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ECO-FRIENDLINESS AND FASHION PERCEPTUAL ATTRIBUTES OF FASHION BRANDS: AN ANALYSIS OF CONSUMERS' PERCEPTIONS BASED ON TWITTER DATA

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Eco-friendliness and fashion perceptual attributes of fashion brands: an analysis of consumers' perceptions based on Twitter data

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Abstract

This research aims at exploring if there is a convergence between the concepts of fashion and eco-friendliness in the consumer perception of a fashion brand. In particular, we assume that an increase in the eco-friendly perception will influence the brand image positively, being this impact much higher for luxury than for high and fast fashion brands. The hypotheses are tested using Twitter data. We analysed all fashion clothing brands with the highest number of followers included in the Socialbakers list and applied a novel social network mining methodology that allows measuring the relationship between each brand and two perceptual attributes (fashion and eco-friendliness). The method is based on the notion of attribute exemplars, which are Twitter accounts that exemplify the attributes. Our exemplars catalyse social media conversations on fashion (identified by the keywords fashion, glamour and style) and eco-friendliness (keywords: environment and ethical business). We computed a similarity function between the followers of the exemplars and those of the brand, based on social network analysis theory. The results suggest that there is a correlation between the fashion and the eco-friendliness perceptual attributes of a brand; this correlation, though, is far stronger for luxury brands than for high and fast fashion brands. The difference in the correlations confirms the tendency of fashion luxury firms over the last few years to consider dealing with environmental issues more and more as a core business and not just as an added value to the firm's offer.

Keywords: Fashion brands, Twitter, consumer perception, environment, ethical business, brand image

1. Introduction

In recent years, fashion companies are increasingly developing and marketing eco-fashion to promote sustainable consumption (Joergens, 2006; Fletcher, 2008; Chan and Wong, 2012). This new trend involves not only the luxury but also the high and fast fashion brands, which have been historically considered as representative of an antagonist concept of fashion (De Angelis et al., 2017; Kapferer and Michaut-Denizeau, 2014; Torelli et al., 2012). Many luxury brands, such as Luis Vuitton, Prada, Armani, Versace, have incorporated materials that satisfy the sustainability consumer expectations (De Angelis et al., 2017), and/or have changed the production system towards more sustainable logics, like, for instance, adopting circular practices (Gardetti and Girón, 2017).

The fashion industries have a strong environmental impact (Pal and Gander, 2018). The European Environmental Agency has ranked the clothing, textiles and footwear industries fourth in the list of industries with high environment impact, after housing, transport, travel and food (European Environmental Agency, 2014). This is due to high water usage during textile production, pollution from chemical treatments used in dyeing and preparation, and the scale of landfill produced during disposal (Fletcher, 2016; Kant, 2012). In a world where there is a growing attention to social and environmental aspect, the fashion industries started to consider as priority social and environmental matters (Pulse of the Fashion Industry, 2018). Therefore companies started to invest on the reduction of energy and water consumption, with practices such as changing from conventional to renewable energy sources, improving lighting and air-conditioning systems, and installing meters to measure energy or water consumption. These practices are implemented across headquarters, stores, and distribution centres. ASOS, for example, a British online fashion and cosmetic retailer, updated the lighting in one of its UK warehouses, replacing all the light bulbs with low-carbon LED alternatives. The result was 76% reduction in electricity consumption and a cut in annual carbon emissions of over 2.3 thousand tons. Hugo Boss analysed their CO2 emissions in logistics and transportation processes and adjusted routes and transport means accordingly. The company reduced emissions by 95% versus conventional sea-air shipment (Pulse of the Fashion Industry, 2018). For sure the sustainability of the fashion industry is dependent on a collective effort to improve the commitment of all the actors involved in the business. Individual action is not enough to lead this transformation, which depends on the establishment of a strong ecosystem rooted in the joint efforts of regulators, consumers, nongovernmental, organizations, and other stakeholders (Pulse of the Fashion Industry, 2018). In order to capture the role of consumers in this ecosystem, Shen et al. (2012) examine the relationship between ethical fashion and consumer purchase behaviour (their willingness to pay a premium for ethical fashion), with the focus on consumers' concerns and beliefs about, and knowledge of, ethical fashion. Their findings suggest that consumer beliefs about ethical fashion, which are based on their

perceptions of a company in terms of its reputation in the fashion industry, influence their support for what they perceive as socially and environmentally responsible businesses. Beside the relevance of this contribution, the sample size, which is relatively small, is a limitation for this research; data were, in fact, collected in Hong Kong, limiting findings to that geographic region. The concerns about ethical consumption is further analysed by McNeill and Moore (2015), who, as a result of survey data analysis, categorized fashion consumers into three groups: 'Self' consumers, concerned with hedonistic needs, 'Social' consumers, concerned with social image and 'Sacrifice' consumers who strive to reduce their impact on the world. Even if it seems to be a tendency towards a more consciousness consumption, still many consumers are hesitant to support this change, and see barriers to the acceptance of sustainably produced products. This is particularly true, in their study, about consumers looking for fast-fashion clothing. Fast fashion products are, in fact, particularly attractive to consumers who prioritise constant change in their fashion consumption behaviour and subscribe to a culture of impulse buying (Mintel, 2007). Clearly, the analysis of the perception of consumers is crucial to sustain a change in fashion production, and the sustainable clothing will be supported by fashion brands as far as the consumers will increasingly associate the concept of fashion with the concept of eco-friendliness. We strongly believe consumers can influence the transition towards sustainability of fashion companies via their purchasing decision. Moreover, it is worthy to investigate if this association stands still for consumers oriented to luxury, high and fast fashion brands. We intend to fill this gap, and contribute to past literature on the topic, by providing original big data analysis on consumer perception of fashion brands.

We therefore explore if there is a connection between the fashion perceptual attribute of luxury, high and fast fashion brands and its eco-friendliness perceptual attribute. In other words, we intend to respond to the following research questions: is eco-friendliness becoming an inherent characteristic of fashion brands? Is there a convergence between eco-friendliness and fashion? Should firms operating in the fashion industry be equally concerned about their green and social investments as well as about their design investments? Is this trend valid for luxury as well as high and fast-fashion brands? A convergence of the concepts eco-friendliness and fashion indicates that, in the fashion industry, being eco-friendly is becoming increasingly a core component of the fashion brands' value proposition, and not just an additional plus of the firm's offer.

