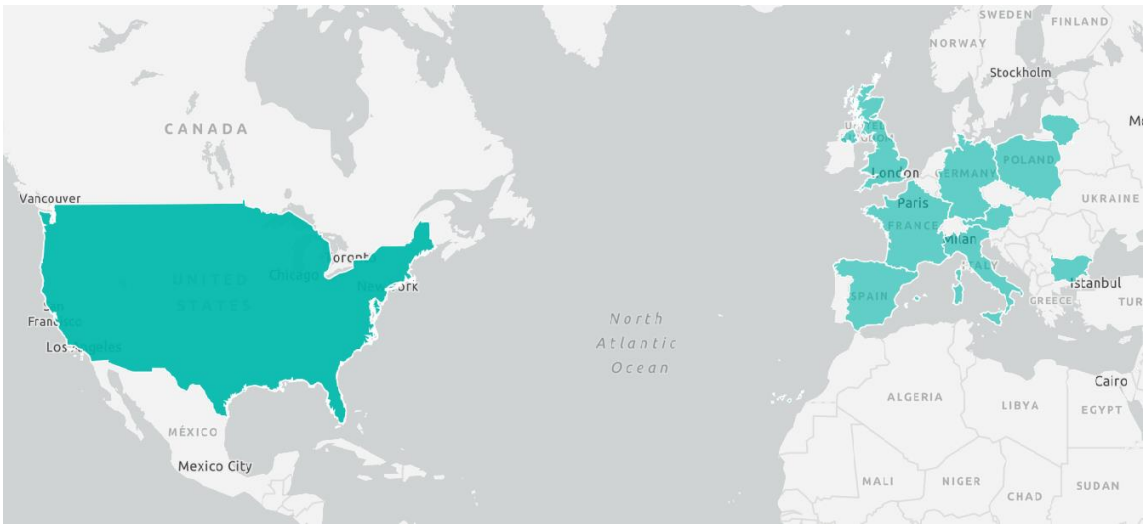

Figure 7: *Countries with counterfeit reports in Beats Headphones data set*

For Adidas Shoes data set, similar to other product categories, we have computed average discount for the products that at least 5 percent of their reviews have mentioned the probability of counterfeiting and the others. The result is similar to the other 3 products and reveals that vendors tend to offer more discount for the counterfeit products.

	Mean	Standard deviation	Observations
Discount offered by all vendors	15.7%	34.07	543
Discount offered by vendors with no counterfeit report (less than 5% of total reviews)	15.2%	34.58	510
Discount offered by vendors with counterfeit report (5% or more of total reviews)	22.5%	24.3	33
Difference discount (No counterfeit – counterfeit)	7.3		

Table 19: *Average discount of Adidas Shoes offered by the vendors on Amazon.it*

Finally, we have decided to put a graph of price range distribution for the "Adidas Stan Smith" model on "Amazon.it", since it is the most frequent model in the data set with 42 items. For this model, almost all the items –except one of them- were offered at a reduced price compared to the official price of Stan Smith.

