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"Determining the optimal number and quality of advertisements in a monopoly setting."

Name student: Mona Malkhasian
Student ID number: 480160

Supervisor: dr. J. J. A. Kamphorst
Second assessor: dr. B. S. Y. Crutzen

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1. **Introduction**

Advertising is one of the most controversial phenomena around us. It is blamed for many social harms and wrongs, from eating disorders to the increase of other unhealthy habits such as smoking (Lovato, Watts, & Stead, 2011). Yet, paradoxically, advertising is commonly viewed as trivial (Hackley, 2017). Regardless of its debated role in society, in the corporate world advertisement has been widely accepted and is not to be missed from everyday marketing and business activities. It is believed to be essential to companies in order to gain (brand) awareness, generate more and stable sales, and enhance firm performance (Moore et al., 2008). Hence, advertising is an 'integral part of twentieth-century consumption' and an "important form of representation in the contemporary world" (Nava et al., 1997, pp. 3–4). Logically, advertisement and its effects on sales have received significant attention from research by various disciplines. One could state that the theoretical microeconomic literature focuses mostly on answering the question "How much advertisement is optimal?" and the Marketing & Business literature is more occupied by providing information on the question "What advertisements should be like?" (Bagwell, 2001; Armstrong, 2010). Then finally, in social sciences, the researches are concerned about *"if"* and "*how*" advertisement shapes cultures and behaviors and whether those consequences are desirable for societies (Sheehan, 2013).

Generally speaking, the first two schools of thought have proven that advertisement has a positive effect on sales indeed (Assmus et al., 1984), whereas the findings from the Social Science research are less straightforward (Preston, 2004; Nairn et al., 2008; Harris et al., 2009). More specifically, economic research on advertising began with Marshall at the end of the 19th century and was popularized with Chamberlin's efforts (1949) on monopolistic competition. Since then countless papers have been written on advertising, usually in monopolies or imperfectly competitive settings with differentiated products, that look at its effects on various variables such as price, profit, consumer surplus, social welfare and consumer demand (Dixit & Norman, 1978; Kessides, 1986; Becker & Murphy, 1993; Deighton et al., 1994; Saffer & Chaloupka, 2000; Graham & Frankenberger, 2000; Ackerberg, 2001; Buijzen & Valkenburg, 2003; Bagwell, 2005; Yoon, & Choi, 2005; Livingstone & Helsper, 2006; Joshi & Hanssens, 2010). As such, several specific advertising types and effects, amongst other things, have been identified. When, for example, a firm uses advertising to increase consumer demand by attracting new customers to the market, the advertising used is most likely to be informative or

generic[1]. In case advertising has business stealing effects because it changes customer preferences, it is considered to be persuasive or brand advertising. And when advertising by itself increases a customer's utility, the advertising has said to have prestige or complementary effects (Bagwell, 2007).

In reality, advertisements are hard to categorize because they are rarely made of just one type. However, researchers generally tend to look at the different effects separately (Ackerberg 2001; Bass et al., 2005; Belleflamme et al., 2015).

This paper has a slightly different view of the advertisement effects compared to previous research. What sets this research apart from it, is firstly its focus on the adjustable/ varying quality of advertisement vs. product quality with a given advertising variable. The marketing literature on how effective advertisement should look is ample; however, in (micro)economic and theoretical literature, the actual quality of advertisement is hardly emphasized. In this paper, *quality* of advertisement refers to how specific and appropriately the ad is designed for the targeted audience. A high-quality ad is a well-executed and thought through one to make the most substantial impact on the emotional motivation of customers to purchase. Our definition will be based on Keller's (2007) brand equity model, where he provides a thorough explanation of the role and effects of advertisement. His model serves to highlight the importance of advertisements and shows that for them to be effective and build brand equity, they should be "carefully designed", which in our paper we refer to as "higher quality" of advertisement. In addition to that this paper wants to emphasize that advertisement is not just a given, but that behind it is a vast science, and so the effectiveness of advertisements should be shown.

Secondly, this paper does not have two separate effects of informative[2] and persuasive (or brand) advertisement, but rather there is an informative effect with an endogenous persuasive effect. One could argue that the lower the quality, the more the ads resemble and operate as informative ads, and the higher the quality level, the more they are similar to persuasive ads. Put it differently; we regard the "reach", "spread", or "degree of penetration" of the market as

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[1] Note there is a slight difference between informative and generic advertising. Both types of advertisements aim to attract new customers. However, informative advertising does it through usually informing new customers about the existence of a company or brand, without mentioning the brand in question. Generic advertisement has the goal to increase specific category demand (e.g., for milk, meat, grains, fruit) together with other companies that offer the same low differentiated products. Generic advertisement is considered to be a type of brand advertisement.

