



**Evaluating the Effect of Brand Activations for  
Affordable Luxury Cosmetics Brand X  
Cosmetics Portugal**

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# Evaluating the Effect of Brand Activations for Affordable Luxury Cosmetics Brand X Cosmetics Portugal

Manuela Pereira Marques, January, 2024

## Abstract

Numerous companies experience uncertainty about how to comprehend the impact of brand activations on marketing outcomes. This study concentrates on the obstacles that a renowned cosmetics brand, referred to as "X Cosmetics Portugal", encountered in this regard.

The primary focus of this research was to examine the extent to which purchase value is impacted by a brand activation conducted by X Cosmetics Portugal. Furthermore, this study explores its influence on consumers of varying genders, age groups, and purchase habits, as well as their perception of being influenced by publicity.

Primary data was gathered through surveys placed at 32 brand stores during active and inactive brand activation periods. Using techniques like Propensity Score Matching and Average Treatment Effect, the research aims to establish a causal link between activation exposure and changes in consumer behaviour. Despite expectations to the contrary, it was not possible to conclude that the brand activation conducted by X Cosmetics Portugal had a positive effect in boosting the average amount spent by consumers. Nonetheless, it was surprisingly pointed out a potential impact on the spending behaviour of new high-value customers in a positive manner, suggesting an opportunity to target and build loyalty within this particular segment.

**Keywords:** marketing, brand activation, brand management, observational data, average treatment effect, propensity score matching, causal effects

# **Avaliação do Efeito das Ativações de Marca para a Marca de Cosméticos de Luxo Acessível X Cosmetics Portugal**

Manuela Pereira Marques, Janeiro, 2024

## **Resumo**

Muitas empresas enfrentam incerteza acerca de como compreender o impacto das suas ativações de marca nos resultados de marketing. Esta investigação surge das dificuldades encontradas de uma popular marca de cosmética, aqui descrita como "X Cosmetics Portugal" em fazê-lo.

O foco principal desta investigação consistiu em examinar até que ponto o valor de compra é afetado por uma ativação de marca realizada pela X Cosmetics Portugal. Além disso, este estudo explora a sua influência em consumidores de diferentes géneros, faixas etárias e hábitos de compra, bem como a sua perceção de serem influenciados pela publicidade.

Foram recolhidos dados primários através de inquéritos realizados nas 32 lojas físicas da marca durante períodos com e sem ativação de marca. Utilizando técnicas como a Correspondência de Pontuação de Propensão e o Efeito Médio de Tratamento, esta investigação pretende estabelecer uma relação causal entre a exposição à ativação e a mudança de comportamento do consumidor. Apesar das expectativas em contrário, não foi possível concluir que a ativação de marca realizada pela X Cosmetics Portugal teve um efeito positivo no valor médio de compra. No entanto, a ativação apontou surpreendentemente para uma potencial mudança positiva no comportamento de compra dos novos clientes valiosos, sugerindo uma oportunidade para direcionar a estratégia a este segmento e para o fidelizar.

**Palavras-chave:** marketing, ativação de marca, gestão de marca, dados observacionais, efeito médio de tratamento, correspondência de pontuação de propensão, efeitos causais

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## 1. Introduction

In the landscape of the retail industry, brand activations have become a crucial strategy for companies to engage with their public and to build brand loyalty. However, many companies remain unsure about their influence on marketing outcomes and on how to evaluate their effectiveness (Wood, 2009). The present research is based on the difficulties encountered by a well-known cosmetics brand, hereby described as “X Cosmetics Portugal”, in understanding the efficiency of their marketing activations.

X Cosmetics Portugal is a popular cosmetics and self-care brand positioned in the segment of affordable luxury, which stands out for the quality of its products and for its unique and involving store experience. Working for X Cosmetics Portugal, the possibility to solve the question of knowing if brand activations in fact contribute to their outcomes of interest, particularly consumers’ average ticket value and new client acquisition, has driven my motivation to undertake this research.

The primary focus of this research was to examine the extent to which purchase value is impacted by a brand activation conducted by X Cosmetics Portugal. Furthermore, this study explores its influence on consumers of varying genders, age groups, and purchase habits, as well as their perception of being influenced by publicity.

This study is based on the collection of primary data at all the 32 physical stores of X Cosmetics Portugal, through a survey placed at the end of every purchase in two different time periods, a weekend in which there was a brand activation taking place – 6, 7 and 8 of October 2023 –, and one in which there was not – 27, 28 and 29 of October 2023. The brand activation consisted of a special offer of a tote bag and a full-size product in theme of the brand’s winter collection for a minimum purchase of 50€, whereas the regular gift with purchase is a sample product for purchases above 45€. Additionally, stores were decorated with balloons and some catering was available for the period of the activation.

Data analysis techniques such as Propensity Score Matching were used to create a model that aims to explain the causal relationship between exposure to the brand activation and consequent behavior change on different consumer segments.

Marketing literature provides evidence of the role of brand events in nurturing the relationship between brands and their audience and how they influence the audience’s perception and loyalty towards the companies (Zarantonello & Schmitt, 2013). Furthermore,

Morey (1980) demonstrated that store atmosphere and attractiveness was effective in boosting sales. Despite this, there is not much literature that relates brand activations to their direct impact on sales.

This dissertation follows a journey aiming to demystify the relation between brand activation and consumers' behavior change and ultimately to contribute to the knowledge of brand management. The main results point out that there was not a significative change on the average purchase value between customers who attended the event and those who did not. However, it was concluded that this purchase value did vary amongst new high-value clients for the activation versus for no activation. This revealed relevant suggestions for X Cosmetics Portugal decision-making process.

The structure of this thesis is as follows: in the literature review, the concepts of brand activations, affordable luxury, propensity score matching and average treatment effect are explained. Next, the methodology outlines how data was collected and the methods used to analyze it. After this, results are presented and conclusions are drawn. Following the discussion, a dedicated section discusses the managerial relevance of the findings. Finally, limitations of the research and possible future work are delineated.

## **2. Literature Review**

This section presents background on key concepts, issues and methodologies that are relevant to answering this study's research questions. It starts with pertinent context on brand activation and marketing and follows describing data analysis frameworks.

### **2.1. Brand activations and marketing cues**

Research has firmly established that marketing cues, such as how sales promotions are presented and consumers' knowledge of brands, can have an impact on their shopping behaviour (Berger et al., 2008). Additionally, the compatibility of these cues with consumers' previous motivations also plays a role (Ramanathan & Dhar, 2010). While certain individuals prioritize saving money, others prefer extracting value from their purchases. Regulatory focus theory (Higgins et al., 1997) distinguishes two types of people, those who have a promotion focus, i.e., pursue goals towards accomplishing the outcomes they desire, and those who have

a prevention focus, i.e., seek absence of loss outcomes (Brockner et al., 2004) & (Cesario et al., 2004). For example, limited time offers provoke a sense of consequence, thus activating those with prevention focus (Abendroth & Diehl, 2006). The brand activation that is scope of this research includes a promotion that is valid only for a weekend, so we assume that it will impact people who have a prevention focus in this way, but also those with promotion focus, as they will, supposedly, see a benefit on the special gift with purchase they can receive.

Bawa & Shoemaker (2004) conducted a study on the impact of free sample promotions on the increase in brand sales. They also differentiated between various consumer segments based on their response to free sample offers, taking into account their previous experiences with the brand. As per the model proposed by these authors, there are three distinct groups of consumers: segment 1, comprising individuals who have previously tried products from the brand; segment 2, consisting of individuals who would have made a purchase even without the free product; and segment 3, encompassing individuals who would not have bought anything unless they received the free product. Considering that segment 1 is already familiar with the brand, it is improbable that the complimentary product will have any influence on them. In segment 2, it is expected that some individuals will be tempted by the offer and make a purchase earlier than they would have if no offer was present. The latter phenomenon is referred to as the acceleration effect (Bawa & Shoemaker, 2004). On the other hand, also in segment 2, there will be individuals who do not find the offer appealing and therefore choose not to make a purchase (Riso & Aspley, 1994). As a result, they will not have the opportunity to try the brand, leading to a negative impact known as the cannibalization effect (Bawa & Shoemaker, 2004). When making the offer for segment 3, certain individuals will be captivated by it and make a purchase. The occurrence of these sales can be attributed to the free offer, thus giving rise to what is known as the expansion effect (Bawa & Shoemaker, 2004). According to the same authors, providing free samples increases the likelihood that consumers will select the brand in the future, whereas reducing prices has the opposite impact. The offer included in the brand activation of this study involves providing a full-size product for a minimum purchase requirement instead of giving out free samples. However, a similar reasoning can be applied.

Gaeth et al., (1991) studied how consumers evaluate multi-product bundles and found out that the influence of the tie-in product compared to the primary product exceeds its monetary value, making the perceived value of the bundle greater than the sum of its parts, particularly among consumers who possess limited familiarity with the brand. They also mention the importance of the quality of the tie-in product. Additionally, they emphasise the

significance of the tie-in product's quality. Given that the offer includes a full-size product and tote bag instead of a smaller-sized product, it could suggest that this promotion is favourable.

Marist, Yulianti and Nabij (2014) state that product marketing has become harder throughout the years due to market saturation and limited opportunities for differentiation. In addition, consumers are inundated with conventional advertising and are becoming more resistant to its influence (Vila-López & Rodríguez-Molina, 2013). This brings on a challenge for brands to find new ways of communicating to their target audiences.

In this respect, it is known that the concept of “affordable luxury” is gaining strength and the segment is becoming more and more fragmented, thus becoming more competitive, as premium brands are trying to acquire middle-class consumers that are fascinated by the idea of having a luxurious life (Shahid et al., 2023). Among personal luxury goods, cosmetics and perfumes are the most widely consumed products (Dubois et al., 1996). This emphasizes the fact that there is a growing challenge for X Cosmetics Portugal to differentiate its marketing strategies.

Despite the existence of various formats of brand activations including discounts, free offers, sampling distribution, events, workshops, among many others, and the high frequency of their use by brands, many companies remain unsure about their influence on marketing outcomes and on how to evaluate their effectiveness (Wood, 2009). Most marketing literature only provides evidence about the role of brand activation in fostering relationships between consumers and the brand (Muniz & O’Guinn, 2001) & (McAlexander et al., 2002).