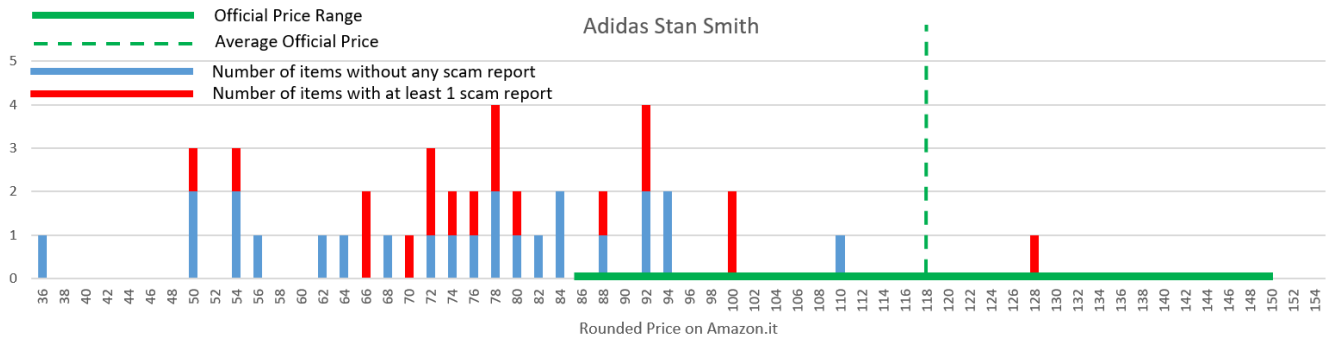

Figure 8: *Price distribution of Adidas Stan Smith Shoes*

For the "Stan Smith" shoes in this data set, the minimum, maximum, and average price of the items with counterfeit reports are higher than the other group. This suggests that, surprisingly, the vendors offering the suspicious items for this specific model tend to offer them at higher price. The standard deviation of the two groups are close to each other –slightly higher for the ones with counterfeit report- revealing that the prices for both group are offered in an almost same range around the mean price of the group.

	Minimum price (EUR)	Maximum price (EUR)	Mean price (EUR)	Standard deviation
Items with counterfeit reports	50	129	79.98	18.47
Items without any counterfeit report	35	110	73.84	17.95

Table 20: *Price distribution of Adidas Stan Smith Shoes on "Amazon.it"*

To put it in a nutshell, 38% of the vendors (81 out of 214 vendors) offering products, in the "Adidas shoes" product category, have received counterfeit report by the customer. Most of them are Italian vendors (39). Germany, Spain, France, United Kingdom, and Poland are the other countries that more one vendors have received counterfeit report. There are 4 vendors with counterfeit reports that the location of the vendor is not available in the data set.

For the price comparison of the items with counterfeit report and the other, like the other product categories, we have divided items in two groups of items with 5 or more than 5 percent counterfeit report and less than 5% counterfeit report. We have compared the average discount offered by the vendors for these two groups as the absolute price would bias our results due to the different price of the different models. Suspicious products –counterfeit reports equal or more than 5%- are on average offered by 22.5% discount compared to the official price. While, the average discount for the items without counterfeit report is 15.2%. We have performed two tailed unpaired T-test to understand if statistically the difference in the means of the two groups are significant. Due to the large P-value (0.116), we cannot reject the null hypothesis –the means are equal; and therefore, we cannot conclude that means are dramatically different. As a result, like the other product categories in this study, we can conclude that this is a consequence of the deceptive market in "Amazon.it" or the misjudgment of the customers in identifying the counterfeit products.

4. Results Discussion and Conclusion

4.1 Research Questions

In this study, we have decided to choose four product categories: two high-tech products and two products that are not technologically advanced. The choice reflected the interest for comparing the situation of counterfeit online sales in high-tech and low-tech products as mirrored in our first research question:

Research Question 1: Are high-tech products more exposed to be counterfeited?

We have also collected the vendors' location in our data sets. The idea was to understand from which countries the counterfeiters tend to sell products to the potential customers. As the origin of the counterfeits, usually, is outside European Union (OECD/EUIPO, 2017), we made the hypothesis that many vendors would put the offer from a store outside Italy. This was reflected in our second research question:

Research Question 2: What are the main countries that are offering counterfeit products on "Amazon.it"?

We have also collected prices and discounts to official price offered on the online market. We did so because some researchers have argued that customers are buying counterfeits because they are cheaper in comparison to the original products (Marticotte & Arcand, 2017; Pueschel, et al., 2017; Omeraki Çekirdekci & Baruonu Latif, 2019; Tang, et al., 2014; Penz & Stöttinger, 2012) often knowing that the product is not genuine, i.e. without being deceived. Thus, in this research, we were interested to find out the price of counterfeit products. In particular, we asked the following:

Research Question 3: Are the vendors offering the counterfeit goods at a lower price or a higher discount in comparison to the genuine ones?

4.2 Descriptive Analysis

4.2.1 High-tech Products vs. Low-tech Products

According to Bastia (2002), “counterfeiting is no longer restricted to clothes, designer watches, and stereos. The high technology industry has been hugely impacted by this activity”. As the electronics sector is relatively newer in comparison to the other sectors, in this research, we want to study if there is any significant difference between high-tech products and the other products in terms of the availability of their counterfeits on the online market.

Nowadays, counterfeiters find the electronics sector attractive. They can have high profit in this sector since they do not invest for R&D, marketing costs, etc. (Bastia, 2002). On the other hand, customers are more likely to distinguish the difference of the genuine and counterfeit product, since counterfeiters use strategies like repackaging which means using the original box of a brand while putting an inferior product inside it (Bastia, 2002). As a result, it might be difficult for sellers of fake product to use well-known channels like Amazon; since there is the risk of prosecution in case of customers’ complaints. Therefore, we are interested to find out if this sector is more vulnerable to counterfeiting in e-commerce websites like Amazon.