Past research into this issue has largely investigated the consumers' motivations to purchase green products (e.g. Griskevicius et al., 2010; Hartmann and Apaolaza-Ibáñez, 2012; Lin and Huang, 2012) and the impact of the "green marketing" in building the company image (Ko et al., 2013; Cronin et al., 2011). Nevertheless, to our knowledge, there are no empirical studies that investigate the relationship between the eco-friendliness and fashion perceptual attributes of fashion brands. The

recent proliferation of social media use by both marketers and consumers offers a promising data source to understand consumer perceptions. In this work, we implemented a novel social network mining methodology proposed by Culotta and Cutler (2016) for estimating brand perceptions along a perceptual attribute of choice from publicly available secondary social media data, specifically Twitter. From the list of fashion clothing brands curated by Socialbakers, we selected those with the highest number of Twitter followers. Then we created an algorithm, which takes as inputs a specific brand (for example Gucci or Hermès), and a brand attribute (for example eco-friendliness or fashion). The algorithm automatically generates a score. The higher is the score, the stronger is the perceived relationship between the brand and the attribute. The main empirical evidence can be synthetized as following: being "eco-friendly" is becoming a fundamental component of the value proposition of fashion brands; there is a strong correlation between fashion and eco-friendliness perceptual attributes of luxury brands; consumers are more sensitive to fashion brands' environmental than ethical business practices.

The article is structured as follow. Section 2 briefly introduces the theoretical framework of the study, summarizing specific extant literature on eco-friendliness and fashion perceptual attributes, and lists the research hypotheses. Section 3 describes the methods and in particular the algorithm created to address the research questions. The results of the estimation of a regression model are presented in Section 4. The last section draws the conclusions.

2. Theoretical background and hypotheses development

2.1 The fashion industry sustainable development: luxury, high and fast fashion brands

Overall, the environmental impact of the fashion industry is massive, since it generates, more than 30 millions tons of global textile consumption a year (Shen, 2014).

The fashion industry is characterized by a complex and fragmented supply chain, which is typically considered less transparent respect other existing sectors (Mihm, 2010; Partridge and Burda, 2011). In this sector the difficulty is to measure how all the suppliers of the individual components works taking into account the social and environmental aspect, from the labour used to manufacture the garment, to its transport from factory to retail outlet, and the garment's aftercare and disposal (Beard, 2008). Many fashion companies started to invest in sustainability, improving resource use, lowering pollution, and enhancing the lives of workers and their communities (Pulse of the Fashion Industry, 2018). The OECD Guidelines for Multinational Enterprises (2008) provide a baseline for a sustainable supply chain, and serve companies by helping them defining targets for human rights, labour, and environmental issues along their value chain.

The literature related to the fashion industry puts particular attention to luxury brands. The reason behind can be easily explained: some studies highlight that "luxury" and "sustainability" are two idiosyncratic elements (Vigneron and Johnson, 2004; Murat and Lochard, 2011). Despite claims of craftsmanship, handmade items or the perpetuation of tradition, many luxury brands are growing by expanding their operations to low-cost factories, while licensed operators pursue volume and sell fashionable, high margin accessories (Kapferer and Michaut-Denizeau, 2014). A few brands may stick to the stringent principles of a luxury strategy (Kapferer and Bastien, 2009; 2012), but many others have abandoned them, minimising the costs of manufacturing and maximising the retail price. The pursuit of higher volumes puts more strain on sustainability concerns, such as rare species preservation, origin of raw ingredients and working conditions in factories (Kapferer and Michaut-Denizeau, 2014). However questions raised in published reports (Bendell and Kleanthous, 2007) and recent scandals have forced luxury companies to be more transparent. It is also for this reason that topics like "responsibility" and "sustainability", especially in the last years, seem to become increasingly linked to the evolution of the concept of luxury itself and its intrinsic values. Luxury fashion companies may play an important role in the implementation of pro-environmental actions (De Angelis et al., 2017), oriented to reduce their environmental impact. It is the case, for instance, of Stella McCartney, which, in 2010, introduced some pioneering shoes of recycled leather, or that of Gucci, which recently launched new sunglasses made with liquid wood instead of plastic. (De Angelis et al., 2017). This evidence suggests a rapprochement between fashion luxury industry and sustainability.

More recently, also high and fast fashion brands turned to a sustainable production. This is strongly supported by the increasing consumers' environmental attitudes, which inevitably influence their eco-fashion consumption (Chan and Wong, 2012). Previous studies reveal, in fact, that fashion consumers are interested in purchasing sustainable fashion products and also willing to pay a higher price as long as the quality of the eco-product is good (Ellis et al, 2012.; Shen et al., 2012; Shen et al., 2014). Following on this progress, for example, H&M, the Swedish multinational fast fashion company, launched a sustainability program (Conscious Action) (Li et al., 2014; Shen, 2014). This program provides job opportunities in less developed countries, introduced the use of recyclable resources in the production process and educated the consumers to be more ethical (Shen, 2014), pioneering a circular economy approach to the process.

However, there is still a need to identify and measure empirically how the sustainability investments of fashion clothing companies might influence the brand consumers' perception.

2.2 The consumer perception: contrasting fashion and eco-friendliness

The study of consumer perception is crucial for shaping marketing strategies, and a straightforward concern about environmental and ethical issues might push fashion brands to invest massively on reducing their environmental impact while enhancing their social consciousness. However, are the consumers able to understand the companies' effort toward a sustainable supply chain? What are their brands perceptions? The existing literature investigated the impact of sustainable clothing industries on the purchase behaviour (Armstrong et al., 2015; Shen et al., 2012; Mohr et al., 2001; McNeill and Moore, 2015), and the consumer perception of a luxury brand's social responsible initiative (Amatulli et al., 2018; De Angelis et al., 2017; Davies et al., 2012; Janssen et al., 2014), providing scattered and mostly anecdotical evidence of the relationship between what we call brand eco-friendliness and consumer perception and purchase behaviour. We define *eco-friendliness* as the ability of brands to communicate their ethical and environmental consciousness, and we contrast the eco-friendliness perception with the *fashion* perception, that is the ability to communicate their fashion, style and glamour characteristics. In order to better understand our argument, a brief overview of brand perception is offered in the following.