Marketing managers collaborate with advertising agencies to strengthen their brands. However, they cease contracts promptly when agencies fail to generate an increase in sales. This is because agencies typically prioritise metrics such as brand recognition and purchase intention, whereas managers are assessed based on their ability to drive sales growth (Bruce et al., 2012). Hence, the methodology for managers to evaluate the influence of brand activation events on sales remains ambiguous, giving rise to the subsequent hypothesis:

**H1:** Brand activation leads to an increase in purchase value.

Vakratsas and Ambler (1999) state that “the consumer's mind is not a blank sheet awaiting advertising but rather already contains conscious and unconscious memories of product purchasing and usage. Thus, behavior feeds back to experience”. From here, we can derive the hypothesis that different customer segments in respect to shopping frequency at the brand will react differently to the brand activation, as frequent buyers already have more

established memories of their experiences with the brand, potentially leading to a greater impact on their willingness to pay. In opposition, new customers may not have the same extent of memories, thus requiring different strategies to connect to the brand. Based on this, the following hypothesis is proposed in this study:

**H2:** Event has a higher impact on frequent clients' purchase value.

Nonetheless, Michael Lewis (2006) acknowledges that short-term promotions may attract a large number of one-time buyers and clients who buy solely during promotional periods, which can affect metrics such as customer lifetime value. X Cosmetics Portugal is interested in determining whether its brand activation efforts are successful in attracting new high-value clients, specifically those who have the potential to become loyal to the brand. In this manner, hypothesis three will be examined:

**H3:** Valuable new clients spend more in the period of the event.

The accepted view holds that women exhibit stronger reactions to advertising compared to men. However, research findings present mixed evidence (Fisher & Dubé, 2005). Fekete-Farkas et al. (2021) state that gender differences affect people's attitudes and behaviors and that divergences exist in the way males and females react to advertising. To account for this, as it is important to know to whom to direct communication to, a fourth hypothesis was derived:

**H4:** Event leads to a higher spending increase among women.

Moreover, as age affects consumers' consumption patterns and is linked to different relevant factors, including family size and income (Fekete-Farkas et al., 2021), it is important to understand its impact on the consumers' behaviour. This way, the following hypothesis emerges:

**H5:** Event has a higher impact on purchase value of adult consumers.

Finally, it is known that brand activations create a bond between customers and brands (Saeed et al., 2015). Unlike with traditional advertising, brand activations employ a targeted,

emotional and practical approach, making people emotionally motivated to adopt the brand's products, which consequently contributes to enhancing the overall reputation of the brand (Saeed et al., 2015). This is why, according to the same authors, brand activations are replacing traditional marketing.

## 2.2. Propensity score matching and average treatment effect

While randomised experiments are the most effective design for studies of this nature, they are not practical for the majority of social science research. Therefore, researchers in this field often rely on observational data, typically collected through surveys (Winship & Morgan, 1999).

Xie et al. (2012) studied the treatment effects with observational data in a similar context to the one of this dissertation. They state that individuals differ in their background characteristics but also in the way they respond to a treatment, so they match control to treated units having the propensity score as a base, i.e., the probability that an individual will be treated based on the respective covariates, to estimate the Average Treatment Effect (ATE). This is due to the impossibility of studying the same individual, under the same circumstances, for both  $treatment = 1$  and  $treatment = 0$  and as the treatment administration is not random. The same authors mention the existence of two types of bias: pretreatment heterogeneity bias and treatment-effect heterogeneity bias.

Consider that our population,  $U$ , is being studied, with  $Y$  being the outcome variable of interest, which is value (with its realized value being  $y$ ). Treatment is defined by the attendance to X Cosmetics Portugal brand event and is denoted as  $D$  (realized value is  $d$ ), for which  $D = 1$  means a consumer attended the event, so is treated, and  $D = 0$  means a consumer did not, so is not treated. Subscript  $i$  resembles the  $i$ th member of population  $U$ . Additionally,  $y_i^1$  defines the  $i$ th member's potential outcome when treated and  $y_i^0$  when not treated.

Pretreatment heterogeneity bias refers to the average difference between the outcomes of the two groups if none of them received the treatment. In this case, the difference of people's willingness to pay due to their different backgrounds and personal characteristics. This can be expressed as:

$$E(Y_{D=1}^0) - E(Y_{D=0}^0) \tag{1}$$

Secondly, treatment-effect heterogeneity bias, which is the difference between the ATE of the treated (TT) and of the untreated (TUT), weighted by the proportion of the untreated (noted as  $q$ ). In this case, this resembles that attendance to the event may be selective as it attracts people with prior expectations of the brand. This can be expressed as:

$$(TT - TUT)q \quad (2)$$

In the case of observational studies, individuals are assigned into treatment and control groups for various reasons, some that cannot be understood by researchers (Xie et al., 2012). It is by controlling covariates that treatment will be independent of potential outcomes – this is assumed in what is called the “ignorability assumption” (Rosenbaum & Rubin, 1984). Thus, being  $X$  a vector of observed covariates:

$$(Y^1 - Y^0) \perp\!\!\!\perp D|X \quad (3)$$

As it is not possible to know under which covariates equation (6) is true, ignorability is always assumed. When this holds true, it is sufficient to condition on propensity score as a function of  $X$  (Xie et al., 2012). So, equation (6) becomes:

$$(Y^1 - Y^0) \perp\!\!\!\perp D|P(D = 1|X) \quad (4)$$

where  $P(D = 1|X)$  is the propensity score, which is the probability of treatment that summarizes all relevant information in covariates  $X$  and is used to balance the distribution of covariates between the treated and untreated (Xie et al., 2012).

Propensity score captures both types of heterogeneity bias, described in equations (4) and (5) (Xie et al., 2012).

The Average Treatment Effect is the value of the difference between the expected value of  $y_i^1$  and  $y_i^0$  in the population (Winship & Morgan, 1999) and can be expressed as:

$$ATE = E(Y^1 - Y^0) \quad (5)$$

### **3. Methodology**

This section outlines the methodology employed in the current study. Subsection 3.1 provides a summary of the data collection approach, while subsection 3.2 outlines the techniques used to analyse the collected data.

#### **3.1. Data collection**

The objective of this study is to measure the impact of the brand activation initiatives undertaken by the renowned cosmetics brand X Cosmetics Portugal.

In order to achieve this goal, primary data was gathered from all 32 physical stores of the brand, located in Portugal, through a Qualtrics survey. The survey was conducted on two separate weekends, one of which coincided with a brand activation taking place in the stores, while the other did not. The survey was designed to be simple and short, enabling store assistants to complete it promptly after each purchase without hindering their own productivity. In addition, before publishing the final survey, a preliminary version was administered to eight individuals to ensure its clarity.

The survey consisted of four sections: a self assessment, ranging from 1 (nothing) to 10 (totally), of the extent to which customers believed that in-store advertising influenced their purchase decisions; the frequency of their shopping at the brand, either if it was their first purchase, sometimes for themselves, sometimes to gift to someone, or if frequently; their gender and age group; and lastly, the value of their purchase (refer to Appendix 1 for the survey). The first section was assessed using a Likert scale with 10 points, moving from a weaker endorsement, as 1 meant that the individual felt no influence of publicity in their purchase, to a stronger endorsement, with 10 meaning that the publicity in store totally influenced their purchase that day. This scale also had no middle/neutral category, as being neutral does not equate to (dis)agreement (Nemoto & Beglar, 2014) and was implemented from 1 to 10 as more scale response options usually lead to less skewed data (John Dawes, 2008). The following two sections, frequency of shopping and customer profile, included multiple choice questions for easy selection. Finally, value was inserted as an open answer.

### 3.2. Statistical analysis method

Succeeding this, a straightforward approach was followed with the observational data collected, to estimate the effects of the brand event on outcome purchase value and distinguishing between customers who experienced the activation and the ones who did not, accounting for covariates gender, age group, region, frequency of shopping at the brand and influence of publicity felt.

It was established an intent to conduct group-level comparisons, where groups are similar in all aspects except for their treatment status, aiming for causal inference. Two main methods were used: Propensity Score Matching (PSM) and Average Treatment Effect.

Because of population heterogeneity, there is no guarantee that both groups are comparable (Xie et al., 2012). Additionally, individuals may self-select into treatment based on their perceived benefits and costs of it (Xie et al., 2012). To account for this, PSM was conducted, as this method is often used to balance the distribution in covariates between treated and control groups (Xie et al., 2012). Ignorability was assumed.

The ATE is the difference between the expected values of outcome variable purchase value for individuals under treatment and those in the control condition and was estimated after PSM, for a more accurate result.

Lastly, the variable related to the influence of publicity in purchase was crossed with frequency, to analyze new valuable clients conversion with and without the brand activation.

Due to a relatively high number of stated hypothesis in this study, the Bonferroni correction was considered. This correction consists of adjusting  $\alpha$ , the study's significance level, to:

$$\alpha_{Bonferroni} = \frac{\alpha}{\text{Number of tests}} \quad (6)$$

After criticism about this correction for being excessively conservative, Armstrong (2014) proposed advice on when to use it. The author advised the use of this correction when a single test of the “universal null hypothesis” that all tests are not significant is required, when it is crucial to avoid type I error (false positives resulting from noise when there is not a true effect (Lieberman & Cunningham, 2009) or if a large number of hypothesis that were not preplanned is carried out. As this is not the case for the present study, the chosen significance level for this study was of 0.05, which is a standard accepted in academic research.

## 4. Data

This section focuses on the steps taken to prepare the dataset for analysis, with data cleaning and data wrangling and presents the obtained sample characterization, describing into detail the dataset's descriptive statistics.

### 4.1. Data cleaning

The collected sample consisted of 5213 observations. Each question of the survey was of obligatory completion. The duration of the survey was the decisive criterion for excluding observations from the analysis. The shortest response lasted 6 seconds, while the longest response lasted 686659 seconds. Furthermore, the median duration was 35 seconds, the first quartile was 18 seconds and the third was 353 seconds. Although it is not possible to read and respond to the questionnaire within 6 seconds, we cannot rule out the possibility that someone completed the questionnaire but forgot to submit it. This may have been discovered some time later when the response was finally submitted, thus explaining the longer duration.

The distribution of *duration* was transformed to a logarithmic scale in order to achieve a more symmetrical distribution and to identify any outliers. This way, it was obtained a left-skewed distribution, where it could be seen that answers with a small duration are quite frequent, thus these are not considered outliers. This can be seen in Figure 1.

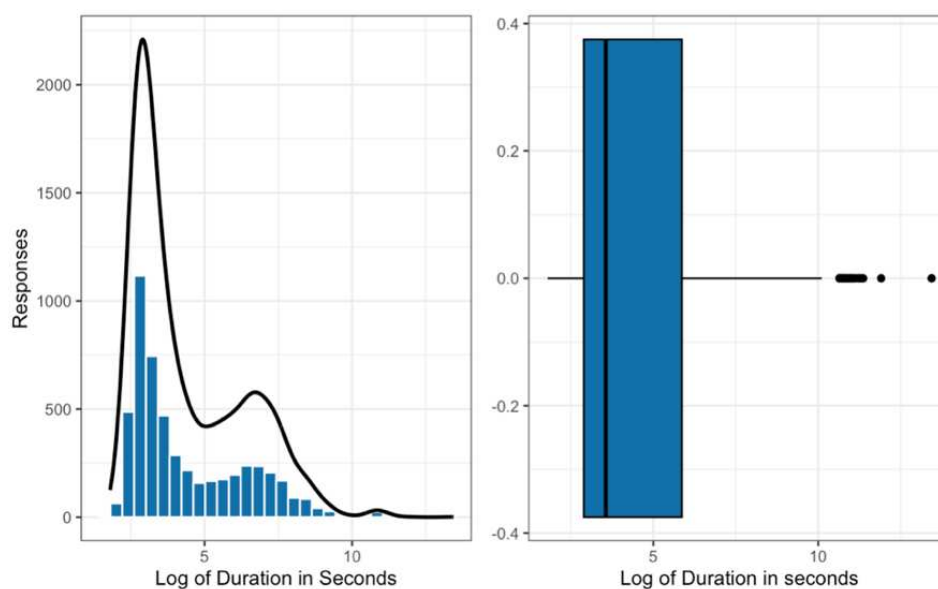


Figure 1 - Distribution of log duration in seconds.