[2] In this paper, generic and informative advertising have the same implications since mainly a monopoly setting is discussed.

the part of the ad that functions as the informative component and the quality of the advertisement as the persuasive component. The idea behind it is that ads are combined of multiple components, and in this research, we look at the optimal allocation of those components. These distinctions are essential since, oftentimes, it is very complicated to separate the different effects that advertisements have (Belleflamme et al., 2015). Therefore, an "endogenous" effect could be considered more realistic.

Finally, the paper takes into account the recent decline of influence the marketing department has experienced (Verhoef & Leeflang, 2009). Therefore, the model incorporates a few restrictions, such as a fixed price and a budget, something that not all papers assume. However, both assumptions are necessary to reflect one, the marketing department's loss of power in strategic areas such as pricing and two, the increase in influence in the actual advertising domain. More details on the role of the marketing department will be provided in the Background Model.

Thus, the purpose of this paper is to answer the question: "What is the optimal quality of advertisement vs. the number of informative advertisements a firm should disseminate, and how does this optimal allocation between quantity and quality change over time?"

We will answer this question by looking at a model where the marketing department of a monopolist firm advertises during two periods. At its disposal, it has the freedom to choose the number of ads that it will distribute, together with an appropriate level of quality. The department is limited by a budget constraint and a fixed price, as mentioned before. This will allow us to also make statements about an optimal distribution between the number of ads and their quality. This paper's aim is certainly not to predict how much precisely there should be invested in the number of ads and their quality, but it will give more information on an important and interesting subject for marketers, wherefrom they can draw their own conclusions.

Regarding further content, this paper is constructed as follows: in section II, the Literature Review will be provided. In section III, we elaborate on the Background of the model, and in section IV and V, the Model & Analysis are given respectively. In the following section VI, we will discuss the results and end with a Conclusion, along with the limitations of the Model and some suggestions for further research.

2. <u>Literature Review</u>

Theoretical work on advertising has long been concerned with the different influences of advertising on consumer behavior. In general, economists have agreed on three distinct views: Informative, Persuasive, and Complementary or Prestige advertisement. According to Stigler (1961), Butters (1977), and Grossman and Shapiro (1984), the informative view on advertising gives the consumer explicit information about the product's existence, price, and characteristics. Here, the fact that the firm is willing to spend resources is a way of signaling that the quality of the products being sold is high. The persuasive view entails that advertisement changes the consumer's tastes in order to achieve consumer loyalty to a particular brand (Nelson 1974; Milgrom & Roberts, 1986). Finally, the third view, which is mainly based on the analysis of Stigler and Becker (1977) and Becker and Murphy (1993), argues that advertisement is complementary to the advertised product. In this case, the advertisement does not intend to persuade consumers, and it is of no importance whether or not it conveys information. The main idea is that it brings extra utility on its own in the form of a social benefit or social prestige when the brand is consumed. Although all the three views are relevant, the literature argues that the various advertising effects should not be meshed into one single explanation since different types have entirely different implications (Belleflamme & Peitz, 2015; Bass, 2005). The effects of informative and persuasive advertisements are at odds with each other. The informative view increases the elasticity of demand as consumers become ever better informed about products and prices available in the market, even of those of the competitors. In contrast, the persuasive view suggests that consumers become more loyal to the brand, and so increase consumer demand. The complementary view stands somewhere in between; advertising is mainly considered uninformative but may be nevertheless beneficial through its direct appreciation by consumers (Belleflamme & Peitz, 2015).

As evident from the papers mentioned above, theoretical researchers have identified and modeled the various effects of advertisement in order to understand the strategic effects and the allocative consequences. However, relatively little empirical research, both in economics and the marketing literature, has been done on *how* advertisement affects consumer demand. This is due to the complexity of measuring the separate effects of advertisement because, in reality, it is challenging to distinguish between the various types of advertisements that make a single piece of advertisement. While Bellefamme & Peitz (2015) state that there is some hope of identifying directly informative advertising, they argue that it seems impossible to distinguish between, for example, indirectly informative and persuasive advertising. Still, scholars have

attempted to distinguish between different types of advertisements empirically, like, for example, Ackerberg (2001). In his study on the informative and prestige effects of brand advertisement, he concludes that the advertisement mainly had an informative effect, because it primarily affected inexperienced users of the brand. Other scholars have aimed to distinguish the different types by looking at the advertising content or by analyzing industries and market outcomes that were subject to a shock, i.e., for example, if certain types of advertisements become suddenly legal (Benham, 1972; Ippolito and Mathios, 1990; and Milyo and Waldfogel, 1999). For example, Resnik and Stern (1978) examined television advertisements and found them primarily image oriented. However, despite some attempts at distinguishing the different (extreme) types of advertisement, one must be critical when it comes to findings that imply a homogeneous advertisement effect. As Ackerberg (2001) points out, even though Resnik and Stern's (1978) approach is quite impressive, advertisements still do not need to contain explicit information in order to inform consumers of a product's existence or to signal information. Furthermore, he is critical about researches by Archibald, Halman, and Murphy (1983) and of Tellis and Fornell (1988) on related advertising levels to product quality. While the results of the studies suggest that advertising provides information, they cannot rule out prestige effects. Moreover, Armstrong (2010) shows in his book on persuasive advertising that most ads contain at least two pieces of information, and only 16 percent contain none. These claims are based on data from 60 published empirical pieces of research conducted over almost two decades from various countries, products, and media (Abernethy & Franke, 1996). Further findings go even as far as showing that advertisement *should* provide relevant information because that increases their effectiveness. For example, in the study by (D.) (2008), TV commercials that scored above the median ratings of "informativeness" had 15 percent better recall and 25 percent higher persuasion rates than those that scored below the median. Likewise, according to a survey of 400 shoppers by Pasadeos (1990), most customers value advertisements that give information and are bothered by the ones that do not.[3]