Brown et al. (1992) define the brand as a mental association that the consumers have about it. In order to create this connection, it is necessary for the consumers to be exposed to the brand. What the customer perceives and experiences while he/she is in contact with the brand will shape his/her idea of it, and finally his/her brand perception. In other words, consumers build brands, not companies (Keller, 2001, 2009). A company can put out messages through advertising and move conversations with and among consumers in specific directions through social media. Also the marketing experience assumes a crucial role; it should be novel, offer an element of surprise, engender learning and engage the customer (Poulsson and Kale, 2004). Nevertheless, it is the consumers' experience the key to be emotionally connected to brands. The results of the effort of companies to improve their brand value depend on how consumers perceive it. Brand equity is customer-based: equity is present when the customers are familiar with the brand and hold some positive, strong, and unique brand associations (Cheng-Hsui Chen, 2001; Krishnan, 1996; Low and Lamb Jr, 2000). What consumers know about a brand influences their reaction to any future contact they will have with the brand itself, be it advertisement, products or staff (Koll and von Wallpach, 2009).

Brand awareness is strictly related to brand perception, and customer response is based on how the customers process the information derived by comparative evaluations, preferences, or social behaviour (Hartman and Spiro, 2005). Managing brand awareness is a crucial task for brand managers (Aaker, 1996; Kapferer, 2012; Keller, 2003). The use of cognitive maps as a way to display the perceptions of existing or potential customers is a widely used technique in marketing, both for products (Kim, 1996; Schmalensee and Thisse, 1988) and for brands (De Chernatony, 1993; Ordun,

2015; Truong et al., 2009; Truong et al.,, 2008). Other studies explore the phenomenon using surveys, focus group, and semi-structured interviews. Vigneron and Johnson (2004), for example, analyse the perceived luxuriousness of a brand using a scale used to explain the decision-making process of the luxury consumer. The scale contains twenty items that measure five different dimensions: conspicuousness, uniqueness, quality, perceived extended self, and perceived hedonism. The respondents evaluate luxury brand thorough a structured questionnaire including some open questions. This contribution provides a conceptual framework and a scale to measure the perception of luxury of brands. Stępień (2018) explores through an online survey and by means of semi-structured interviews the possible interrelation between "snob" and "bandwagon" consumers' inclinations in the luxury fashion sector. The results suggest that both snob and bandwagon attitudes towards luxury can be expressed by the same individuals. Both snob and bandwagoners want to differentiate themselves from their peer groups. The difference between them lies in the different peer group and in their motivation: bandwagoners want to be affiliated with higher social classes, while snobs want to be socially recognized as superior and unique. Nonetheless, survey methods, which rely on consumers attitudes, have overstated how much ethical issues influence purchase intention (Auger and Devinney, 2007; Chan, 2001). This is because there is a social expectation about how much a person cares about ethical and environmental issues, and respondents tend to provide biased answers due to social desirability (Bobo and Dawson, 2009). By using social media data, this research dampens the intention-behaviour gap: all results are based not on what consumers say (as for surveys), but on how they have acted. The act of following a specific Twitter account, in fact, is a behaviour and social cue, which shows the loyalty of the consumer to the brand (Danaher et al., 2003), and can be used to define the public image of a brand (Naylor et al., 2012), relying on more trustable opinion (Chamlertwat et al., 2012).

2.3 Hypotheses

Fashion luxury firms over the last few years have considered dealing with ethical and environmental issues (*eco-friendliness*) as a core business, and not just as an added value to the firm's offer (Kapferer and Bastien, 2010; Lochard and Murat, 2011; Thomas, 2015; Niemtzow, 2016; Pavione et al., 2016). Counting on larger profit margins, luxury brands have shifted towards a sustainable path of production much more easily than high and fast fashion brands, which have to combine quality and low price through costs reduction activities. Even if this last category of brands are now moving towards sustainability, they still lag behind luxury brands, whose value is recently strictly associated with high quality and high sustainability (as well explained in section 2.1). On the contrary, in luxury, the dimension that mainly contributes to the generation of value for the consumer is the semiotic one (Kapferer and Michaut, 2016). The value of a luxury product is tied to the perception that the others

have of the product itself, to the social position and to the prestige it gives to the owner. The consumer associate to this product a symbolic value of status, which goes beyond the specific functions of use and justifies the willingness to pay a premium price. A firm must promote the differentiating characteristics of the brand and promote the intrinsic elements of the product/service offered to preserve the value of the brand identity. This picture indicates the growing importance attributed to the topics of responsibility and sustainability, importance that appears intimately connected to the evolution of the concept of luxury itself and its intrinsic values. Sustainability may be conceived, in modern society, as a source of luxury (Wiedmann et al., 2012).
Based on the theory reviewed above, we put forward our two testable hypotheses.

H1. There is a convergence between eco-friendliness and fashion perceptual attributes of a fashion brand.
H2. The convergence between eco-friendliness and fashion perceptual attributes is higher for luxury than for high and fast fashion brands.

3. Method

3.1 Data collection and data mining

The hypotheses were tested using Twitter data. Twitter uses an algorithm that pushes content into the user timeline (Asadi and Agah, 2017). The algorithm evaluates the relevance of each tweet based on how much recent the tweet is or whether it contains media, the eventual past interactions with the author of the tweet, and tweets the user found engaging in the past. Twitter is extensively used for brand image and brand personality development. The brand community can be reached directly and at low costs, with frequent messages that have a conversation-like quality that is missing from other social media (Etter et al., 2011; Boyd et al., 2010). Furthermore, in Twitter all social connections (follow and followers) are public, except for a minority of private accounts, and these connections can be accessed automatically and dynamically using the Twitter API. This fact is significant, because the act of "following a brand" is a social signal that can tie the social network data and the users, and this data can be processed to define the brand image (Naylor et al., 2012). Finally, users often classify Twitter accounts using thematic lists. These lists can be accessed dynamically and provide a tool to define which Twitter accounts are the most relevant to a particular topic.