Nonetheless, it was decided to remove observations that took less than 10 seconds to complete the questionnaire (145 answers were removed) after handing the questionnaire over to eight people who tried to fill it in as quickly as possible, having taken, on average, a total of 13 seconds. If filtered for a longer duration, we started to account for a lot of observations. It could be the case that the employee asks the client about their frequency of shopping and the influence of publicity and fills it out quickly by themselves.

The variable *Value* was inserted in an open answer format. Although a numeric format was asked for in the instructions of the questionnaire, responses were recorded in various formats. The answer types were uniformised and five observations with invalid answers were removed.

The distribution of *Value* was log-scaled in order to achieve a more symmetrical distribution and check for the presence of outliers. The histogram and boxplot obtained, that can be seen in Figure 2, indicate the presence of some outliers.

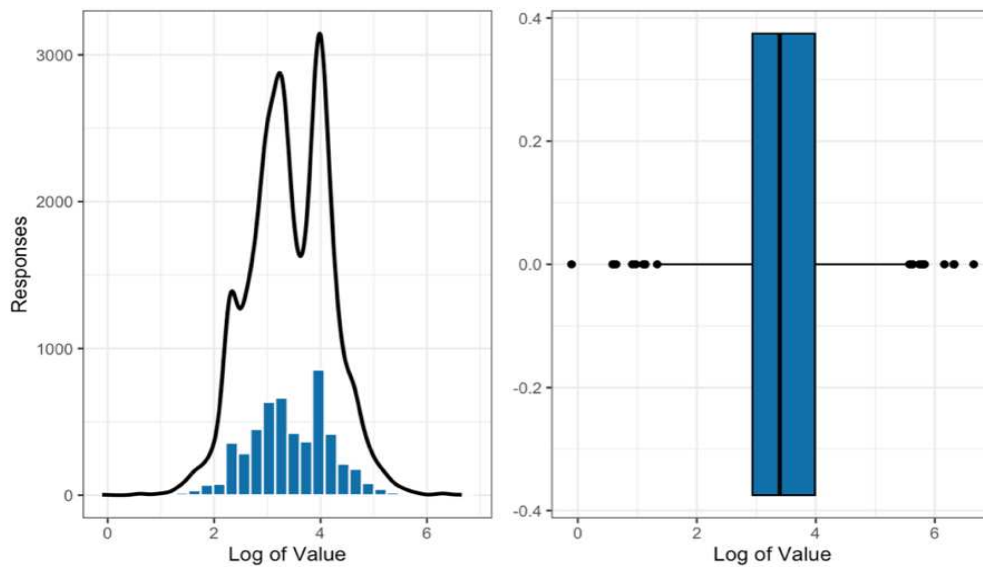


Figure 2 - Distribution of log value.

These outliers were removed through filtering the data for observations that were smaller than the mean of *Value* minus 3 times its standard deviation and higher than the mean of *Value* plus 3 times its standard deviation.

## 4.2. Data wrangling

First of all, the variable *Event* was created. This is a dummy variable that is equal to 1 if the survey was completed during the period with the brand activation and 0 otherwise. Secondly, in an effort to enhance the analysis, the survey question pertaining to customer profile was separate into two variables, gender and age.

To examine shopping frequency, the question regarding this variable, which was initially divided into four categories, was reconsidered as if divided into three, as sections “Sometimes, to treat myself” and “Sometimes, to gift someone” addressed a different topic other than frequency, which could not be measured in the same way as options “It’s my first purchase” and “Frequently”. This was why these two options were merged into one category labeled “Sometimes”.

The variable *Pub\_influence*, as it is not entirely independent from treatment, i.e., the same person could evaluate their perception differently with and without the brand activation and due to its subjective nature, was not included in the PSM and ATE analysis, to ensure that the required assumptions of these tests were met. It was rather included in order to understand how this activation attracted new valuable clients into the stores of X Cosmetics Portugal: A new variable called *Valuable\_new\_client* was created, being 1 for observations with low shopping frequency (people that answered it was their first purchase or that they had shopped sometimes at the brand before) and high publicity influence (6 or higher) and 0 otherwise, aiming to account for newly acquired customers that respond positively to brand activation, thus having potential to be converted into loyal customers.

Additionally, the variable *Region* was created based on the location of the store where the survey was completed from.

To enhance clarity, variables and their corresponding descriptions are succinctly summarised in Table 1.

Table 1- Type and description of the variables considered in this dissertation.

<b>Variable</b>	<b>Description</b>
<i>Age</i>	Ordinal categorical variable. Categories are <i>young</i> for respondents that are 30 years old or younger, <i>adult</i> if from 31 to 65 years of age and <i>senior</i> if over 65 years of age.
<i>Event</i>	Dummy variable. 1 if survey was answered during the brand activation period and 0 otherwise.
<i>Frequency_cat</i>	Ordinal categorical variable. Categories are <i>First_purchase</i> , <i>Sometimes</i> and <i>Frequently</i> and speak for themselves
<i>Pub_influence</i>	Discrete ordinal variable. How much customers perceived their purchased was altered because of publicity in store they were exposed to, which was different for <i>Event</i> = 1 (added publicity) and <i>Event</i> = 0 (regular publicity). Takes values from 1 (nothing) to 10 (totally).
<i>Region</i>	Categorical variable. Categories are <i>North</i> , <i>Center</i> , <i>South</i> , <i>Lisbon</i> and <i>Islands</i> and speak for themselves
<i>Valuable_new_client</i>	Dummy variable. 1 if individual reported low shopping frequency (first-time buyers or people that buy sometimes) and high publicity influence (6 or higher) and 0 otherwise.
<i>Value</i>	Continuous variable. Amount spent by the customer in store, in euros.
<i>Woman</i>	Dummy variable. 1 if respondent is a woman and 0 if a man.

### 4.3. Sample characterization

The period of the brand activation accounted for 45.5% of answers, while the remaining 54.5% were registered for the period without it.

During the event, the sample was characterised in terms of demographics. 84.24% of the respondents were women, 15.76% were men (see Figure 3). Among the respondents, 70.63% were adults between the ages of 31 and 65, 21.22% were young people aged 30 or

younger, and 8.15% were seniors over the age of 65 (see Figure 4). Lisbon accounted for the majority of responses (43.24%), which was anticipated given its higher average sales record. The North region represented 28.67% of the responses, the South region accounted for 10.92% of the responses, the Central region accounted for 13.12% of the responses, and the Islands region accounted for 4.05% of the responses (see Figure 5).

In terms of frequency, during the same period, 52.58% of respondents reported occasionally shopping at the brand, 36.24% indicated being frequent buyers, and 11.18% made their initial purchase (see Figure 6). In addition, 18.71% of individuals were purchasing gifts for another person.

On the other hand, during the period without the brand activation, 83.35% of the respondents were female, 16.65% were male (see Figure 3), 67.77% were adults, 24.40% were young individuals, and 7.83% were elderly individuals (see Figure 4). Lisbon was once again the location with the highest percentage of answers, accounting for 41.79%. The North region accounted for 34.33% of answers, the South region for 13.82%, the Centre region for 8.01%, and the Islands for 2.06% of answers (see Figure 5).

Regarding frequency, during this period, 51.49% of respondents reported occasional shopping at the brand, 37.23% indicated being frequent buyers, and 11.28% made their initial purchase (see Figure 6). Furthermore, 20.29% of individuals were engaged in the act of purchasing a gift for another person.

The previously mentioned results are summarized in Figure 3, Figure 4, Figure 5 and Figure 6.

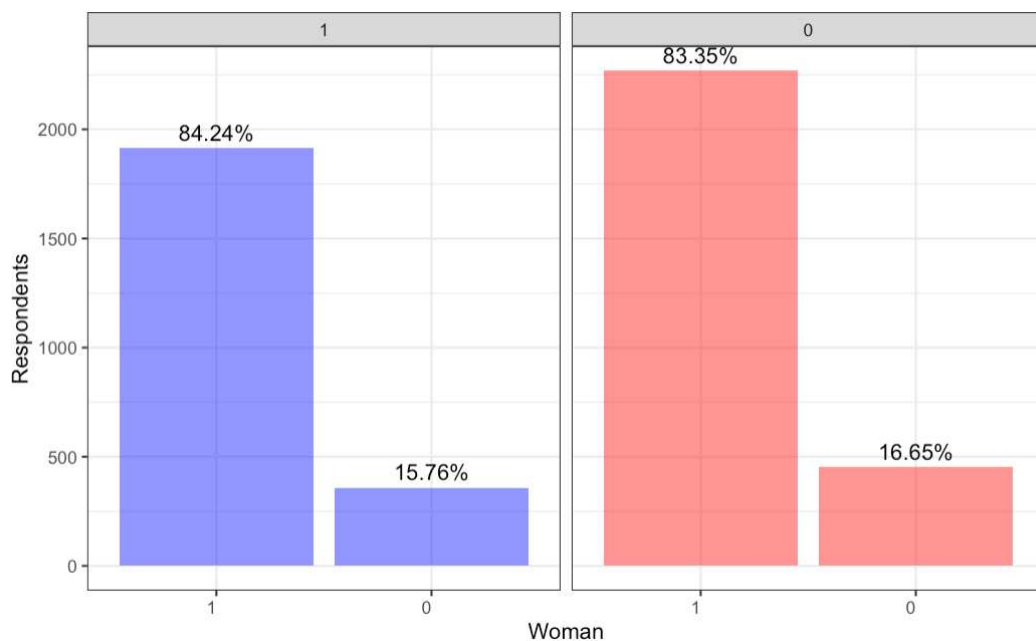


Figure 3 - Bar plots of Woman for Event = 1 and Event = 0.

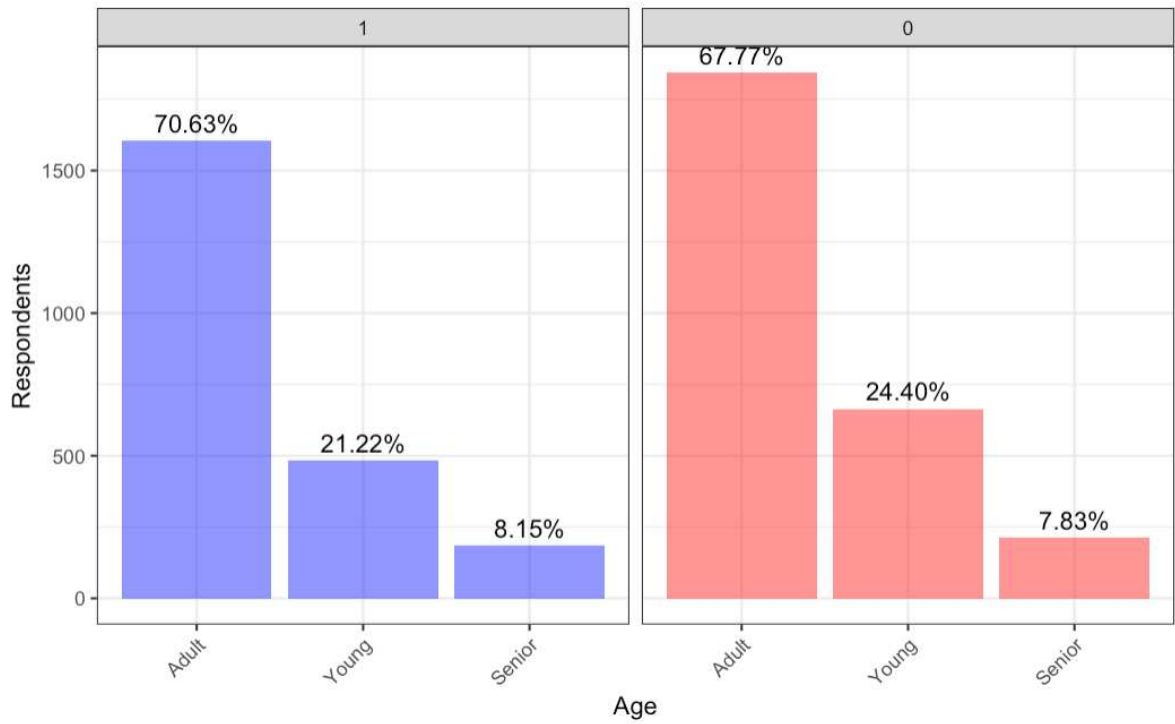


Figure 4 - Bar plots of Age for Event = 1 and Event = 0.