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[3] Printed advertisements that included product information were more easily recalled. This was evident from the analysis of 37 pairs of printed advertisements, whereby one of them gave information about the product, while the other did not detail specifications. For instance, an ad for Panasonic cordless telephones that communicated six important features of the phone, such as up to 21-day battery charge and Secure Guard for protection from listening in by third parties, had significantly better recall than a Sony ad that did provide any product information. In summary, informative advertisements had 1.34 times better recall than other advertisements (Armstrong, 2010).

Lastly, Keller (2007) argues in his well-known customer-based equity model that ad and point-of-purchase congruence and improved ad recall could be achieved by making the brand name and package information prominent in the ad. Unfortunately, by doing so, less emphasis can be then put on providing persuasive information and creating positive associations in order for consumers to have a reason to why they should buy the brand.

Note that this latter observation goes to show that there must be an optimal composition and allocation of persuasive and informative components in one single ad. Especially when a company is facing a fixed budget and is not able to afford many different types of advertisements.

With regards to the interaction of the two components, we look at the study of Isariyawongse et al. (2009) where they investigate the interactions between generic advertising (which is mainly considered to be of informative nature (Ward, 2006)), brand advertising and firm profits when brand advertising is purely informative. Since the authors define generic advertising very similar to informative advertisements, we can use their paper to draw some parallels to our paper that is concerned with informative advertisements vs. persuasive. Keep in mind that in the case of a monopoly, which applies to our primary model, generic and informative ads have mostly the same effect since there is only one brand in the market. Furthermore, their model is inspired by the advertising practices and the latest developments in the agricultural sector. As in that sector, there is significant competition but no to little product differentiation, it is uneconomical to advertise for an individual firm because of the free-rider problem. This means that, since the products in principle do not differ from each other, each brands' advertisement automatically promotes all competitors' products. To solve the problem, producers agree to coordinate advertisement and so engage in generic advertisement campaigns to increase total market demand for the intrinsically identical product[4]. All the producers are obliged to participate and contribute in order to eliminate the free-rider problem. One of the well-known examples is the "Got Milk" campaign, where celebrities showed the benefits of drinking milk (Isariyawongse et al., 2009). More recently, it has become popular to augment generic campaigns with brand advertising. Because of the high effectiveness of brand advertising, some producers have started to doubt the usefulness of generic advertising and state that it might dilute the effectiveness of brand advertising. However, pulling out of it leads to legal problems since they are not only mandatory but also the guideline for a proportional division of benefits among all the producers in the industry. Hence, as Isariyawongse et al. (2009) put it, "at issue

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[4] Think of products such as wheat, corn, potatoes, gasoline, packaged ice.

is whether generic advertising causes brand advertisers to spend more on brand advertising and receive disproportionately less benefit from generic advertising."

The findings of Isariyawongse et al. (2009) are essential for us to see how generic advertisement (and, to a certain extent, informative advertisement) interacts with brand advertisement. Likewise, their paper provides insights into the difference in effects between branded informative advertisements and informative advertisements. Specifically, we are interested in if both types react to each other as complements or substitutes. As such in their model, which is based on a hoteling model (similar to our model) with vertically or horizontally differentiated products in a duopoly setting, they demonstrate that firms can gain from spending on brand advertising that reduces consumer search costs (i.e., relatively more informative) as well as from brand advertising that is entirely persuasive. However, most importantly and contrary to other studies, the authors find that brand advertising (across rivals) is complementary when it is persuasive and a strategic substitute when it is informative. These results are key to the initial intuition of our model, where the more people are reached by the informative ads, the more it makes sense to increase their quality, meaning their persuasiveness accordingly. Therefore, in our model, we expect informative and persuasive components to be complementary to each other to a certain extent.

Finally, in this section, we will mention paper by Bass et al. (2005) that looks into the timing of and budget allocation between two different advertising types. In their research, Bass et al. (2005) make a distinction between generic and persuasive (brand) advertising and examine the issues of whether, when, and how much brand advertising vs. generic advertising should be done. In this spirit, the researchers provide answers to a research question that is very similar to ours, due to them taking into account both having a budget and the timing of advertising and considering the implications of generic and informative advertisements to be practically identical.