Given a brand (e.g., Gucci) and a perceptual attribute (e.g., eco-friendliness), our goal is to develop an automated method to assign a score to the brand, where a high score indicates a strong perceived relationship between the brand and the attribute. Our approach is based on the notion of an attribute

exemplar. An exemplar is an individual or organization that is known to be strongly affiliated with an attribute. When a user in a social network follows a Twitter account, puts a like on a Facebook page, or establish a connection with another entity in a social network, he/she publicly associates with that entity. We can interpret this association as an expression of affinity (or homophily) between the user and the entity. Survey research also supports that the primary reason users connect to a brand is that they like its products and that most fans are customers (Pereira, Salgueiro, & Mateus, 2014). For these reasons, we will measure the users' perception of a brand by looking at how many users that follow a particular brand, also follow Twitter accounts that are representative of a particular concept. Users that follow accounts widely acknowledged as exemplifying a particular attribute are likely to consider that concept important. Using eco-friendliness as an example, if a user follows the Greenpeace Twitter account, it is likely that this user is sensitive to environmental issues. We can assume that if a brand on Twitter (e.g., @gucci) has many users that follow also the Greenpeace Twitter account (@greenpeace), it is perceived by the followers as closely related to eco-friendliness.

Twitter profile of fashion clothing brands were gathered from the SocialBakers website (https://www.socialbakers.com/) in April 2018. This platform provides a list of all the fashion-clothing brands with the highest number of followers. We selected twitter accounts with a sizeable number of followers to collect enough data too execute the analysis, therefore accounts with less than 100.000 followers have been excluded from the analysis. The list has been filtered to eliminate duplicate and not English-speaking accounts, and to keep only international brand accounts, thus excluding accounts that referred to particular locations (for example, Levi's Mexico). For each of the accounts, we collected their followers'user codes automatically. Since many of these accounts have more than 10 million followers and collecting them would be impractical, a million followers' codes are collected, adopting a random sampling procedure.

For each brand, we calculated a score that indicates the degree of eco-friendliness and fashion perceived by consumers. If the fashion score results to be dependent on the eco-friendliness score, we can assume that the eco-friendly perception of a brand is correlated with the fashion perceptual attribute.

Figure 1 exemplifies the overall process of data mining. Each stage of the process is explained in details in the following sections.

-Insert Figure 1 about here-

Is it possible to generalize the obtained results referring to the consumer perception of the online brands to the whole population? According to the existing literature yes, Danaher at al. (2003), in

fact, demonstrate the presence of a relationship between online and offline loyalty to a brand. Baird and Parasnis (2011) and Naylon at al. (2012) show that consumers are increasingly looking at a brand's social media presence to form judgments about the brand.

3.2 Choice of the Exemplars

To collect data about a concept and monitor the conversation within a brand's list of followers, we need to have a list of Twitter accounts that best exemplify that concept. We call these Twitter accounts "exemplars". While some accounts can be readily determined, we prefer to automate this process, following the procedure suggested by Culotta and Cutler, 2016. The reasons behind this choice are essentially three:

- For some attributes, it can be challenging to find suitable exemplars;
- Automating the process, it becomes scalable and generalizable to multiple attributes;
- Less-known accounts are usually more valuable in computing the final perceptual score (well-known accounts with many followers are followed by people that are not necessarily much interested in the concept that we are trying to measure, while niche accounts are followed only by people who are considerably interested in the topic).

Twitter accounts are commonly organized by users into topic-based Lists[1], accounts users deem relevant to a perceptual attribute can be identified programmatically, eliminating the need for manual curation. In Twitter, Lists are a crowd-sourced method to categorize accounts, i.e, a folksonomy (Peters 2009). Google search engine is used to find which lists are the most influential for a specific attribute. The attributes under scrutiny are *fashion* and *eco-friendliness*. The keywords used to retrieve conversations on *fashion* have been chosen following a study concerning the personality of luxury fashion brands (Heine, 2009). From this pool of words we removed words not directly ascribable to the fashion industry (such as creative, cool, experience), and words that did not generate at least 20 exemplar accounts (such as luxury and elegance). Finally, the keywords kept and used to capture the *fashion* attribute are *fashion, glamour*, and *style*. For the eco-friendliness attribute, we considered two keywords: *environment* and *ethical business.* For each keyword, we compiled a word cloud of the most cited words in the first 500 tweets of each exemplar account, in order to better understand the meaning of each keywords within the conversation around the exemplar account and improving the interpretation of the results.[2] All the keywords related to the *fashion* attribute are strongly associated to the terms "new" and "now". The keyword fashion is also associated with the words "collection"

[1] Twitter lists are a group of Twitter accounts, curated by a single user. We assume that a user creates a list because he wants to aggregate the most relevant accounts (for the user) regarding a single topic (ex. photography, racing, social activism, journalism, environmentalism).

[2] Wordclouds are available upon request.

and “season”, while glamour is also related to “on line experience” and to a brand creating bridal clothing: “Marchesa”. The keyword style is also linked to generally positive adjectives referred to experiences more than products (“love”, “great”, “good”, “best”). The environment keyword is linked to themes such as climate change, clean energy (“climate”, “flood”, “water”, “big”, “oil”) and on the institutions that have an impact on the regulations that are supposed to help fight this phenomenon (“EPA”, “Trump”, “first”, “world”). It also has a positive and future-oriented connotation (“great”, “now”, “change”, “today”, “will”, “thanks”). The ethical business keyword, instead, is more general in its connotation, because it also considers themes such as discrimination, exploitation of child labour or the implementation of ethical business practices. The “ethical hour” word refers to a community of “ethical & sustainable businesses, consumers & bloggers”. It is more business oriented than environment (“business”, “brand/brands”) and has also a direct link with “fashion”.

We implemented a Google query for each of the keyword selected for illustrating the perceptual attributes, filtering only webpages that corresponded to a Twitter List.[3] After removing duplicate Lists, we collected the Twitter accounts contained in the first 50 results of the Google query.
A Twitter account is considered as an exemplar if it appears in at least two of the lists collected in the previous step and has more than 1,000 followers. For each of these exemplar accounts, we collected their followers with a procedure similar to the one used for the brands. For feasibility reasons, we collected up to 100,000 followers’ codes for each exemplar, using random sampling techniques.

3.3 SPS (Social Perception Score) Index and test of the validity and reliability of the perceptual attributes

To understand how many followers of the brand also follow an exemplar account, we followed the approach of Culotta and Cutler (2016), calculating a similarity index, specifically the Jaccard similarity index, which is a measure used in social network analysis (Hamers, 1989):

$$J(B,E) = \frac{F_{B,E}}{F_B + F_E - F_{B,E}}$$

Where the Jaccard Index between the Brand B and the exemplar account E is the ratio between the followers in common between them ($F_{B,E}$) divided by the users that follow at least one of the two Twitter accounts ($F_B + F_E - F_{B,E}$). We subtract the followers in common in the denominator to avoid counting those users twice. Finally, we average these indexes to calculate a single score that defines the perception of the brand about the attribute. To do so, we used a weighted average, where the

[3] Webpages that matches the expression http://twitter.com/*/list/*

weight of each score calculated is inversely proportional to the number of followers of the exemplar account (Manning and Schutze, 2008).