Consequently, we would like to consider two main groups for the four chosen products. The first one is the high-tech products in the electronics sector which are “Apple EarPods” and “Beat Headphones”. On the other hand, there are “RayBan Aviator” and “Adidas Shoes” as the well-reputed products which are respectfully in optical sector and footwear sector. The basis of our analysis is the customers’ reviews on “Amazon.it”; since we are not experts to distinguish the genuine and fake products and we did not have access to the products.

Based on the four products chosen for this study, we figured out that customers are more curious about the electronics sector. In fact, the average reviews per product –i.e. the total number of reviews divided by the total number of observed items in each category- is higher for the electronics sector as it is shown in “table 21”.

Moreover, considering the percentage of the items that within each category has received at least one review reveals that customers were highly motivated to express their opinion for both "Apple EarPods" and "Beats Headphones". These two product have received at least one review for 100% and 83.5% of their products on the Amazon. "Adidas Shoes" have also a very high percentage of items with at least one review (97.4%), however, this indictor is relatively low for "RayBan aviator" which equals to 46.4%:

Product Category	Average reviews per item	Percentage of items with at least one review
1. Apple EarPods	249.3	100%
2. Beats Headphones	68.8	83.5%
3. RayBan Aviator	15.2	46.4%
4. Adidas Shoes	49.9	97.4%

Table 21: *average reviews per item and percentage of items with at least one review for the four product categories*

For the next step, we have decided to figure out how critically customers commented on each product. To do so, we have calculated the number of critical reviews per item for these four product categories. We have defined critical reviews as the reviews that have evaluated the purchased product from 1 to 3 stars out of 5. Then, we have divided this number by the total observed items in each product category. The result is consistent with the first measurement. Like "average reviews per item", the two high-tech products, on average, have received more critical reviews:

1. Apple EarPods	23.7
2. Beats Headphones	10.8
3. RayBan Aviator	2.6
4. Adidas Shoes	4.3

Table 22: *average critical reviews per item for the four product categories*

The three abovementioned indicators –i.e. “average reviews per item”, “percentage of items with at least one review”, and “average critical reviews per item- show how customers are more concerned about the products in the electronics sector and motivated to express their opinion. It could be a result of the difficulties that customers have for evaluating the high-tech product; thus, they try to share their experience with others.

As the critical reviews per item of the high-tech products are relatively higher, we have decided to introduce another indicator to find out the relation between the critical reviews and the likelihood of the item to be a counterfeit. We have introduced “the percentage of critical reviews that contains counterfeit report”. It is calculated by dividing the total number of counterfeit reports over the total number of critical reviews for each product.

1. Apple EarPods	18.6%
2. Beats Headphones	8.4%
Average high-tech (1 & 2)	13.5%
3. RayBan Aviator	42.9%
4. Adidas Shoes	28.6%
Average low-tech (3 & 4)	35.75%
Mean difference (low-tech – high-tech)	22.25%

Table 23: *percentage of critical reviews that contains counterfeit report*

This indicator is lower for the two products in the electronics sector. This is confirmed by the T-Test, that leads to rejecting the null hypothesis of equal percentage of critical reviews in the high-tech and low-tech groups. We conclude that the customers appear to scrutinize high-tech products more than low-tech ones and share their experience about different aspects of the purchase. For the low-tech products, a greater percentage of the negative reviews were counterfeit reports which reveals that, for this group of products, the authenticity of the product is the main concern of customers. This could confirm our abovementioned reasoning that sharing

experience in the electronics sector is more common and it is not limited to the authenticity of the product. One common source of concern, in the electronics sector, is that if the purchased product is second-hand. For example, one of the buyers of Apple Airpods has mentioned in the review:

“used product ... nothing else to add ... clearly already used. Open box, without the plastic filter that wraps a new product. In addition, the headphones had already been given a name, visible when pairing with other products: "Captain's AirPods". On the Apple website, I checked the purchase date, which had occurred 2 months earlier. Returned immediately !!!”[2]

For understanding which group is more exposed to counterfeiting on “Amazon.it”, we have decided to introduce another indicator as well. To do so, we have introduced “the counterfeit report percentage” that is number of counterfeit reports by customers over the total number of received reviews. Counterfeit report percentage for both two products in the electronics sector is less than the other two products. The “table 24” summarizes this indicator for all the four products:

1. Apple EarPods	1.77%
2. Beats Headphones	1.33%
Average high-tech products (1 & 2)	1.55%
3. RayBan Aviator	7.45%
4. Adidas Shoes	2.49%
Average low-tech products (3 & 4)	4.97%
Mean difference (low-tech – high-tech)	3.42%

Table 24: *Counterfeit report percentage for all the four product categories*

[2] This is the translation of the review which is originally in Italian:
“prodotto usato... niente altro da aggiungere...chiaramente già usato. Sarà stato un reso che hanno rimesso in commercio.
Scatola aperta, senza il filtro di plastica che avvolge un prodotto nuovo. Inoltre le alle cuffie era stato già dato un nome, visibile al momento dell'accoppiamento con altri prodotti: "AirPods del Capitano".
Dal sito Apple sono risalito alla data di acquisto, avvenuta 2 mesi prima. Reso immediatamente!!!”

The result reveals that, on “Amazon.it”, the electronics sector products have received less counterfeit reports by considering the total received reviews. The result is consistent with the result of “percentage of critical reviews that contains counterfeit report” indicator. Taken together these two indicators seem to indicate high-tech products are less vulnerable to counterfeiting on the “Amazon.it” e-commerce website. In fact, although tech products are more likely to be scrutinized by customers, as witnessed by more abundant consumers’ reviews, there are fewer reports of counterfeit. Of course we cannot rule-off the possibility that counterfeit exist but are less likely to be detected. However, given the intense scrutiny, this seems less plausible.

The reviews of high-tech products appear to focus more on the functionality and less on the authenticity. The concern is more about if the product fulfills its expectation, the value for money trade-off, and whether the product is new or used. On the other hand, critical reviews of the two low-tech products are commonly about the authenticity of the purchased item.

4.2.2 Main Countries

The second purpose of this study is to understand the countries from which the vendors tend to offer counterfeit products. For all the four products, the majority of the vendors with counterfeit reports are located in Italy. This is plausible, given the data was collected on “Amazon.it”. The result also suggests that the counterfeit goods were either produced in Italy or they were imported from above, thus passed the custom with no major incident.

Despite the most common country of vendor is Italy for both high-tech and low-tech products, there is an obvious difference between the two product groups. For the electronics sector, foreign vendors of counterfeits are very uncommon. All the supposed counterfeiters of “Apple Earpods” are Italian vendors. For the “Beat Headphones”, the only foreign country of vendor’s location is People’s Republic of China. It seems that sellers of high-tech counterfeits on “Amazon.it” prefer to sell their products locally instead of offering from another country.

On the other hand, for the two other products, there relatively more countries that have been selling counterfeit products. There are seven countries for the "Rayban Aviator" and ten countries for "Adidas Shoes" –moreover, there are some vendors that their location is not available for these two products categories.

	Apple EarPods	Beats Headphones	RayBan Aviator	Adidas Shoes
Italy	✓	✓	✓	✓
People's Republic of China		✓		
Germany			✓	✓
Spain			✓	✓
United Kingdom			✓	✓
Israel			✓	
India			✓	
Czech Republic			✓	
France				✓
Bulgaria				✓
Poland				✓
United States				✓
Austria				✓
Lithuania				✓
N.A.			✓	✓

Table 25: *Countries that their vendors have received counterfeit reports in each product category*

As Italy is the country which is presented in all product categories for selling the counterfeit, we would like to analyze the percentage of vendors in this country that have received counterfeit reports. The majority of the Italian vendors in the electronics sector have received counterfeit reports – the percentage is 85.7% and 100% respectfully for the "Apple Earpods" and "Beats Headphones". However, for the other two products, the percentage of Italian vendors with counterfeit reports is considerably lower –less than 40% for both products.

1. Apple EarPods	85.7%
2. Beats Headphones	100%
3. RayBan Aviator	38.5%
4. Adidas Shoes	33.9%

Table 26: *Percentage of Italian vendors with counterfeit report*

Therefore, it can be concluded that the main country for offering counterfeit products, on "Amazon.it", in the electronics sector is Italy. But for the other group, offering from outside the local country is also significant. In order to understand the behavior of vendors for the tow low-tech products, it is useful to compare percentage of Italian vendor which have counterfeit report with percentage of vendors of other countries with counterfeit reports (table 2 and table 17). It is obvious that counterfeiters, in terms of location, are totally different with the vendors in the electronics sector. For the low-tech products, if a vendor is not Italian; the probability of the product to be counterfeit is higher.