However, the main difference between our research and that of Bass et al. (2005) is that, whereas Bass et al. (2005) provide insights for two different types of advertisement (even though hard to distinguish in practice), our paper looks into one advertisement that can have various effects (which is often more realistic).

In other words, this paper assumes that one advertisement is composed of an informative and persuasive element, while the findings by Bass et al. (2005), on the other hand, are built on separately modeled effects of brand and generic advertising.

The authors model generic to increase category demand and brand advertisements to capture market share from competitors. Later, the two separate advertisement effects are added, and the

total impact on sales is analyzed. In our model, we look at the "total" effect of both components on sales and profits.

Furthermore, Bass et al. (2005) assume a relatively dominant role for the marketing department, whereby it has control over product prices and budgets, however as mentioned earlier in the paper, this is unfortunately increasingly often not the case in reality. Our analysis does take the diminishing role of the marketing department into account.

Regarding the results of the paper by Bass et al. (2005), the general and expected findings are that the optimal generic advertising increases with a rise of the effectiveness of generic advertising, which then leads to a proportional increase in sales. And an increase in one firm's brand advertising (because of an increase in its effectiveness) leads to a decrease in the rival's brand advertising. Furthermore, the firm's profit increases with an increase of the competitors' costs and the effectiveness of their generic advertising.

With regards to timing, in all cases, whether generic and brand advertising are equally effective or if generic advertisement is set to be more effective, generic advertising should be relatively more emphasized in the beginning (compared to later periods), and brand advertising should be given relatively more priority in later periods (compared to initial periods). The intuition behind these dynamics could be considered quite logical. Firstly the firms are being concerned with the increase of the total "pie" of sales, i.e., category demand, and later about increasing their individual share of that pie. Their potential piece in this way becomes larger than when firms would engage in brand advertising immediately, which would only result in business stealing effects.

The budget allocation is primarily dependent on the relative effectiveness of both types of advertising. Given the same advertising budget, in the case that generic advertisement becomes more effective, the optimal level of generic advertisement increases and the optimal level of brand advertising decreases. Hence, one could observe a trade-off between the two types of advertisement; the decline of one type of advertising goes along with a rise in the other type.

In one of their three extensions, the authors analyze the model's outcome with a fixed market potential. The main finding is that, when only a small part of the market is saturated, generic advertisement is greater. This is because both firms have more incentive to expand the market. As more of the market potential is covered, the firms put more emphasis on brand advertising while decreasing generic advertising. In the exaggerated case that the entire market is covered, generic advertisement is zero and all efforts are put into brand advertisement.

Finally, even though the authors analyze a duopoly, they do provide insights for a monopoly setting. For example, when the same firm controls both brands, the total generic advertising is

higher than when there are two firms in the game, and for one, the less profitable brand, the brand advertising level is zero. The intuition for this result originates from the fact that there is no free-riding since the monopolist captures all the revenues of generic advertisement. Additionally, since there are no other brands on the market, the firm is more concerned with reaching relatively more new customers and less with convincing that their brand is superior in order to increase their sales. Therefore, "when a firm is a de facto monopolist, it spends on generic advertising near the optimal industry level" (Bass et al., 2005). This is, for example, reflected in the large generic-advertising expenditures of companies like Campbell's Soup and De Beers (Bass et al., 2005).

In conclusion, the authors state that generic and brand advertising should be accurately and carefully controlled in order not to overlook one of the two, because that could result in the suboptimal allocation of the advertising budget.

Based on the literature mentioned above and the fact that we can look at generic and informative advertisement as having the same implication for our paper, the following hypotheses are made:

Hypothesis 1a: The informative component of advertisement will be more critical at the beginning (i.e., first period) compared to later (i.e., second period).

Hypothesis 1b: The more the market is saturated, the more emphasis will be put on the quality of the advertisements.

Hypothesis 2: The more effective the increase in the quality of advertisement, the more emphasis is needed to be put on the quality of advertisement.

Hypothesis 3: In case of a low budget, the emphasis should be placed on the informative component of advertising.

When looking at the Marketing and Business literature, advertisement is considered to be part of branding and is approached by qualitative explanations and qualitative models (Nowak et al., 1994; Levin et al., 1996; Keller, 2001). Often the relationships and effects suggested by those models are tested in empirical studies that aim to find causal relationships. A large part of those studies measures *if, and, to what exten*t, specific advertisement (campaigns) lead to increases in consumer demand (Bauer et al., 2005; Goic et al., 2018). The other significant part dedicates its efforts to determine what makes an ad effective (Keller, 2007; Armstrong, 2010; Hackley, 2017). For example, Armstrong's (2010) evidence-based book on persuasive advertisement states numerous strategies and tactics on how advertisement is made maximally persuasive. It finds that each situation, target audience, and marketing objective calls for a

specific and appropriate advertisement design (based on his proposed advertisement principles).