To calculate the SPS we used an algorithm. The inputs for the algorithm are: 1) the Twitter account name of a brand 2) a query that describes the attribute for which we want to measure the brand perception. To verify if each keyword is correctly tied to the target attribute and to have slightly different points of view for the same attribute, the algorithm is repeated using multiple queries.

In order to validate and check the reliability of the perceptual attributes (*fashion* and *eco-friendliness*), we performed some robustness test.

First we validated the attribute *fashion.* Figure 2 clarifies the presence of a correlation between the SPS scores: the more the points in the scatter plot are plotted along a line, the more the SPS scores of the two keywords are correlated. The presence of this correlation implies that these keywords describe similar concepts and thus we can use them in our analysis.

- Insert Figure 2 about here -

The fashion/glamour and glamour/style plots show the highest correlation, while the fashion/style plots (top-right and bottom-left scatter plots) are the least correlated, finally, glamour occupies a central position between the other two terms. On the basis of this qualitative analysis, we expect luxury fashion brands to have a higher fashion and glamour score than the style one, while for other non-luxury fashion brands, we will expect the opposite.

Second we validated the *eco-friendliness* attribute. Figure 3 shows the correlation diagram of the SPS scores calculated for the two keywords ethical business and environment; the line indicates the linear regression estimate of the two series of scores. The dimension of each point represents the number of followers for each Twitter account, whereas the color represents the "type" of each brand. The type of brands is relative to the price point of its "flagship" product:

- Luxury brands are brands with the highest price point (such as Gucci or Stella McCartney);
- High fashion brands are brands with a lower price point than luxury brands, but can be defined as "not casual" brands (for example, Lacoste or Ralph Lauren);
- Fast fashion brands have the lower price point (for example, H&M or Zara).

- Insert Figure 3 about here -

It appears that there is a clear link between the ethical business scores and the environment ones, with exceptions of Diesel, Mulberry, and Vivienne Westwood. A major concern that can arise when measuring SPS scores is that people who consider the attribute measured as important follow a

Twitter account because the associated brand is negatively related to the attribute, acting as a sort of "watchdogs" on the activities of the brands. To verify this, we executed a sentiment analysis on some of the brands we analyzed (Pang & Lee, 2008; Liu, 2015). More specifically, we analyzed the brands with the lower scores for the environment concepts, that is Gucci, Chanel and Versace; and the brands with the highest scores, that is Vivienne Westwood, Diesel and Stella McCartney.

Figures 4 to 9 report the graphs that have been generated using the NCSU Tweet Sentiment Visualization App[4], a tool made available by Christopher Healey, Goodnight Distinguished Professor at the Institute of Advanced Analytics at North Carolina State University, who has built one of the most robust and highly functional free tools for Twitter sentiment analysis. The sentiment analysis is based on three emotional dimensions for words: 1) pleasure (how happy you are); 2) activation (how excited you are); 3) dominance (how much does this particular term dominate the overall sentiment of the snippet of text it's in). By measuring pleasure, activation and dominance, the NCSU Tweet Visualizer offers far more dimensions than can be found in many other sentiment analysis tools. Most of these tools only focus on the "pleasure" dimension and rate sentiment according to a three-value scale: positive, negative and neutral. By contrast, the scales proposed by Healey run on a nine-point range, thus providing a semicontinuous representation of sentiment.

- Insert Figure 4 about here -

- Insert Figure 5 about here -

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- Insert Figure 8 about here -

- Insert Figure 9 about here -

For all brands, we can notice that the majority of tweets lie in the right part of the graph. Tweets on the left side of the graph, which indicates a "negative" connotation, are more numerous for brands with a low score on the environment scale (Figures 7-9) than for the ones with a higher score (Figures 4-6). The results suggest that people that follow a brand do so mainly because they enjoy the brand products and the brand message, and that "watchdogs" users are only a minority of the total.

4. Estimation model and results

[4] https://www.csc2.ncsu.edu/faculty/healey/tweet_viz/tweet_app/

In order to determine if the eco-friendliness perception of a fashion brand influences the reputation of the brand itself, we executed a OLS regression on the eco-friendliness against the fashion SPS. The linear model used in this estimation is the following:

$$SPS_F = \beta_0 + \beta_1 SPS_E + \beta_2 SPS_{E\mathrm{B}} + \varepsilon$$

Where SPS_F is the Social Perception Score of a brand for the fashion perceptual attribute. In particular we ran three different OLS regressions (for fashion, glamour and style) and we considered the relation between these variables not only for the entire dataset, but also for the brand type (luxury, high and fast fashion brands). SPS_E and $SPS_{E\mathrm{B}}$ are the Social Perception Score of a brand respectively for the environment and the ethical business aspects. β_0 is the intercepts, β_1 and β_2 are the coefficient, estimated by the linear model that describes the relation between the two scores.

Table 1 presents the results obtained, where the eco-friendliness attribute (composed of environment and ethical business) is considered in relation to the fashion attribute (composed of fashion, glamour and style).

- Insert Table 1 about here -

Table 1 shows how the three components of fashion (fashion, glamour and style) are positively correlated with the environment component of eco-friendliness for “all brands”. Therefore our Hyp. 1 is only partially confirmed, because we do not see any positive correlation between ethical business and aspects related to fashion for “all brands”.
Moreover, looking at table 1, when distinguishing by type of brand, we see that the relation between all the three components of fashion (fashion, glamour and style) is positively correlated with the environment component of eco-friendliness only for the category “luxury”, thus, again, partially confirming Hyp. 2. For the “high and fast fashion” brands, in fact, the relationship is valid only considering the keywords style and environment.