To put it a nutshell, the high-tech counterfeit products are usually offered by Italian vendors on "Amazon.it". However, the counterfeit report percentage is low in this sector, most of the vendors have received at least one counterfeit report. This even could draw the attentions towards the ability of the customers to judge high-tech products; since they are not univocal when it comes to the electronics products. On the other hand, the other group of products have received counterfeit reports from the Italian vendors as well as other countries. The percentage

of Italian vendors that have received counterfeit report is considerably lower to other countries. Therefore, if a low-tech product is offered from outside Italy, it is more probable to be counterfeit.

4.2.3 Price and discount

Another aim of this study is to figure out the behavior of vendors in terms of offered price for their products. As a first step, we have decided to have a boxplot for comparison of percentage of the discount offered by vendors for each product category (figure 9). The discount is calculated by considering the official price of the product as the base line. Therefore, the products that we do not have information about their official price are removed for this plot. Then, we have calculated discount percentage by comparing the price of each item at the time of data collection with its official price. As some of items has official price range, we have computed the average price of that specific item and compared the offered price on Amazon with this average price. For this plot, we have eliminated some of obvious outliers as their price were unexpectedly high or low –e.g. one of the RayBan sunglasses were priced 2750 euro which was more than 10 times expensive comparing to the official price.

This plot suggests that the offered price of the two high-tech products are more close to their official price –especially “Apple EarPods”. This result could be linked to the lower counterfeit report percentage of this category. As the counterfeit report rate is lower for the two products in electronics sector, it is plausible that there are less counterfeits in this sector; and therefore, the prices are closer to the official price. Moreover, items with a discount more than 20 percent are few in this group of products; while for each of the two low-tech products, at least 50 percent of items have had more than 20 percent discount. Finally, “Rayban Aviator” that has the highest “counterfeit report percentage”, is the only product that almost all of its items were cheaper compared to the official price.