Although it is not clear what the optimal "quality level" of advertisement (i.e., to what extent well designed) should be, it is evident from the studies that mindfully crafted persuasive ads have the largest impact on consumer motivation to buy.

Building on that, Yang & Smith (2009) show in their research how "going the extra mile" in the creation of ads results in better consumer motivation and, eventually, higher sales. They demonstrate that marketers who are often taking a safe and conservative approach when it comes to advertising, which might, of course, be the optimal approach in some cases, could make their ads gain much persuasive power from creativity by unconventional and surprising choices. This is especially important when consumer willingness to pay is relatively low or when the source's credibility is perceived to be low—and both are often the case in marketing. Furthermore, the authors state that the consumers' involvement in advertising is often highest right before product purchase but could perhaps be slightly insufficient, and therefore an investment in creativity (in this paper quality) of the ad can be the little push a consumer at a critical point in the purchasing process needs.

Based on the statements mentioned, hypothesis 4 is derived:

Hypothesis 4: The marketing department will need to focus more on the quality of ads when consumers' willingness to pay is relatively low and more on the informative component when willingness to pay is high.

3. <u>Model Background</u>

In this part, we will discuss the two key assumptions of our model. Firstly, section 3.1 is based on the theory of Keller (2007) on brand equity, which will help us to understand how advertisements work and how they are most effective. This part is essential in the explanation and argumentation of what we call "quality" of advertisement and how a higher quality of ads leads to more sales. Secondly, section 3.2 puts into perspective the role of the marketing department and explains how and why it is modeled relatively limitedly in our paper.

3.1. Details on Advertisement

Advertisement in the marketing literature is considered to be part of the promotional mix, a management instrument characterized by its outspoken promotional, mediated, and paid-for nature. It is to be differentiated from other marketing communication disciplines such as public relations, personal selling, corporate communications, sales promotion, etc. In turn, promotion is one of the 4 P's of which the marketing mix consists of (Hackley, 2017). Advertising comes in numerous forms that could be categorized into five major types, namely: on-line, media, place (e.g., billboards, product placement), point of purchase (e.g., shelf-talkers and in-store radio or TV) and direct and response (e.g., mail, media, telephone, and internet) advertising. Thanks to its versatility, advertising allows marketeers to contribute to brand-building and or achieve many different targets. For example, advertising is a channel by which the marketing department of a firm can inform, persuade, and remind consumers about their brand's products or services that it sells. One could state that advertisement is the voice of the company and the brand to which it is connected. Even though advertising does not stand alone and should be in harmony with other means of communication like personal selling, direct response, promotion, events, experiences, and public relations, as emphasized by Schultz et al. (1993) in the Integrated Marketing Communications theory, it does play a central role in building strong brands. In turn, strong brands are proven to lead to better financial results for firms (Keller, 2007), thus making building and maintaining strong brands a management priority (Aaker, 1991, 1996; Kapferer, 2005). In marketing textbooks, it is theorized that for a brand to be considered strong, it must have much "brand equity"[5], which refers to "the differential effect that consumer knowledge about a brand has on their response to marketing for that brand" (Keller, 2009, p. 142). Brand knowledge here does not only mean facts about the brand, but it includes all the rational, emotional, and physical associations (i.e., thoughts, emotions, impression, imagery, experiences) that become connected to the brand in the head of customers (Keller, 2001, 2003).

Several models for brand equity have been proposed in academic literature (Aaker, 1991, 1996; Aaker & Joachimstahler, 1999), however in this paper we use the customer-based brand equity model introduced by Kevin Lane Keller (2001, 2003), because of its specific advertising communication implications and the way in which it advises on certain advertising communication developments. As such, according to Keller's customer-based brand equity model, creating and maintaining a strong brand can be represented as a consecutive sequence

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[5] Consumer-based brand equity to be more specific.

of steps. Each step being dependent on successfully reaching the previous one, whereby all steps taken, involve achieving specific goals with both existing and future customers (Keller, 2007). The necessary steps and brand building blocks, which are brand salience, performance, imagery, judgments, feelings, and resonance, need to fall in place in the same way a pyramid is built (see figure 1). This implies that in order to create significant brand equity, marketers need to reach "the top of the pyramid", something that only can be achieved in case lower-level building blocks are completed fully. Practically, this means accomplishing the following four steps with regards to customers in order to establish the six brand building blocks:

1. *Identity: Make sure that the consumer recognizes the brand and associates it with a specific product class or benefit or need of the customer.*
2. *Meaning: By strategically linking material and intangible brand associations, build a consolidation of all the brand meanings in the mind of the consumers.*
3. *Responses: Evoke the appropriate affective and cognitive responses of customers to the identity and meaning of the brand.*
4. *Relationships: Convert the reactions to the brand to establish intense, active loyalty relationships between the brand and clients.*