Our results suggest that there is a positive correlation between fashion, glamour and environment, as crucial component of a brand perception; this correlation, though, is far stronger for luxury brands than for non-luxury brands. The difference in the correlations confirms the tendency of fashion luxury firms over the last few years to consider dealing with environmental issues more and more as a core business and not just as an added value to the firm’s offer (Gazzola et al., 2017; Kapferer and Bastien, 2012; Murat and Lochard, 2011). The results shows also that there is a strong and positive relation between style and environment as component of a brand perception not only for luxury brands, but

also for high and fast fashion brands. This results are consistent with the ability of fast fashion brands to identify and respond to changing styles, trends and demand (Christopher et al., 2004).

Moreover, the relation between ethical business and all the components of fashion is not significant. The results suggest that the ethical business perception is negatively related to the brand perception of being glamour and stylish. In other words, themes such as discrimination, exploitation of child labor, and in general ethical responsibilities in the employer-employee relationship are negatively related to the glamour and stylish perception. Therefore there is a mismatch between the ethical business perception and the glamour and style ones. A note is due to the fact that for this analysis we consider the English-speaking Twitter accounts. The majority of them has more than 10 million followers, and for calculation constraints we collected a million followers' codes using a random sampling procedure. The ethical business concept covers different business area and takes into consideration local culture and moral values that can diverge across different geographical regions (Crane & Matten, 2016). For example, capital punishment is largely condemned in European countries, but in US is morally acceptable. Women can sunbathe topless on the most European beaches, but in some American States they can be fined for doing so, and in Pakistan is forbidden (Crane & Matten, 2016). In other words these examples of cultural mismatch suggest that behaviours condemned as unethical in some countries, could be consider ethical in others (Shleifer, 2004). This discrepancy could negatively impact on the perception of the brands to be considered glamour and stylish. Another interpretation is that consumers do not seem to be as aware about firms' ethical business practices issues as much as they are about their environmental issues.

5. Conclusions

This study, using Twitter data, investigated if there is a correlation between the eco-friendliness and the fashion perceptual attribute of a brand. In order to do that we implemented an algorithm that, starting from publicly accessible data (Twitter API), can provide an estimation of the brand perception regarding a specific topic. The analysis is based on brands with an international reach, and with an active Twitter account with a sizable number of followers (at least 100.000 followers).

This investigation offers a significant contribution to the literature on consumers' perception, which is so far focused particularly on the luxury brands, and reporting results derived mainly through surveys and interviews. The present research has the advantage to consider not only the luxury brands, but also the high and the fast fashion ones, and introduces a novel approach to evaluate the consumer perception: the Twitter data mining. The survey approach, historically used to evaluate the consumers' brand perceptions, may present some bias, people, in fact, are unwilling to provide accurate answer that reflects unpopular attitudes or opinions. Twitter data are an alternative way to

analyse existing data reducing bias due to social desirability, by not explicitly asking any questions to the people, therefore reflecting a more trustable opinion about the brands. The novel methodology used in this paper measures consumers' perception of a brand starting from a behaviour: the act of following a Twitter account. This fact implies that measurements done using this technique would reduce the overestimation of the discrepancy between pro-environmental attitudes and actual behaviour (social desirability bias), and thus can provide ulterior insights in research that explore the topic of the link between green attitudes and green consumption.

From a managerial standpoint, this research presents interesting implications for clothing companies looking at increasing the effectiveness of their environmental and social sustainability initiatives. While the clothing companies adopt new production model (like circular ones) or invest to reduce their environmental impact, they still have doubts regarding if and how the consumers perceive their investments. The present research suggests that the brands' eco-friendly perception has a strong positive relation especially for luxury brands. Consumers that are familiar with the luxury brands and follow them on Twitter expect an increasing commitment regarding the environment. This is related to an increasing consumers' perception of fashion, glamour and style as attributes of the brands. In addition, it is desirable that luxury, high and fast clothing companies rethink how to communicate their ethical business investment. At present, consumers appear less engaged regarding the ethical business practices. The reasons may be diverse: the different perception about the ethical concept around the world; the different feeling in respect to this kind of sustainability, which could also be perceived as part of a greenwashing campaign pushed by the brand desire to appear (but not to be) eco-friendly, and, finally, the difficulty to understand how and to what extent the ethical practice have an impact on the society. Therefore, investments in this area still do not affect the consumers' consideration of a brand as fashion, glamour or stylish. In short, the environmental aspect can play a crucial role in the luxury, but also in the high and fast fashion markets. More investments, on the other hand, must be done on how to communicate ethical aspects (for instance, through ethical certifications such as the B-corp).

The method here implemented is highly generalizable and can be applied by researchers and practitioners desiring to deeply investigate consumer' perceptions about a variety of aspects. Marketing specialists can implement routines in order to map constantly the position of a brand against competitors and measure the impact on consumer' perceptions and sentiment of specific actions oriented, for instance, to reduce the environmental impact or increase the social engagement of the company. Perceptual maps have long been a major analytical tool in marketing research; the method here proposed and implemented allow to use big data as a crucial component of the marketing business intelligence.

The algorithm used in this work returned plausible results. Nevertheless, there are various areas of improvement, which can help in generating more precise estimates of brand perception, or allow the execution of this estimate for brands with less reach and followers. In the first place, this analysis can be executed at various points in time to generate a panel dataset and use regression algorithms created explicitly for panel data, such as the "within" estimator (Nerlove, 2002) to analyse the collected dataset. This estimator allows us to regress the environment and ethical business coefficients removing all time and brand-invariant effects from the estimate. Another area of improvement is the generation of the list of exemplar accounts for each topic: the method herein used leverages the Twitter lists to automatically classify Twitter accounts. Using a semi-curated exemplar list, by adding to the accounts generated with the current method the Twitter accounts resulting from an ad-hoc survey, can help in increasing the precision of the brand perception estimates. Future research might also be oriented at using this social network mining model for computing similarities measures between brands (and not between brands and attributes), generating competitive market structures and brand associative networks. Similarly, clustering consumers by specific attributes might be possible, allowing to produce market segmentations based on social network similarities. Those segmentation have the quality of being emergent and bottom-up, as for the ones required by those promoting tribal marketing strategies.