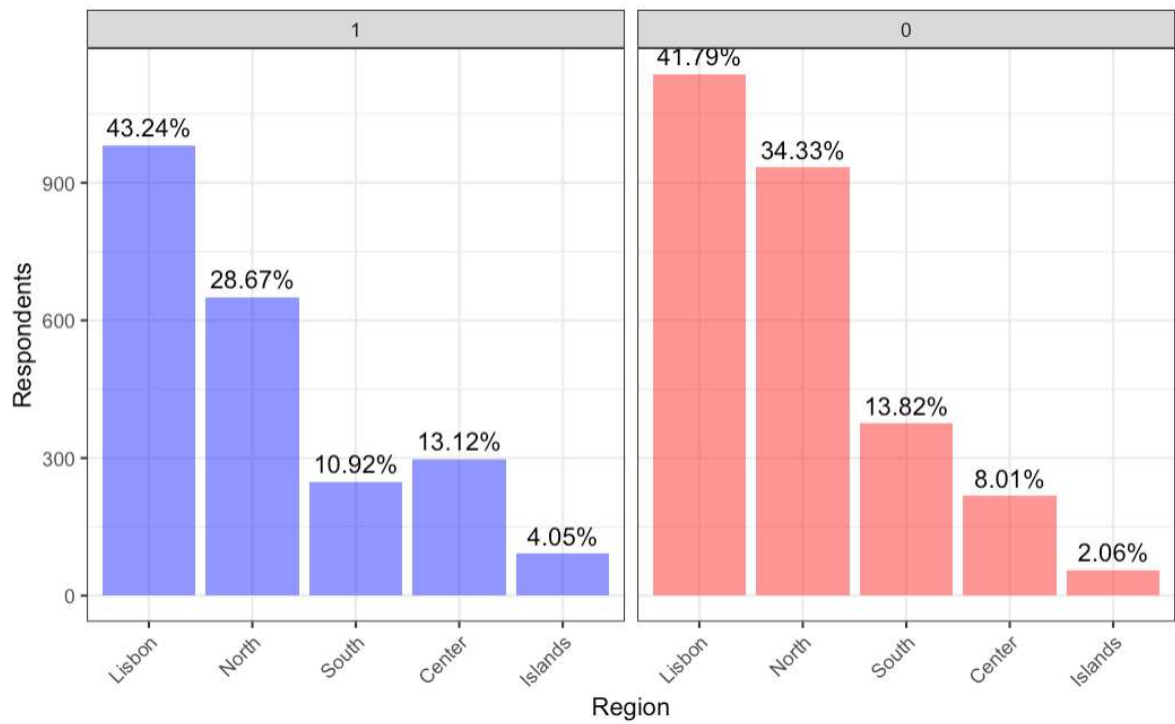


Figure 5 - Bar plots of Region for Event = 1 and Event = 0.

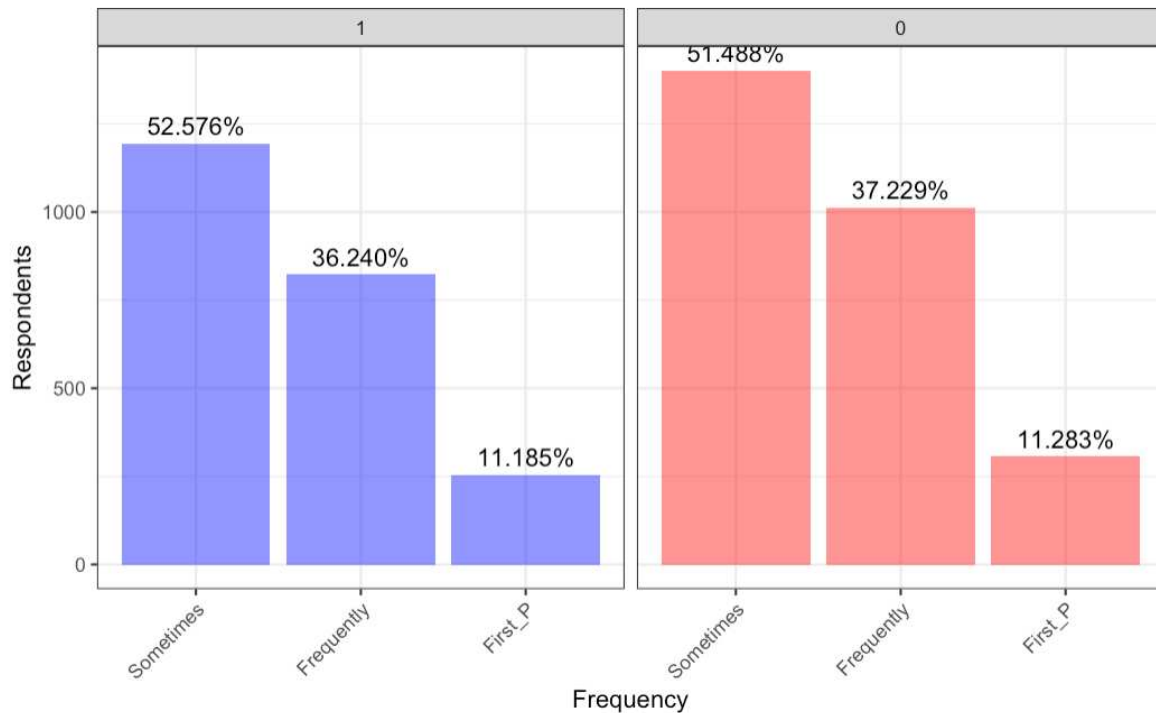


Figure 6 - Bar plots of Frequency for Event = 1 and Event = 0.

In regard to *Pub\_influence*, i.e., how much customers perceived their purchased was altered because of publicity in store, that ranged from 1 (nothing) to 10 (totally), for the period of the brand activation, the most answered categories were 10 (18.76%), 5 (14.88%) and 8 (13.83%), while the least answered were 3 (4.45%) and 4 (4.84%) (see Figure 7). The mean of this variable was 6.39 and its median was 7.

The categories with the highest number of responses during the activation-free period were 5 (17.93%), 10 (16.87%), and 8 (12.05%), whereas the categories with the lowest number of responses were 1 (2.83%) and 2 (5.22%) (see Figure 8). The mean of this variable was 6.37, and its median was 6 (see Appendix 2, Figure 16, Figure 17 and Figure 18).

Figure 7, Figure 8 and Figure 9 summarize the distribution of *Pub\_influence* separately for *Event = 1* and *Event = 0*.

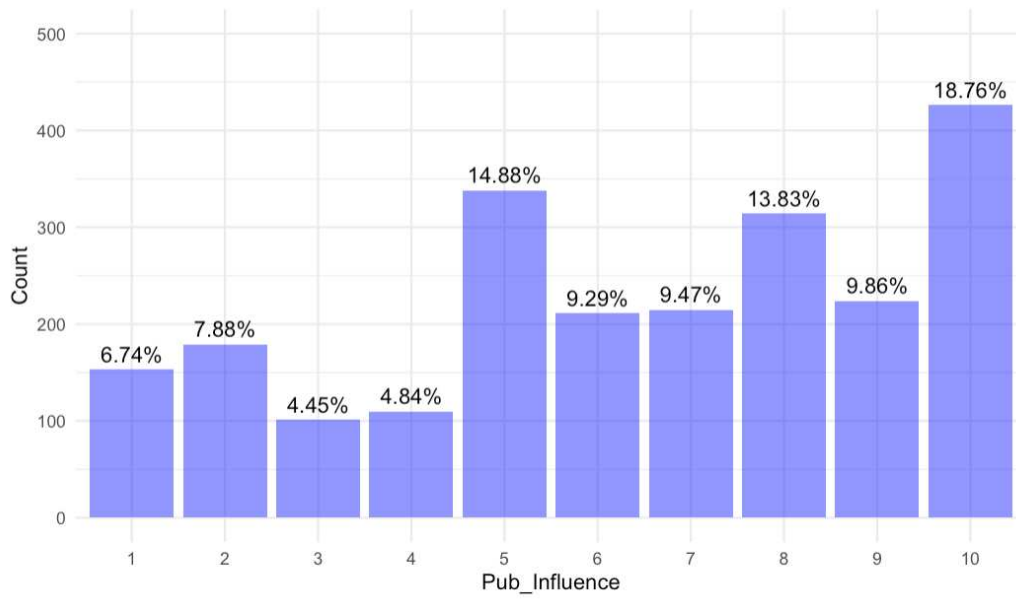


Figure 7 - Bar plot of Pub\_Influence for Event = 1.

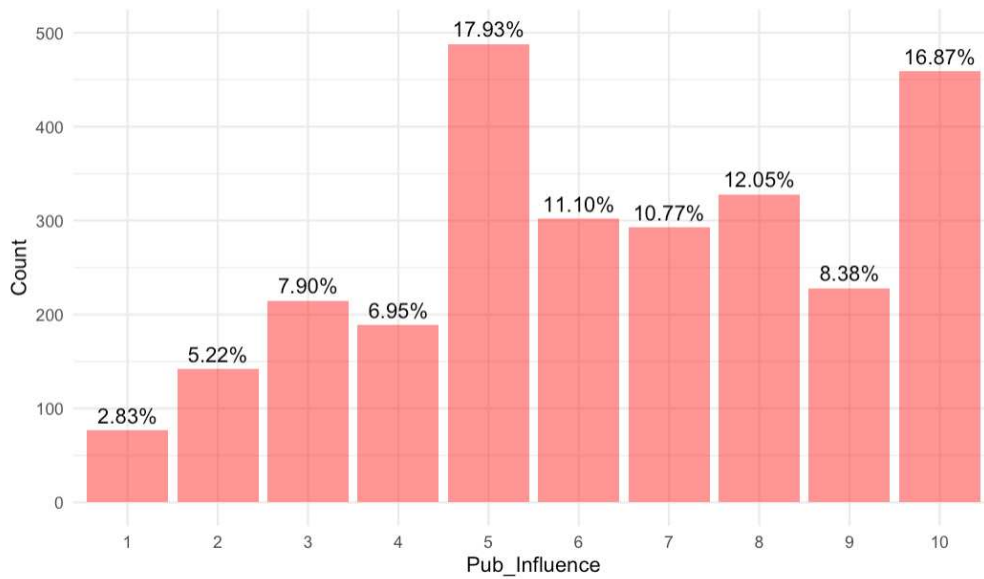


Figure 8 - Bar plot of Pub\_Influence for Event = 0.