Figure 1.
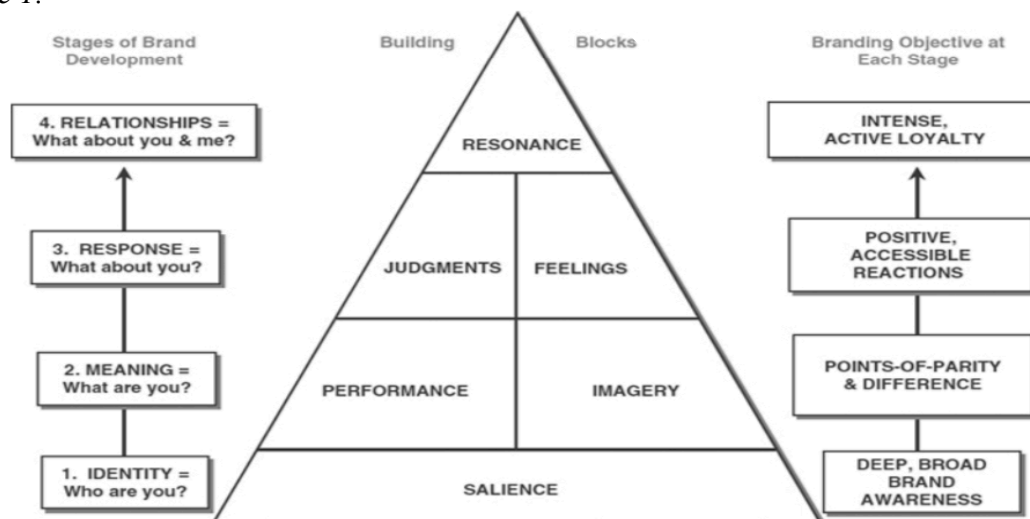
Source: Keller, 2007

Regardless of the specific segment of the brand building blocks involved, advertising plays a critical role each stride of the way in order to accumulate brand equity, by shaping the right knowledge structures in the minds of potential consumers for them to respond positively to marketing activities. Without downplaying the importance of actual product or service

performance, advertising can definitely help to reach the goal of creating brand loyalty and resonance, since advertising, as mentioned earlier, not only has the power to inform customers about the product and set expectations, it also has the power to persuade. The tone and or mood of advertising helps to define the brand personality (Aaker, 1997; Aaker et al., 2001) and by shaping imagery and helping to link intangible associations to the brand and its product performance, both judgment and feelings responses could be evoked (Edell and Moore, 1993; Aaker et al., 1986; Stewart et al., 2007). Consequently, persuasive advertisement can bring out favorable judgments and create a strong "call to action". For example, by providing engaging product demonstrations or fascinating "problem-solution" executions, advertising can create favorable overall brand assessments and experience of quality.

Following the customer-based brand-building perspective, it is important that consumer knowledge about the brand changes in some way in order for advertisement to be called effective, i.e., that it has an impact on brand equity. The communications associated with the brand about the performance and imagery associations and judgment and emotional responses should be coordinated correctly. Hence, advertising must be carefully designed to maximize the probability that the proper and optimal communication effects are achieved. In this paper, that transfers to the intensity/degree by which advertisement leads to persuasiveness, which in turn leads to resonance and brand loyalty, which then results in eventually higher sales, can be assigned to the quality level of how appropriately the add is designed. The following citation of Keller (2007) summarizes the thought mentioned above rather nicely:

"The strength of brand associations that result from exposure to advertising will depend on the quantity and quality of processing that occurs" (p. 11). Meaning that the more intense a consumer processes and reacts to an advertisement and recalls brand-related knowledge in the process, the higher the probability that strong brand associations are created.

Therefore, the challenging aspect of advertising becomes to incorporate media, message, creative, and other strategies in order to establish strong and favorable brand associations.

Logically, different forms of advertising will have different degrees of success, achieving different targets and goals. But luckily, marketers can use a vast range of creative strategies and approaches to influence consumer motivation positively and appreciate ad processing in consumers' minds. This could be done through the use of fear, sex, music, and so on. According to Othman (2017), creative advertisement, measured by its originality, flexibility, elaboration, synthesis, and artistic value, is the most efficient in motivating consumers to purchase specific products or services because it is more memorable and long-lasting. For example, brands like

Hallmark and Kodak spark warmth through their advertising, whereas McDonald's and Coca-Cola evoke fun and excitement thanks to their creatively designed advertising.

Other advertisements, point-of-purchase, interactive, or direct-response advertising, have even more direct effects on financial firm performance, because of the way they were specially created to increase sales (promotions).

Despite all the benefits it brings, making advertising effective can be very difficult. In some cases, consumers genuinely do not care for the products that are being marketed, and (poorly) designed advertisements are not enough to increase their motivation/willingness to pay to change their minds and purchase (Keller et al., 1998). And so, marketing departments always face the risk, regardless of their means, of making inadequate advertisements that do not fit the consumers. For improved effectiveness of ads, one of the strategies that Keller (2007) suggests is the use of brand signatures, which refers to showing the brand's logo and name and packaging information very highlighted in the advertisements. However, because of the attention being placed on the brand signature, less emphasis is put on the persuasive elements of the advertisement. This is reflected in the interchangeability of the number of advertisements (informative effects) and their quality (persuasive effects).