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Figures and Tables

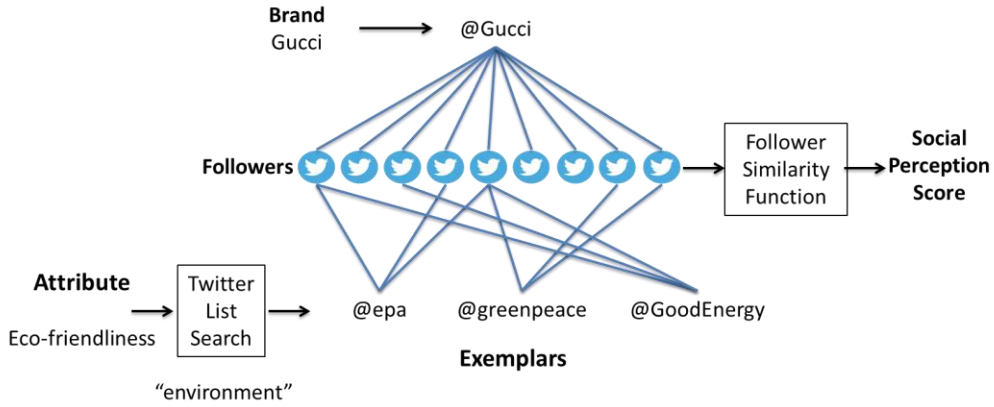

Figure 1: Data mining process
Source: Authors elaboration

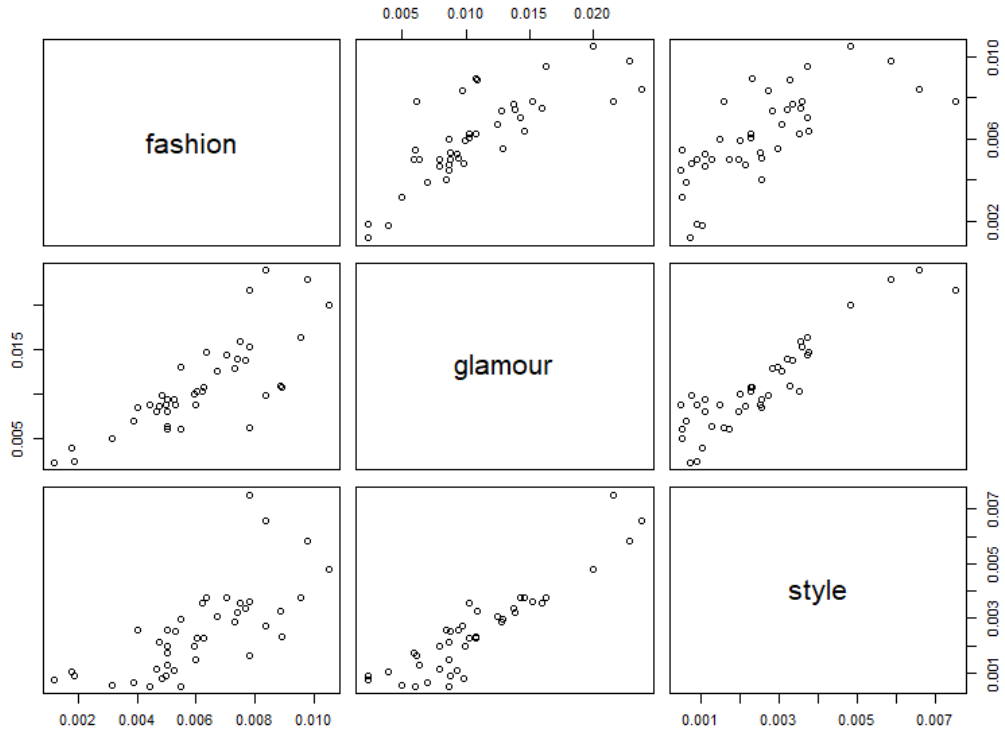

Figure 2: Scatter plot
Source: Twitter API, authors elaboration

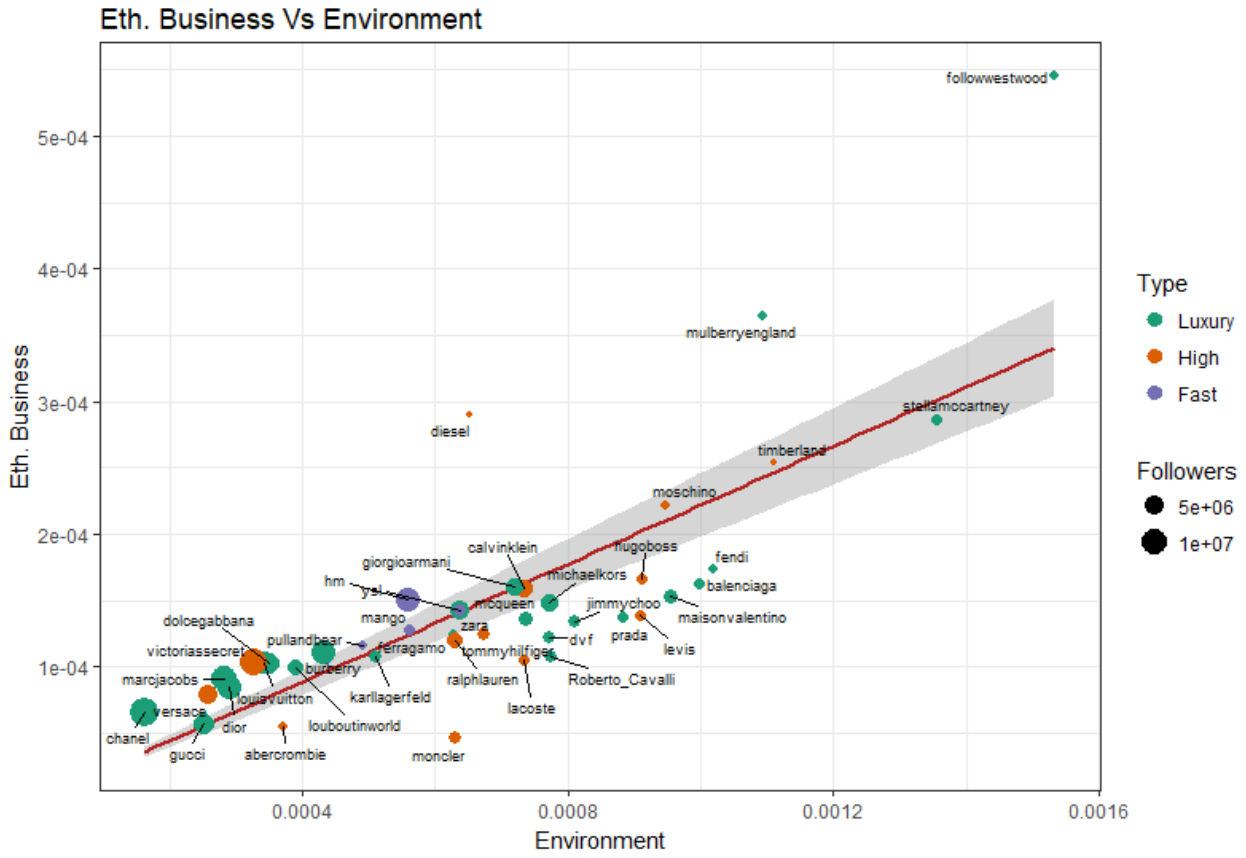

Figure 3: Correlation diagram
Source: Twitter API, authors elaboration

Figure 4: Vivienne Westwood sentiment analysis, authors' elaboration

Figure 5: Stella McCartney sentiment analysis, authors' elaboration

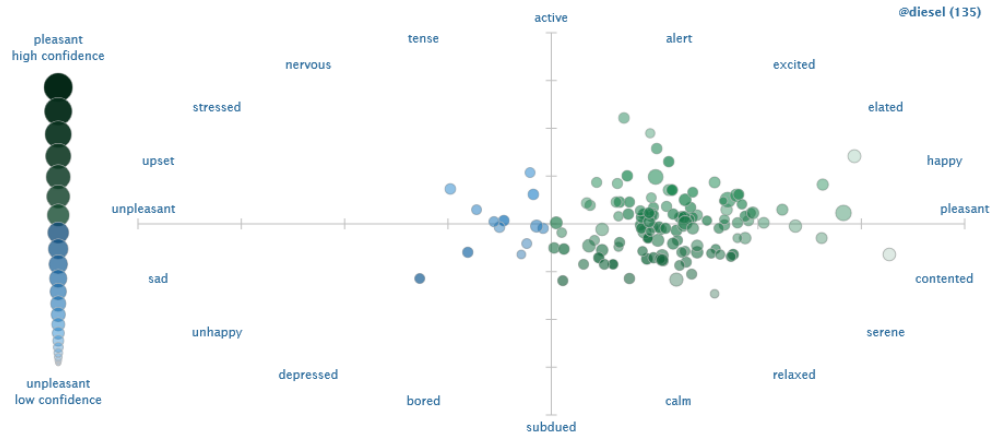

Figure 6: Diesel sentiment analysis, authors' elaboration

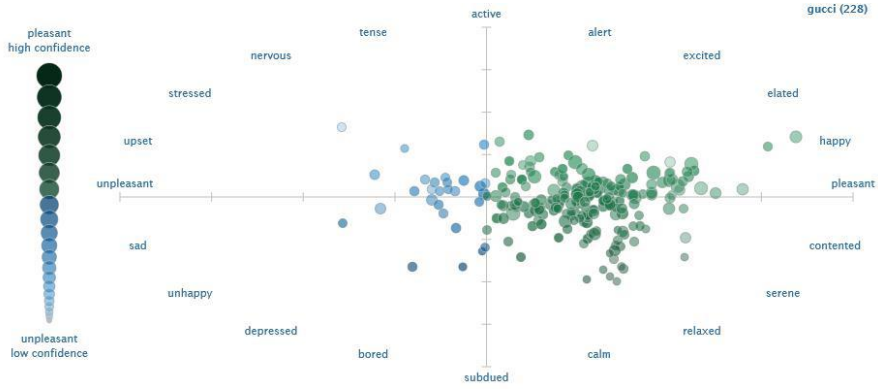

Figure 7: Gucci sentiment analysis, authors' elaboration

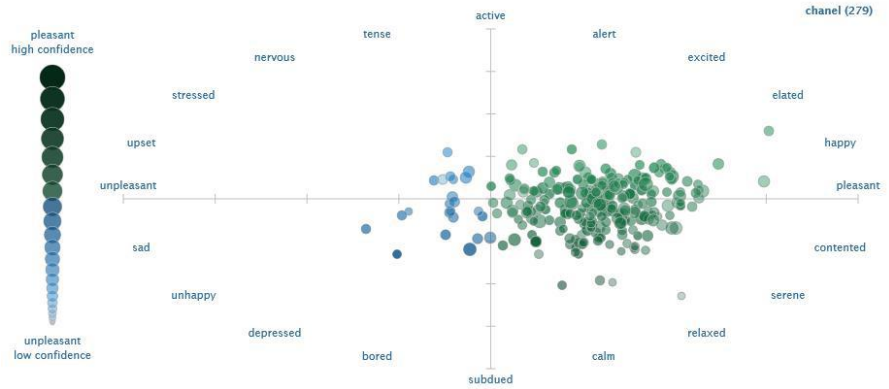

Figure 8: Chanel sentiment analysis, authors' elaboration

Figure 9: Versace sentiment analysis, authors' elaboration

	Fashion			Glamour			Style		
	All brands	Luxury brands	High and Fast brands	All brands	Luxury brands	High and Fast brands	All brands	Luxury brands	High and Fast brands