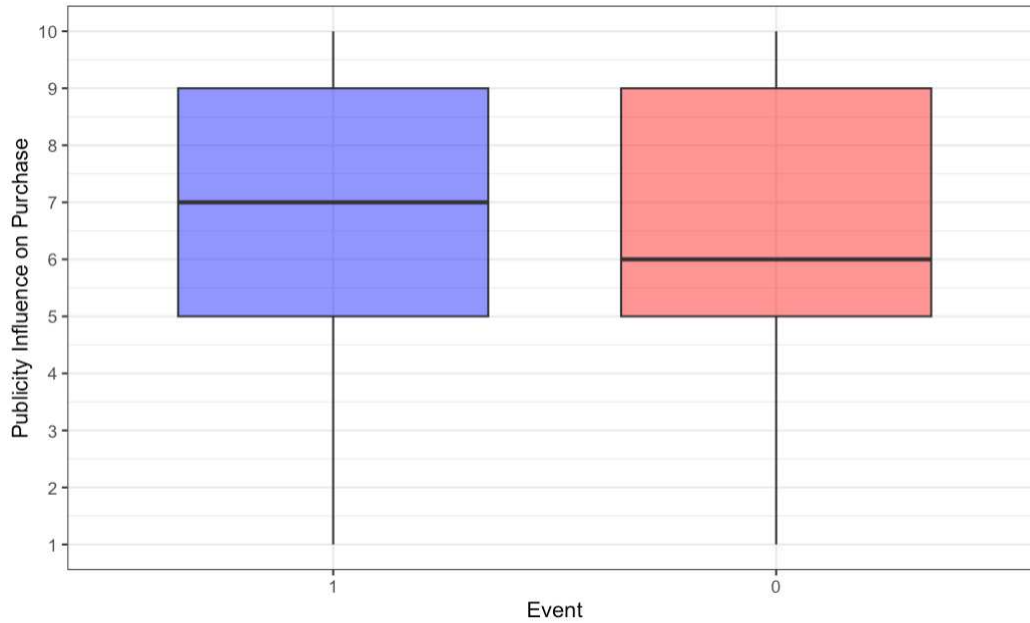


Figure 9 - Boxplot of *Pub\_Influence* for *Event = 1* and *Event = 0*.

Regarding *Value* for the period of the brand activation, the average value was 39.26€ and its median was of 30.9€. The minimum and maximum values were 0.90€ and 148.40€, respectively.

For the period without the brand activation, the average purchase value was of 37.40€. As for the median, it was of 27.90€. The minimum value was 1.90€ and the maximum was of 151.7€ (see Appendix 2, Figure 17 and Figure 18).

Moreover, it is known that during the brand activation, 37.25% of consumers spent an amount equal to or higher than 50€, thereby qualifying for the special gift with purchase. In the period without the activation, only 33.11% of consumers spent an amount equal to or exceeding the standard threshold of 45€.

The previous data is summarized in Figure 10.

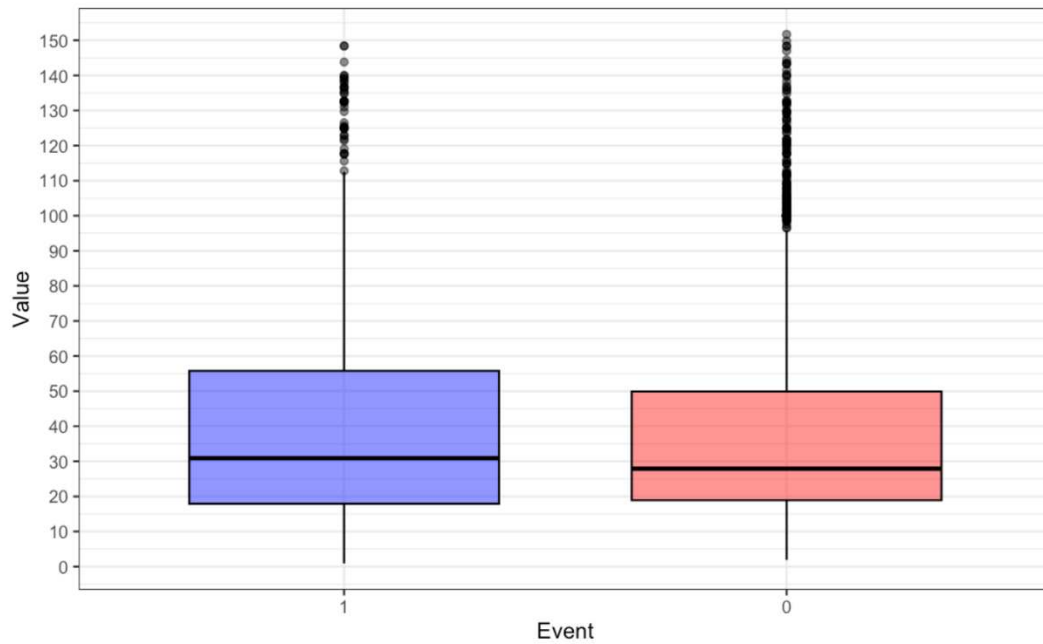


Figure 10 – Boxplot of *Value* for *Event* = 1 and *Event* = 0.

## 5. Results

This chapter presents the key results from the research conducted to address the question of how brand activations impact consumers of X Cosmetics Portugal. It begins with preliminary verification and progresses with the analysis of the stated hypothesis.

### 5.1. Preliminary verification

The Shapiro-Wilk normality test was performed to determine whether the variable *Value* followed a normal distribution. The test produced an observed statistic ( $W$ ) of 0.88667, corresponding to a  $p$ -value of  $2.2e-16$ , less than the significance level of 0.05, so the null hypothesis of normal distribution is rejected (see Appendix 2 Figure 19).

Since the Shapiro-Wilk test suggested that the variable *Value* does not follow a normal distribution, non-parametric test Wilcoxon rank-sum test was performed to compare the median of the groups for *Event* = 1 and *Event* = 0. This test suggested that there is evidence to reject the null of both groups having identical medians, as the  $p$ -value obtained is of 0.0009849, less than the significance level of 0.05 (see Appendix 2, Figure 20).

## 5.2. Hypothesis testing

**H1:** Brand activation leads to an increase in purchase value.

First of all, to validate the stated hypothesis, a Welch Two Sample T-Test was intended to be conducted. However, not all the necessary assumptions were verified, as it was discovered in the preliminary verification that the data did not follow a normal distribution. This way, the nonparametric Wilcoxon rank-sum test was done instead. As mentioned in Section 5.1., it is feasible to infer that there is evidence that there is a significant difference between the medians of *Value* between the control and treatment groups (*p-value* obtained is of 0.0009849 with a significance level of 0.05). This goes in line with the boxplot in Figure 10. Nonetheless, to validate H1, more analysis should be done, as this test only indicates a difference in the medians of both groups.

Thus, secondly, Propensity Score Matching was applied, to balance the distribution in covariates between the treated and control groups. The following love plot (Figure 11) resembles the covariate balance before (red dots) and after (blue dots) PSM.

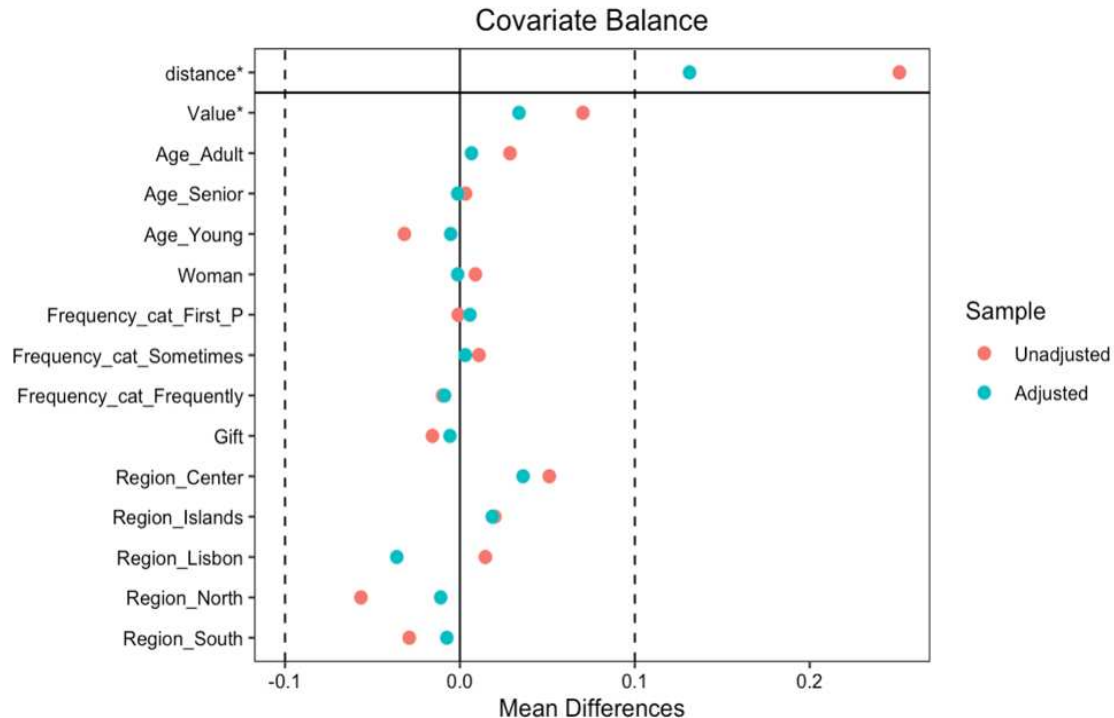


Figure 11 - Covariate balance before and after PSM.

This way, each observation in the group for Event = 1 is matched to the most similar observation in group Event = 0. 2271 observations from the treated group were matched to

2271 from the control group, leaving 450 observations unmatched (see Appendix 3, Figure 21 and Figure 22).

After the matching procedure, a linear model was estimated, to validate (or reject) hypothesis 1. Model 1 can be represented as:

$$Value_i = \beta_0 + \beta_1 * Event_i + \varepsilon_i \quad (7)$$

By running the regression, the obtained results were  $\beta_0 = 38.361$ , for a confidence level of 99% and a  $\beta_1 = 0.894$ , which was not statistically significant even at a 90% confidence level (see Figure 12). As expected, due to the non-inclusion of any covariates, the  $R^2$  statistics of the model were very low, of 0.003. These are included in the error term. Through this analysis, H1 is not supported, as there is not significant evidence that the event led to an increase in purchase value.