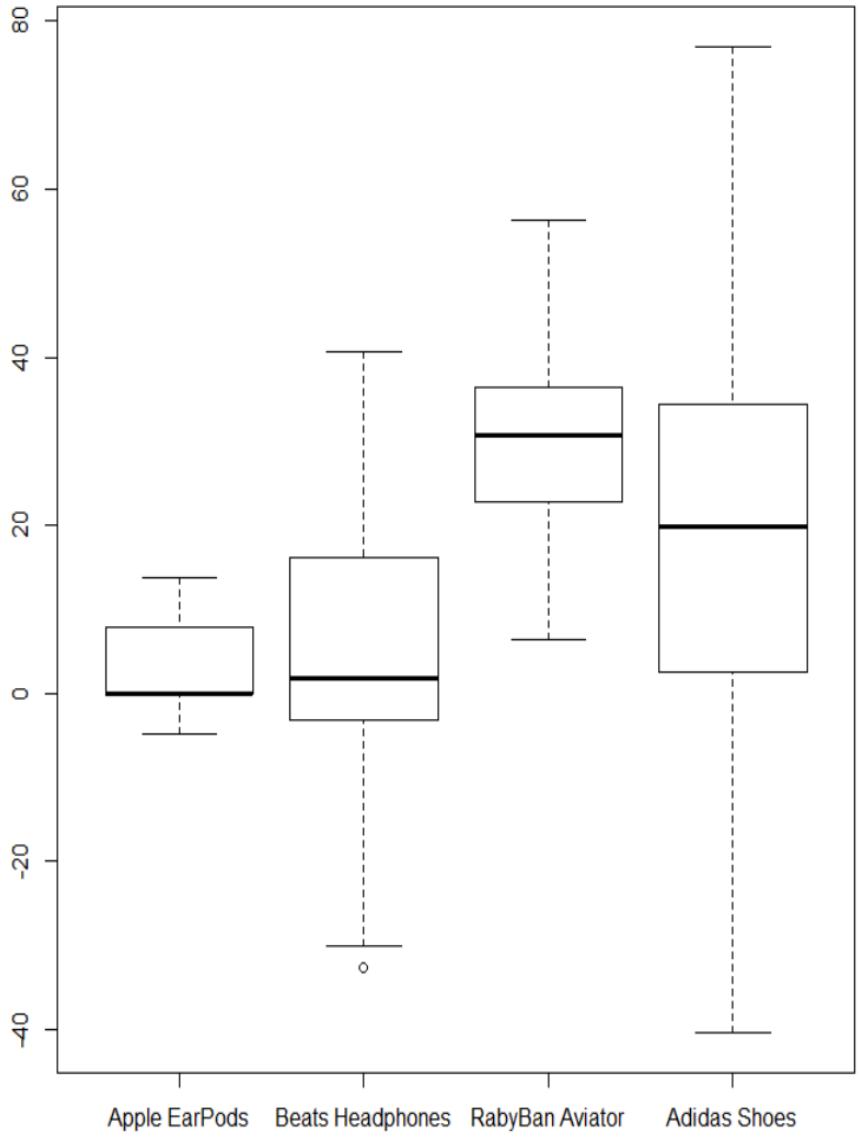

Figure 9: *boxplot of distribution of discount offered for each product category*

Finally, in order to understand if there is a relation between counterfeit products and the discount offered for them compared to the official price of the product, we have compared the discount offered for the products that their counterfeit report is equal or greater than 5 percent of received reviews with the ones with a counterfeit report less than 5 percent. By doing so, we have considered the potential counterfeits as the ones that their counterfeit report is

considerable compared to their total number of reviews –the counterfeit report greater than 5 percent. “Table 27” show the average discount for these two groups:

Product category	Average discount for the items with counterfeit report less than 5%	Average discount for the items with counterfeit report equal or greater than 5%
1. Apple EarPods	2.1%	2.3%
2. Beats Headphones	5.6%	11.5%
Average of high-tech products (1 & 2)	3.85%	6.9%
3. RayBan Aviator	25.7%	30%
4. Adidas Shoes	15.2%	22.5%
Average of low-tech products (3 & 4)	20.45%	26.25%
Mean difference (low-tech – high-tech)	16.6%	19.35%

Table 27: *Average discount offered by the vendors*

By comparing these two groups, as the average discount offered for potential counterfeit items in all four categories is greater in comparison to the ones which counterfeit report is less than 5 percent, it seems that the counterfeit items are more likely to be offered by a greater discount compared to the ones that their counterfeit reports are no significant. In order to understand if these differences in average discounts are statistically significant, we have run Welch two tailed unpaired T-test for each product category as the variances of the two groups are not equal. The null hypothesis is that the means for the two groups of products –suspicious ones and the ones with a negligible counterfeit report- are equal.

Based on the results of “P-values” for the two tailed unpaired T-test, we are not able to reject the null hypothesis as the P-values for the all four product categories are large; Therefore, we cannot conclude that differences in the means of discounts for the two groups –i.e. product with counterfeit reports more than 5% and the ones with negligible counterfeit report- are statistically different. In terms of interpretation, this could lead us to two plausible conclusions. On one hand, the counterfeit reports by customers can reveal that the sale of counterfeit goods on “Amazon.it” is likely to be deceptive; Hence, the purchased price of the counterfeit products is close to the genuine ones as supposed vendors of counterfeits try to deceive customers. On the other hand, it is possible that the counterfeit reports by the customers are incorrect. In this case, our data would be inconclusive.

Moreover, it is perceived that the discount offered for the low-tech product are higher than the discount offered for the two high-tech products. However, on average, the potential counterfeit products in electronics sector are being sold by a higher discount compared to the ones with low counterfeit report –less than 5 percent, the offered price by vendors on “Amazon.it” for this sector is closer to the official price of the items. Therefore, it reveals that discounts for low-tech products are more common than high products.

As a conclusion, based on the reviews of “Amazon.it”, it seems that the suspicious counterfeit products, on average, have been on a discount slightly more than the ones without or with a negligible counterfeit report for all product categories. We failed to statistically support this idea; which could signal a deceptive market on “Amazon.it”. Moreover, the vendors on ecommerce are willing to offer a higher discount for low-tech products compared to the high-tech products –both for counterfeit or authentic ones. Finally, in the electronics sector, there are few items a discount offered more than 40 percent of original price. However, it is possible to find items with extremely high discount in the low-tech products –up to 80 percent.