Environment	5.021***	6.085***	3.016	13.19***	18.02***	7.830	4.189***	5.455***	2.856**
	(1.206)	(1.024)	(2.637)	(2.523)	(2.061)	(5.152)	(0.695)	(0.773)	(1.335)
Ethical_business	4.330	-1.313	4.672	-13.22**	-39.36***	-1.956	-3.317*	-10.46***	-0.132
	(4.092)	(6.436)	(4.892)	(6.098)	(9.619)	(5.105)	(1.853)	(3.738)	(1.164)
Followers	0.000435***	6.62e-05	0.000580***	0.000585**	-0.000547	0.000893**	-4.20e-05	-0.000356**	4.90e-05
	(0.000120)	(0.000253)	(0.000194)	(0.000226)	(0.000377)	(0.000382)	(6.14e-05)	(0.000135)	(0.000104)
Constant	-0.00413**	0.00176	-0.00544***	-0.00459	0.0138**	-0.00876**	0.000783	0.00587**	-0.000489
	(0.00176)	(0.00436)	(0.00194)	(0.00327)	(0.00631)	(0.00343)	(0.000923)	(0.00227)	(0.000842)
Observations	58	30	28	58	30	28	58	30	28
R-squared	0.567	0.621	0.477	0.640	0.789	0.576	0.576	0.684	0.525

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1: OLS regression between the Fashion and Environment SPS score
Source: Author's elaboration