**H2:** Event has a higher impact on frequent clients' purchase value.

**H4:** Event leads to a higher spending increase among women.

**H5:** Event has a higher impact on purchase value of adult consumers.

To further investigate the rejection of H1 and to also validate or reject hypothesis 2, 4 and 5, covariates were included in a second model. Model 2 is the following:

$$Value_i = \beta_0 + \beta_1 * Event_i + \beta_2 * Woman_i + \beta_3 * Age_i + \beta_4 * Frequency_i + \beta_5 * Region_i + \varepsilon_i \quad (8)$$

Model 3 also accounts for interaction terms and is represented as:

$$Value_i = \beta_0 + \beta_1 * Event_i + \beta_2 * Woman_i + \beta_3 * Age_i + \beta_4 * Frequency_i + \beta_5 * Region_i + \beta_6 * Age_i * Event_i + \beta_7 * Woman_i * Event_i + \beta_8 * Frequency_i * Event_i + \varepsilon_i \quad (9)$$

To make sure that there is no multicollinearity in models 2 and 3, i.e. that explanatory variables in the models are not linked with each other and with the outcome variable (Akinwande et al., 2015), the Variance Inflation Factor (VIF) was calculated. If there are no correlated factors, the VIFs will be 1. If it exceeds 1, the regressors may be somewhat correlated. A VIF between 5 and 10 denotes a high level of correlation that could pose a

problem (Akinwande et al., 2015). Model 2 showed not to have any issues with multicollinearity. Model 3 indicated potential moderate multicollinearity (see Appendix 3, Figure 23 and Figure 24), thus its output was only considered to look into the coefficients for the interaction terms.

Additionally, The Breusch-Pagan (BP) test was performed, as it is one of the most important tests for heteroscedasticity in linear regression models (Martín, 2023). Model 1 showed not to have heteroscedasticity as the test's *p-value* was higher than 0.05. However, models 2 and 3 accused heteroscedasticity. This way, they were corrected with the robust covariance matrix estimator (see Appendix 3, Figure 25).

By running the models, the output represented in Figure 12 was obtained.

Dependent variable:			
	SEs (1)	Value Robust SEs (2)	Robust SEs (3)
Event	0.894 (0.806)	0.896 (0.780)	0.863 (0.780)
AgeSenior		0.326 (1.477)	0.461 (1.477)
AgeYoung		-5.346*** (0.925)	-4.125*** (0.925)
Woman1		-0.653 (1.061)	-1.496 (1.061)
Frequency_catSometimes		-1.580 (1.290)	-1.524 (1.290)
Frequency_catFrequently		12.690*** (1.450)	13.766*** (1.450)
RegionIslands		-4.416** (2.217)	-4.377** (2.217)
RegionLisbon		-4.107*** (1.261)	-4.108*** (1.261)
RegionNorth		-1.710 (1.317)	-1.706 (1.317)
RegionSouth		-0.027 (1.698)	0.062 (1.698)
Event:AgeSenior			-0.191
Event:AgeYoung			-2.536
Event:Woman1			1.698
Event:Frequency_catSometimes			-0.073
Event:Frequency_catFrequently			-2.182
Constant	38.361*** (0.570)	38.697*** (1.837)	38.691*** (1.837)
Observations	4,542	4,542	4,542
R2	0.0003	0.074	0.075
Adjusted R2	0.0001	0.072	0.072
Residual Std. Error	27.145 (df = 4540)	26.148 (df = 4531)	26.152 (df = 4526)

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Figure 12 - Output of models 1, 2 and 3.

Once again, there is no evidence that supports H1. Regarding H2, although frequent shoppers buy, on average and holding everything else constant, 12.69€ more than first time buyers (for a confidence level of 99%), the estimated value of  $\beta_8$  is not statistically significant. Being negative, it suggests that, on average, the impact of the brand activation on the purchase value of frequent customers is lower than for the reference category, first time buyers. Nonetheless, there is no sufficient evidence supporting H2, i.e., there is not enough evidence to state that the impact is different for both groups.

To test H4, the same rationale was applied. As  $\beta_2$  is negative, women, on average, are expected to spend less than men.  $\beta_7$  is positive, indicating that the impact of the activation is, on average, higher for women. However, there is not enough evidence to state this with certainty to support H4.

Regarding H5, the primary impact of the age categories is that senior consumers are anticipated to have higher expenditure compared to adult consumers, on average. In contrast, young clients, while keeping everything else constant, spend an average of 5.35€ less than the reference category, adults, for a confidence level of 99%. However, none of the interaction terms concerning *Age* show statistical significance, despite suggesting a lesser influence of the event on the purchasing behaviour of both older and younger consumers compared to adults. Consequently, there is not statistical evidence to reject the contrary to H5 hypothesis.

The observed Average Treatment Effect was calculated as the mean difference in *Value* between observations for *Event* = 1 and *Event* = 0. The obtained  $\overline{ATE}$  was of 0.8936988. This would mean that, on average, the event leads to an increase of approximately 90 cents in the purchases of people that attended the brand activation versus if they did not. However, to see if this is true, a permutation test was applied, a non-parametric test to assess the significance of the ATE. This test calculated the ATE 1000 times for different, random permuted datasets and a *p-value* as the proportion of the calculated ATEs that are equal or higher than the observed ATE. Its null hypothesis is that there is no effect of treatment on the outcome, being the ATE zero.

The obtained *p-value* was of 0.252, which is greater than 0.05, hence we fail to reject the null, meaning that there is no evidence to state that ATE is different from zero.

Figure 13 Figure 13 is a visual representation of the permutation test for the ATE.

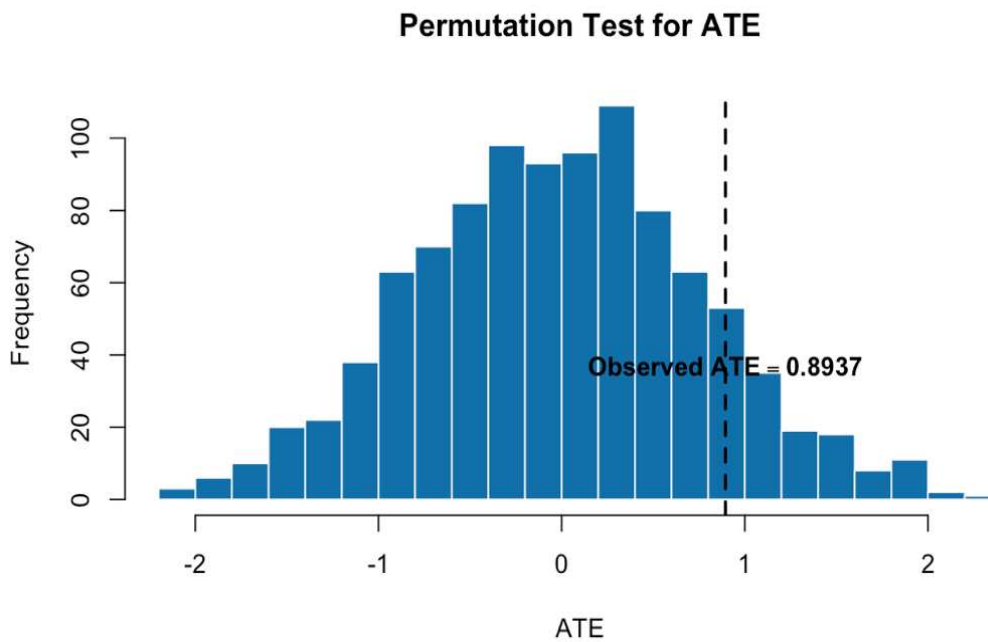


Figure 13 - Permutation test for ATE.

**H3:** Valuable new clients spend more in the period of the event.

Variable *Valuable\_new\_client* is 1 if individual reported low shopping frequency at X Cosmetics Portugal (first-time buyers or people that answered “sometimes”) and high publicity influence (6 or higher) and 0 otherwise, aiming to identify newly acquired customers that responded positively to the brand activation. The diagram in Figure 14 is a visual representation of this reasoning.

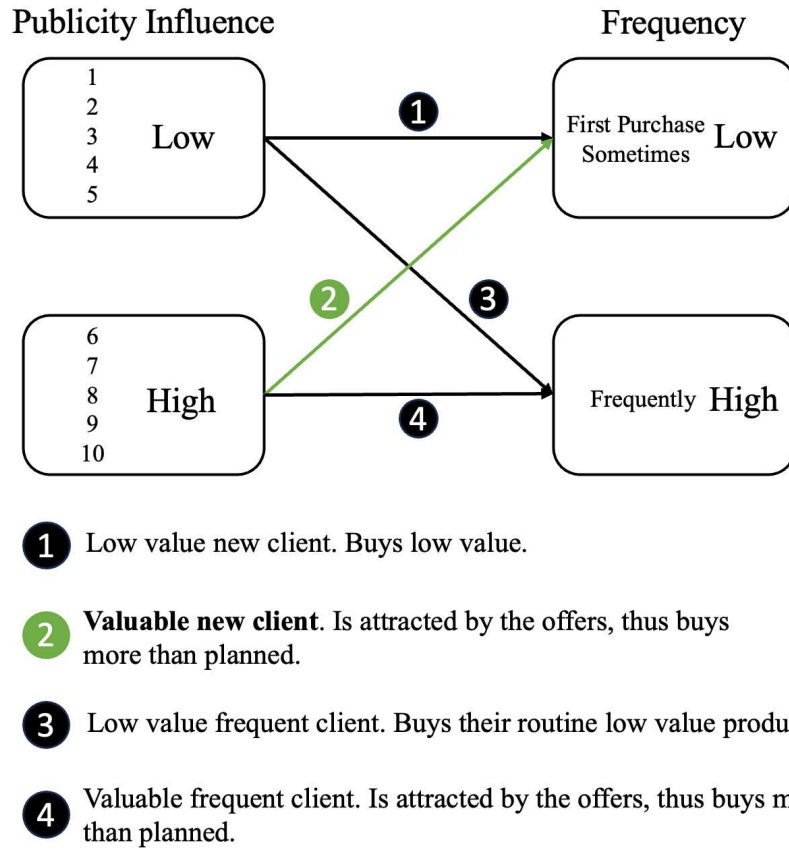


Figure 14 - Diagram of crossing between publicity influence and shopping frequency.

For the period with the brand activation, there were 34.17% of valuable new clients, whilst for the regular period, this type of customers accounted for 34.87%.

Furthermore, it is known that during the event, 34.54% of valuable new clients spent an amount greater or equal to 50€, meaning that they got the special gift with purchase, whereas in the period without it, only 28.77% of those spent an amount greater or equal to the regular threshold of 45€.

To test H3, the mean of *Value* of valuable new clients was calculated, being for *Event* = 1 of 37.61€ and for *Event* = 0 of 33.84€, representing a mean difference of 3.77€. The Wilcoxon rank-sum test was performed (as *Value* is not normally distributed). The *p-value* of the test was of 0.003875, less than the significance level of 0.05, thus there is evidence to reject the null, meaning that there is a significant difference between *Value* of both groups. Finally, a fourth model was computed:

$$Value_i = \beta_0 + \beta_1 * Event_i + \beta_2 * Valuable\_new\_Client_i + \beta_3 * Event_i * Valuable\_new\_Client_i + \varepsilon_i \quad (10)$$

The VIF verification for Model 4 indicated no multicollinearity (see Appendix 3, Figure 26). However, the BP test indicated heteroscedasticity. This way, it was corrected with the robust covariance matrix estimator (see Appendix 3, Figure 27).

Analysing the robust estimators of Figure 15, the positive value of  $\beta_2$  obtained goes in line with results from Model 2, indicating that, on average, less frequent shoppers spend less than frequent buyers. The positive coefficient of  $\beta_3$  also indicates an additional spending when both *Event* and *Valuable\_new\_client* are equal to 1, i.e., the coefficient of the interaction term suggests that there is a positive effect on purchase value when brand activation is simultaneous with the valuable new client status. These estimators are not, however, statistically significant. This way, H3 is not supported.