4.3 Conclusion

Findings of previous researches emphasize that, thanks to the technological improvements, counterfeiting is now a threat even to the high-tech products (Tom, et al., 1998; Bastia, 2002; Huang, et al., 2015; OECD/EUIPO, 2017). Based on the report of OECD/EUIPO (2017), according to the seizure records provided by custom officials, "articles of apparel and clothing accessories" is the most vulnerable product category to counterfeiting; followed by "Electrical machinery & equip. & parts, telecommunication equip., sound recorders, television recorders".

The present research investigates the differences of counterfeiting in the electronics sector products and traditional vulnerable products to counterfeiting on the online market. To do so, we analyzed two product categories in each of the two groups on the "Amazon.it" website - "Apple EarPods" and "Beats Headphones" in the electronics sector and "RayBan Aviator" and "Adidas Shoes" for the low-tech sector. The baseline for distinguishing fake products from the original ones, is reviews provided by the customers for each item.

The results of our data suggest that customers are more willing to share their experience with others in the electronics sector. "Average reviews per item" and "average critical reviews per item" are higher for the high-tech products in comparison to the other two product categories in the low-tech sector. The reviews in the low-tech sector are more about the authenticity of the products. On the contrary, the products in the electronics sector, have received more reviews about price-value trade-off and the functionality of the products. Moreover, they have received more reviews questioning the newness of the purchased product.

Generally, it seems that low-tech products are more vulnerable to counterfeiting on "Amazon.it". "Counterfeit report percentage" –i.e. number of counterfeit reports over total number of reviews- and "percentage of critical reviews that contains counterfeit report" are both higher for the low-tech products in comparison to product categories in the electronics sector.

The second purpose of this study was to understand the location of vendors that are offering counterfeit products. Based on the OECD/EUIPO report (2017), a considerable share of the

counterfeits in European market are imported from Asian countries via complex routes to reduce the price production. Therefore, this research aimed to understand the possibility of selling counterfeit products from vendors located outside of Europe on the ecommerce websites. Based on the consumers' reviews, most of the counterfeit products are offered from Italian vendors. However, an explicit difference is noticeable for the high-tech products in comparison to the low-tech products. offering counterfeits from outside Italy is negligible for the high-tech products; while, in the low-tech products offering from other countries is also common.

Finally, we investigate the price difference of the counterfeit products in comparison to the authentic ones. As the price of different models are significantly different, we have compared the average discounts offered by the vendors for counterfeit and original products. As the average discount offered by the vendors for the counterfeit products are higher, we have performed two-tailed unpaired T-test to understand if this difference is significant. Based on the results, it seems the difference in the average discounts is not significant, which may show that we are facing a "deceptive market" for this well-known ecommerce website. Indeed, the prices are not considerably lower for counterfeit products as vendors try to deceive their customers. Last but not least, vendors tend to offer a higher discount for the low-tech products in comparison to the products in the electronics sector for both counterfeits and authentic products.

4.4 Limitations

In this research, we aim to study the counterfeiting in the internet. To do so, we have decided to focus on the "Amazon.it" since it is one of the well-known e-commerce website in Italy. However, this is one of the limitations of this study and future work could expand our analysis by looking at other websites.

Counterfeit is an illegal phenomenon, hence difficult to detect and measure. As we are not able to analyze each product that is being sold on the Amazon.it, our strategy was to consider the reviews of the products by the customers after the purchase. We used the comments as the main source of information about the authenticity of the product. This has clearly limitations. First, if the counterfeit is very well-made, it is possible that the counterfeit would go undetected. Second, the reviews require some time to be posted. Hence, vendors that have recently opened were at lower risk of report. Third, the customers could mistakenly consider a product to be not-genuine. In our analysis, we have not considered any difference between the reviews that were certain about the product to be counterfeited or have mentioned some doubts about the authenticity of the product. This should be considered as another limitation of this research as the customers are not expert to fully understand the difference between the genuine product and the fake one. Moreover, customers who were aware of purchasing a fake, would not necessarily report afterwards.

Another factor that could bias the results is the fact that data about each product category is collected in specific period of year. It was not possible to collect the data for all the four products simultaneously. The most important problem is that vendors dynamically change their offered price. As a result, the discounts calculated for each product categories could be different if they were collected in the same time.

All these limitations invite further future work that refines and improves the present one. Despite the limitations, the data and analyses performed provided an interesting view of the emerging and understudied phenomenon of online sales of counterfeit goods.

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