The above elaborated model by Keller (2007) is the basis for our analysis since it emphasizes the role and effect of advertisement. The model explains that, in order to be effective and build brand equity, advertisement should be "carefully designed", what this paper calls having "higher quality" of advertisement. In short, ads must have good quality in order to achieve that persuasive effect. The higher the quality means that the more it contributes to higher brand equity, which results in higher persuasive power that increases the willingness to pay or even directly affecting sales. In this paper, we look at the latter case.

In closing, this model has the goal to assist marketers to strategically assess advertising in order to find out how it can contribute to brand equity and to materialize sales.

3.2.   Role of the Marketing department

According to Kotler and Armstrong (2015), marketing is the activity to engage customers and manage profitable customer relationships. In practice, this means understanding the consumer's needs, developing products that provide superior value and pricing, distributing, and promoting in order to sell more effectively (Kotler and Armstrong, 2015). For marketers to achieve the goals mentioned above, they have to coordinate many factors through various channels, which make up the so-called "marketing mix". The marketing

mix is the strategic combination of and mutual alignment between the instruments that a company has at its disposal to navigate the market on which it is active (Culliton, 1948; Borden, 1964; Kotler, 2000). One of the most time-proof and widely accepted marketing mix frameworks in the marketing literature, dating back to the 1960s, is McCarthy's 4P's model, which stands for Price, Promotion, Place, Product (Bitner, 1991; Dominici, 2009), as mentioned earlier. Optimizing this marketing mix is often (traditionally) seen as the essential responsibility of the marketing function in an organization. By finding the right combination of the four P's, marketers can create consumer value and engagement, which lead to improved effectiveness and better business results (Gronroos,1994)[6]. Naturally, the marketing literature designates itself a crucial role within a firm, and some marketers go as far as to claim that if marketing is performed sufficiently well, the actual selling of the product becomes almost abundant (Kotler & Armstrong, 2016). However, Wirtz et al. (2014) provide a more specific and nuanced approach to the influence of the marketing department on firm performance. Their findings show that the marketing department's influence depends on various firm-specific characteristics. For example, greater marketing responsibilities, more marketing resources, and a marketing background of the CEO have a positive influence on the marketing department's influence. Further, they go on to prove a positive relationship between increasing the marketing department's influence and firm performance.

Despite the proven positive effects on firm results (Moorman & Rust, 1999; O'Sullivan et al., 2007; Homburg et al., 2015), recent literature detects a declining role for the marketing department (Webster et al., 2005; Verhoef & Leeflang, 2009; Homburg et al., 2015); according to many senior managers, "marketing has died, [is] impotent, or most likely [will] become irrelevant" (Schultz 2003, p.7)

Likewise, the diminishing importance given to the marketing department is rather striking. From a survey done by Fournaise Marketing Group, that interviewed the CEOs of 1,200 large corporations and small- and medium-sized firms in Asia, Australia, Europe, and North America, 80 percent of the CEOs surveyed either put marketers low in the ranking of their company's' executive committees or didn't incorporate them at all (Lukovitz, 2012).

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[6] In 1990, an adaptation to the 4P model was proposed by Robert Lauterborn, who introduced a more customer - driven-opposed to McCarthy's product-driven - model based on the 4C's. His 4C stands for consumer, cost, communication, and convenience. According to a more recent study by Moorman (2012), who surveyed CMO's, marketing research, promotion, market positioning, competitive intelligence, public relations, and social media were stated as the primary responsibilities of the marketing department (Wirtz, Tuzovic & Kuppelwieser, 2014).

Moreover, 64 percent of the CEOs mentioned that they had eliminated essential tasks, including product development, pricing, and channel management from the marketing department's authority (Lukovitz, 2012).

The latter is also confirmed by ex-LEGO chief Christian Majgaard, who believes that marketing has lost its strategic role and that few marketers remain involved in rolling out strategies (Verhoef & Leeflang, 2009).

As Lukovitz (2012), Webster et al. (2005) report that "in many organizations, the corporate marketing function has lost budget, headcount, influence, and confidence".

As companies experience these budget cuts, the annual marketing budget of the marketing department is usually set in the previous year, which means that it is fixed (Fischer et al., 2011). Despite the increasing number of scholars arguing that a dynamic budget would be more optimal (Fischer et al., 2011; De Leon et al., 2012), the reality is that still many traditional marketing departments/ companies employ an annual, i.e., fixed budget, which on its turn is often distributed over countries, products, etc. The amount of budget is determined by, for example, a percentage-of-sales approach, the competitive-parity method, or an objective-and-task method (Murphy, 2011).