Dependent variable:		
	Value	
	SEs (1)	Robust SEs (2)
Event	0.811 (0.935)	0.811 (0.780)
Valuable_new_client	-5.452*** (1.071)	-5.452
Event:Valuable_new_client	2.957* (1.592)	2.957
Constant	39.296*** (0.632)	39.296*** (1.837)
Observations	4,992	4,992
R2	0.007	0.007
Adjusted R2	0.007	0.007
Residual Std. Error (df = 4988)	26.621	26.621
Note:	*p<0.1; **p<0.05; ***p<0.01	

Figure 15 - Output of model 4.

## 6. Discussion

This chapter will discuss the primary findings as well as relevant conclusions of the study. Furthermore, it will address its managerial importance, prior to discussing its limitations and suggestions for future research.

## 6.1. Findings and main conclusions

X Cosmetics Portugal wanted to undertake the challenge to communicate to an audience inundated with advertising from its competitors, aiming to increase sales, through a limited time brand activation. This increase in sales can either come from an increased average ticket value or from a higher number of clients. Despite the lack of literature on the direct impact of brand activation on these marketing outcomes, it was expected a positive impact on these marketing outcomes. Nonetheless, the results obtained were not what were expected *a priori*.

It was found that the groups for  $Event = 1$  and  $Event = 0$  exhibited differences in their covariates. In order to address this issue and minimise pretreatment heterogeneity and treatment-effect heterogeneity bias, Propensity Score Matching was utilised. This approach employed a technique of pairing observations from the treated group with their most similar counterparts from the control group, resulting in a more seamless and insightful analysis. In an ideal scenario, there would exist replicas of every individual, with one replica participating in the event and another replica not participating, in order to accurately measure the impact of the event. Since this was not feasible, the analysis continued using the matched observations.

Hypothesis 1 posited that "brand activation leads to an increase in purchase value". A regression analysis was conducted, which yielded a non-significant estimate. In line with this, the result for Average Treatment Effect was estimated but there was no evidence that it was different from 0. Hence, we cannot infer that the brand activation conducted by X Cosmetics Portugal was relevant in increasing the average ticket value of clients. On average, the event did not result in increased expenditures among individuals. Possible reasons for this could be that the offer of the tote bag and full size product on the days of the brand activation was not attractive enough and people that were in the first place planning to buy at X Cosmetics Portugal did not feel like the special gift with purchase had a value higher than the extra amount they needed to spend to receive it. Additionally, that the communication of the offer did not effectively capture the interest of consumers, or competitor brands may have had more appealing ongoing offers. It is also possible that the timing of the activation did not align with the needs and desires of customers or with their income availability.

X Cosmetics Portugal gained valuable insights regarding the customer profile that exhibited higher average spending during the observed period. These customers, aged between 31 and 65, were frequent shoppers at the brand. Furthermore, it was observed that customers

from Lisbon spent an average of 4.11€ less compared to customers from the central region of Portugal. This can serve as a criterion for determining the target audience for publicity. However, maybe not with this exact type of brand activation, as there was not enough evidence to prove that there was an impact of the event on the ticket value among any gender, age group or loyal/disloyal type of customer.

It was further analysed if there was an impact on valuable new client acquisition, which is also a very important metric for the company. X Cosmetics has a strong customer relationship management (CRM) program, which has as a main objective increasing the shopping frequency of its customers, as loyal customers see X Cosmetics Portugal as part of their well-being and use its products to unwind religiously. Due to privacy reasons, the data on new opt-ins to the CRM program could not be accessed. Nonetheless, a category of valuable new clients was created, represented in Figure 14 by the number 2. To this category were assigned people that reported a low frequency of shopping but that interacted positively with the brand activation. For X Cosmetics Portugal, these are valuable leads, as they represent an opportunity for building customer loyalty. While there was about the same ratio of valuable new clients for both periods, it was tested if those that attended the brand activation spent more than those who visited X Cosmetics Portugal at the period without any activation. While there were tests supporting this idea, Model 4's robust estimators did not lead to precise conclusions. However, a possible positive tendency on the purchase value for  $Event = 1$  can be pointed out and should be considered, as it is of the company's interest to retain these customers. This goes in line with research done by (Gaeth et al., 1991), as these authors mention that multi-product bundles with high quality tie-in products have a specially high perceived value to consumers with limited familiarity to the brand.

These valuable new clients, in line with (Bawa & Shoemaker, 2004), could either be likely triers, i.e., people that sooner or later would buy at X Cosmetics Portugal without any promotion, or nontriers, people that would not buy without the promotion. For the first case, likely triers that visited the event produced what is called the acceleration effect (Bawa & Shoemaker, 2004), as they bought sooner than they would. For nontriers that visited the event, they produced the expansion effect (Bawa & Shoemaker, 2004), as there would not be any purchase without the brand activation. Low frequency buyers that reported having low publicity influence, represented in Figure 14 as number 1, most likely were the ones buying low value products due to necessity or low purchase power, thus are unlikely to become loyal customers through marketing efforts. Clients represented in Figure 14 by the number 3 were most likely not affected by the activation while the ones represented by the number 4 are those

that are fans of the brand and that live by its philosophy. This type of clients most likely would buy the products that were offered if they were not, so it can be said that there was a cannibalization effect.

To summarise, it was not possible to conclude that the brand activation conducted by X Cosmetics Portugal had a positive effect in boosting the average amount spent by consumers. Nevertheless, there was an indication that it impacted the purchases of disloyal customers that felt influenced by publicity, suggesting a trend of increased spending within this group. This reveals an opportunity for the brand to target this specific audience, tailoring this activation to the preferences of this segment, aiming to build brand loyalty among them.

Suggestions include targeting newsletters to the opt-ins to the CRM program that occurred during the event, with cross-selling of products that complement the ones bought at the event and letting them know about the advantages of being part of the program, such as special offers in their next purchases. Additionally, exploring ways to foster engagement during the activation, for example with challenges in social media.

Although this study primarily emphasised quantifiable metrics, it is of great importance to highlight the influence of brand activations on brand reputation. These activations represent the company's values and contribute to a positive perception of it by its audience in the long-term. Customers who are emotionally connected with brands are more likely to be loyal to them (Russo Spina et al., 2012). Additionally, in an industry that is fierce with competition, brand activations influence customer choices between equivalent brands.

## **6.2. Managerial relevance**

The preceding sections have deep dived into the effect of brand activations on consumer behaviour. This section discusses practical implications of the findings of this research and recommendations for management decision-making in X Cosmetics Portugal.

X Cosmetics Portugal does this specific brand activation two times a year, every year. While the company anticipates it is a revenue and new client acquisition driver, it does not measure its impact. It is of great relevance to leverage data-based decision making, to improve marketing strategies and tailor them to the audience of interest and to the settled objective. Doing research like this one once a year or every two years would provide meaningful insights to help define a more effective and cost-conscious marketing approach.

The results indicate that the brand should direct its brand activation communication towards clients who do not frequently engage with the brand. In addition to the immediate advantage of potentially increasing the average ticket value, they present an opportunity to be transformed into loyal customers.

## 7. Limitations and Future Research

There are several limitations that need to be addressed in the current study. Initially, the time allocated for working on this thesis was comparatively brief (one semester), which not only constrained the amount of work that could be accomplished but also restricted the study to a single brand activation conducted by X Cosmetics Portugal, the sole event occurring within this timeframe.

The implemented surveys had to be tailored to the complexity of salespeople having to manage customers. This way, there was a small number of questions made, which were very simple, which was reflected in the  $R^2$  of the models, i.e., how much the covariates explained the variable of interest. For instance, purchase value can be influenced by so many more factors, as income, timing within the month, family size, use of social media, among other factors. This is true even if it was a sunny day and people chose to go to the beach instead of a shopping centre. Furthermore, frequency of shopping at the brand and influence of publicity felt can yield some subjectiveness. All these factors were captured in the error terms of the models. Additionally, there might have been the influence of moderate multicollinearity and heteroscedasticity. Conducting interviews within a smaller group of people would generate fewer observations, but would produce more in-depth feedback, making it possible to account for more covariates.

The salespeople responsible for completing the questionnaires have distinct motivations. Some of them are more interested in completing the surveys than others. It is possible that certain individuals completed the survey for each client they helped, while others only did so during periods of low traffic, thereby failing to capture the clients who were most enthusiastic about the brand activation.

In addition, despite being controlled for with PSM, the groups for  $Event = 1$  and  $Event = 0$  were different. Different backgrounds and characteristics influence how people buy and attendance to the event may be selective due to prior brand expectations, thus not random.

There could also be the case that there exists a carryover effect. This effect quantifies the influence on sales that originates from prior advertising (Bruce et al., 2012). This way, as the period without the event was recorded after the period of the event, there could be a residual effect impacting the sales of this period. For future research, this effect can be included by including a lagged dependent variable in the model (Assmus et al., 1984).

For future research, incorporating surveys or even more in-depth interviews for randomly selected visitors, regardless of whether they made a purchase or not, can yield qualitative data that complements the quantitative findings. Additionally, for future analysis, the influence on brand recognition and reputation can also be assessed, for both individuals who made a purchase and for store visitors who were affected by the brand promotion but ultimately did not make a purchase.

Conducting a longitudinal study to track the long-term effects of the event on the same individuals, as well as performing a cost-benefit analysis, can be highly relevant for future research. This would help determine if the short-term benefits brought by customers, as well as their lifetime value, justify the investment made for brand activations.

Another interesting option for future research is to perform a randomized experience, through the selection of stores with similar characteristics, for example revenue and customer demographics, and randomly selecting a treatment and control group, with treatment, of course, being a brand activation.

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## 9. Appendix

### 9.1. Appendix 1: Survey

This questionnaire is part of ongoing quantitative research conducted by X Cosmetics Portugal. Thank you for taking the time to answer this short questionnaire, which will take about 20 seconds.

Q1. From 1 (nothing) to 10 (totally), rate how much in-store advertising influenced your purchase

Q2. How often do you shop at X Cosmetics Portugal?

- It's my first purchase
- Sometimes, to treat myself
- Sometimes, to gift someone
- Frequently

Q3. Select your profile

- Woman up to 30 years old
- Woman from 31 to 65 years old
- Woman over 65 years old
- Man up to 30 years old
- Man from 31 to 65 years old
- Man over 65 years old

Q4. Amount of your purchase in € (Ex.: 9.90€)

End of Survey

## 9.2. Appendix 2: Data cleaning, sample characterization and preliminary verification

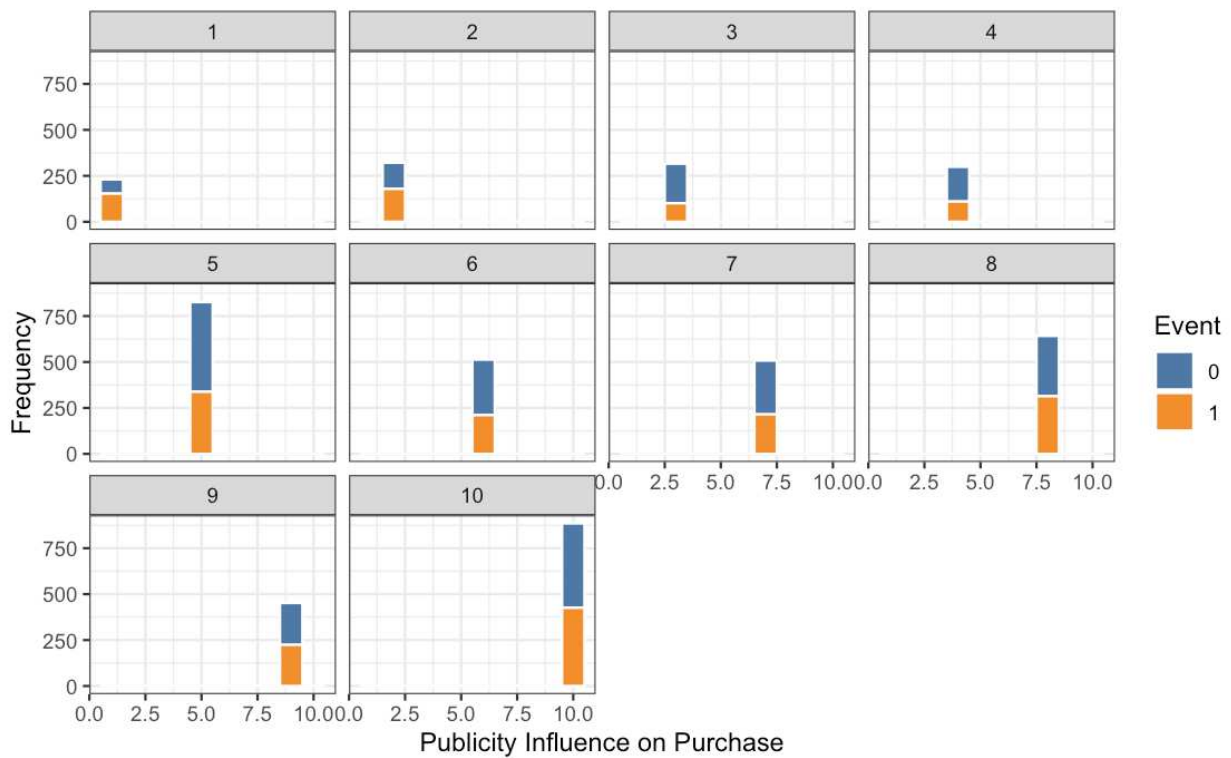


Figure 16 - Frequency of categories of Pub\_Influence by Event.

### Summary Statistics Event = 1

Statistic	N	Mean	St. Dev.	Min	Median	Max
Value	2,271	39.255	26.462	0.900	30.900	148.400
Pub_Influence	2,271	6.386	2.842	1	7	10
Duration_sec	2,271	1,302.786	15,446.500	11	53	686,659
log_Duration	2,271	4.680	1.907	2.398	3.970	13.440
log_Value	2,271	3.426	0.737	-0.105	3.431	5.000

Figure 17 - Summary statistics for Event = 1.

### Summary Statistics Event = 0

Statistic	N	Mean	St. Dev.	Min	Median	Max
Value	2,721	37.395	26.891	1.900	27.900	151.700
Pub_Influence	2,721	6.369	2.573	1	6	10
Duration_sec	2,721	742.312	4,142.534	11	29	79,745
log_Duration	2,721	4.252	1.848	2.398	3.367	11.287
log_Value	2,721	3.380	0.713	0.642	3.329	5.022

Figure 18 - Summary statistics for Event = 0.

```
Shapiro-Wilk normality test
data: filtered_data$Value
W = 0.88667, p-value < 2.2e-16
```

Figure 19 - Shapiro-Wilk normality test for Value.

```
Wilcoxon rank sum test with continuity correction
data: Value by Event
W = 2922640, p-value = 0.0009849
alternative hypothesis: true location shift is not equal to 0
```

Figure 20 - Wilcoxon rank sum test for Value.

### 9.3. Appendix 3: Hypothesis testing

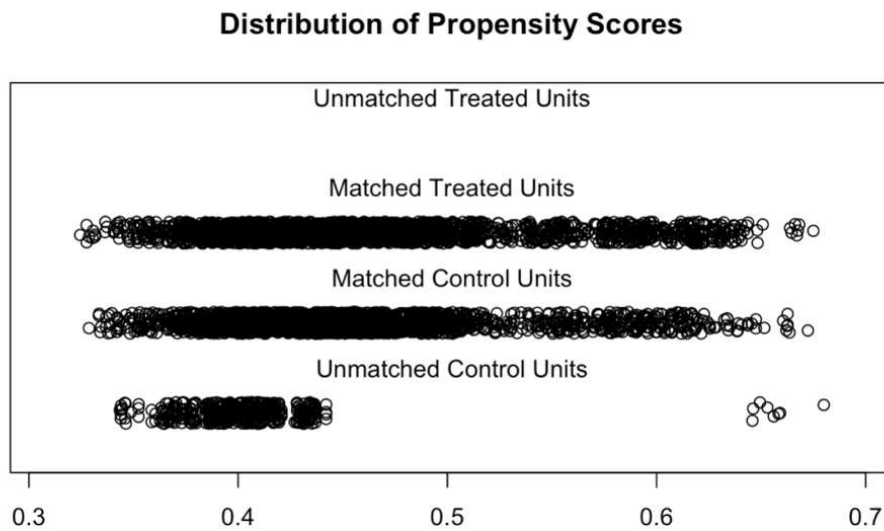


Figure 21 - Distribution of propensity scores.

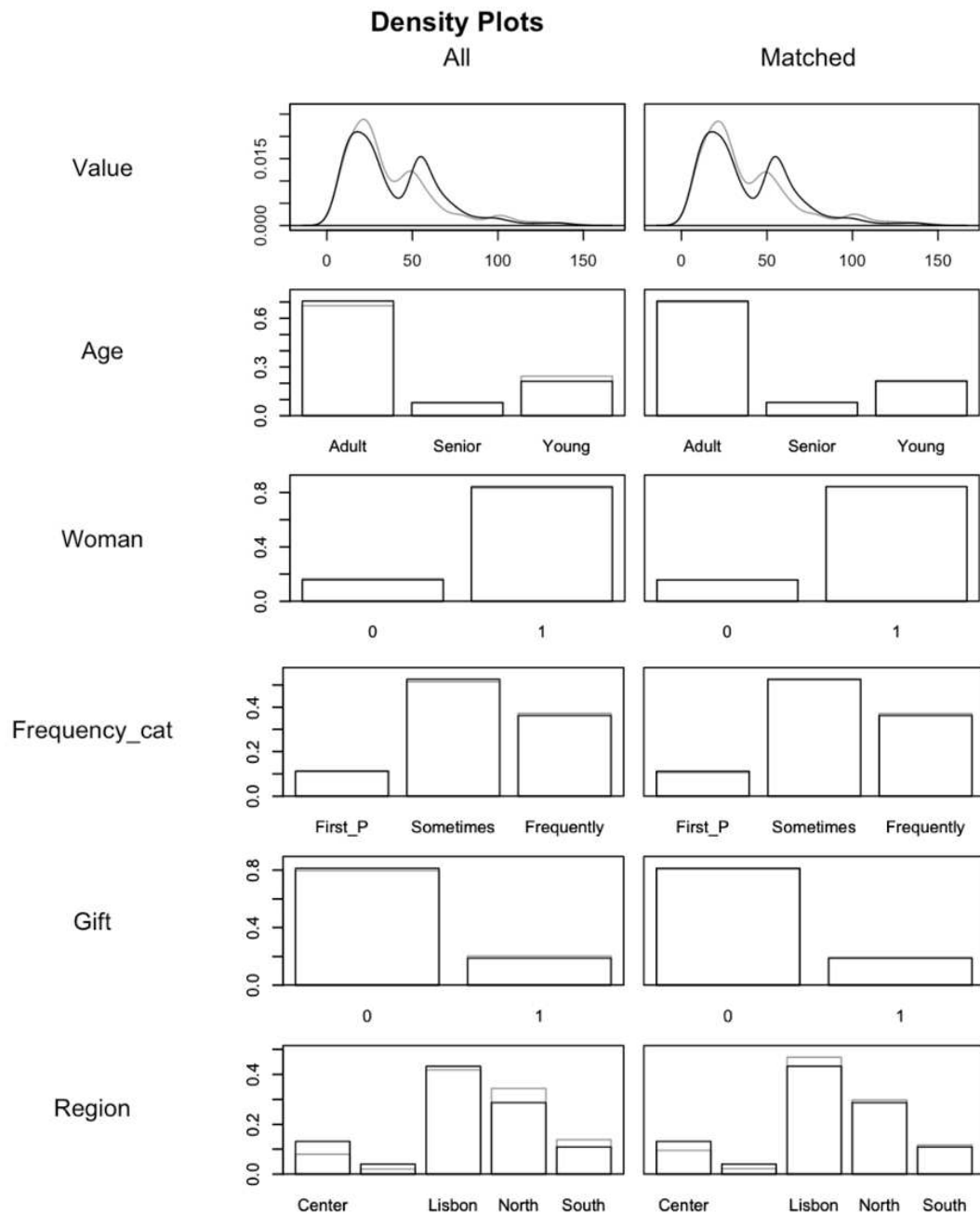


Figure 22 - Density plots of unmatched and matched observations.

	GVIF <dbl>	Df <dbl>	GVIF^(1/(2*Df)) <dbl>	Interacts With <chr>	Other Predictors <chr>
Event	1.006764	1	1.003376	--	Age, Woman, Frequency_cat, Region
Age	1.043091	2	1.010603	--	Event, Woman, Frequency_cat, Region
Woman	1.007947	1	1.003965	--	Event, Age, Frequency_cat, Region
Frequency_cat	1.064253	2	1.015690	--	Event, Age, Woman, Region
Region	1.057274	4	1.006986	--	Event, Age, Woman, Frequency_cat

Figure 23 - VIF output for model 2.

	GVIF <dbl>	Df <dbl>	GVIF <sup>1/(2*Df)</sup> <dbl>	Interacts With <chr>	Other Predictors <chr>
Event	1.065351	11	1.002882	Age, Woman, Frequency_cat	Region
Age	15.045997	5	1.311421	Event	Woman, Frequency_cat, Region
Woman	10.346393	3	1.476153	Event	Age, Frequency_cat, Region
Frequency_cat	7.513819	5	1.223450	Event	Age, Woman, Region
Region	1.065351	4	1.007944	--	Event, Age, Woman, Frequency_cat

Figure 24 - VIF output for model 3.

$GVIF^{1/(2*Df)}$  provides a comparable measure to the traditional VIF for binary variables. It also offers a more accurate evaluation of multicollinearity for categorical variables with more than two categories.

```

studentized Breusch-Pagan test
data: model1
BP = 3.1048, df = 1, p-value = 0.07806

studentized Breusch-Pagan test
data: model2
BP = 100.8, df = 10, p-value < 2.2e-16

studentized Breusch-Pagan test
data: model3
BP = 126.77, df = 15, p-value < 2.2e-16

```

Figure 25- Breusch-Pagan test output for models 1, 2 and 3.

	GVIF <dbl>	Df <dbl>	GVIF <sup>1/(2*Df)</sup> <dbl>	Interacts With <chr>	Other Predictors <chr>
Event	1	3	1	Valuable_new_client	--
Valuable_new_client	1	3	1	Event	--

Figure 26 - VIF output for model 4.

```
studentized Breusch-Pagan test  
data: model4  
BP = 32.33, df = 3, p-value = 4.46e-07
```

*Figure 27 - Breusch-Pagan test output for model 4.*