Furthermore, the most considerable consequence of the declining role of the marketing department is perhaps the influence on pricing. The study by Verhoef and Leeflang (2009) on understanding the marketing department's influence within a firm shows that the "actual decision influence of marketing departments is limited to advertising, relationship management (including satisfaction assessment and improvement); and segmentation, targeting, and positioning." Core fields of influence that were traditionally lead by marketing, which is mentioned by many marketing textbooks, such as distribution and pricing, are now assigned to sales and finance.

In a similar, but later study from 2015 by Homburg et al. on the German market, the researchers mostly confirmed the findings of Verhoef & Leeflang (2009) that were obtained from Dutch market data. The results of the analysis by Homburg et al. also show a significant decrease from 1996 to 2013 in the influence of the marketing department in strategic aspects such as the strategic vision of the business unit, growth into new markets geographically, and choices of strategic business partners (for details about the exact magnitudes of the decreases see the table 1 from Homburg et al., 2015 p.4 in the Appendix). Furthermore, the data yet again reports that the marketing department has lost significant power concerning pricing decisions, leaving the sales department to be the leading department in this area. And again, advertising is the only area that the marketing department gained influence at.

A plausible reason for a marginalized role of the marketing department is that firms struggle to identify and quantify the direct results of marketing efforts, leading to the fact that often the marketing activities are seen as costs rather than a fruitful investment. O'Sullivan & Abela (2007) show that "ability to measure marketing performance has a significant impact on firm performance, profitability, stock returns, and marketing's stature within the firm."

As such, to model the reduced role of the typical marketing department, we assume a fixed price and a fixed marketing budget. On the other hand, it will reflect the increased power in advertising by including two variables for advertisement.

4. <u>Model</u>

Consider a monopoly that takes place during two periods. We use the index $i = 1,2$ to indicate the two periods. We start by stating the main notation:

Z_i Sales generated by the marketing department in period i
π_i Profit of the firm in period i.
q_i Quality of the advertisement in period i.
s_i Share of potential consumers reached in period i.
r Reservation value of potential consumers.
p Price charged by the firm.
τ Transportation cost
θ_i Indifferent consumer in period i
D_i Demand in period i
M_i Budget in period i
b Effectiveness of the quality of advertisement
c Cost parameter associated with reaching potential consumers
d Cost parameter associated with the quality of advertisement
δ Discount rate
v_i Willingness to pay in period i

In our model, we consider the marketing department of the monopolist firm that will be in charge of the advertising activities during two periods. The marketing department controls two instruments that influence the demand of the monopolist's product: number of advertisements and their quality. The other marketing-mix variables are less impactful or non-strategic.

The monopolist informs about its existence through advertisement that increases the share of informed consumers s_i, which are uniformly and homogenously distributed along a line $\in [0,1]$. The consumers incur a linear transportation cost τ that measures the substitutability between buying or not, and there is unit demand in both periods. Upon buying the product, the consumer receives a utility v_i (i.e., willingness to pay):

$$v_i = r + bq_i - \tau * \theta_i - p \qquad (1)$$

where q_i represents the quality of advertisement, r the consumers' reservation value with regards to the monopolist's product, and $b \cdot q_i$ depicts how the quality of advertisement increases the reservation value of the consumer by the positive (effectiveness) parameter b. The price p of the normal product is assumed to be fixed, which is a realistic assumption because marketing departments are not always price-setters and have to take the price as given as mentioned earlier in part 3.2.

For the consumer that is indifferent between buying or not buying the product her willingness to pay in period 1 and 2 will be equal to the fixed price p, implying that indifferent consumer can be represented as follows:

$$\theta_i(q_i) = \frac{r + bq_i - p}{\tau} \tag{2}$$

We assume that only consumers who have seen at least one advertisement about the product during the two periods are potential buyers. Implying that the demand in period 1 and 2 is:

$$D_1(s_1, q_1) = s_1 * \theta_1 \tag{3}$$

$$D_2(s_2, q_2) = \begin{cases} s_1(1 - s_2) * \theta_1 + s_2 * \theta_2 & if \ q_1 < q_2 \\ s_2(1 - s_1) * \theta_2 + s_1 * \theta_1 & if \ q_1 > q_2 \end{cases}$$

$$\text{(4a,b)}$$

Our model incorporates linear advertising cost:

$$C_i(s_i, q_i) = cs_i + dq_i \tag{5}$$

Furthermore, the marketing department is faced with a budget M_i that will be spent on the number of distributed ads and their quality per period. Note that because the marketing department aims to maximize sales, and more advertising increases sales, they will spend their entire budget, M_i, meaning $C_i(s_i, q_i) = M_i$, whereby choosing $M \leq d$ ensures an interior solution. Considering the above mentioned, the sales function that the marketing department is aiming to maximize for the firm is as follows:

$$Z_i = p * D_i(q_i, s_i) \ \text{s.t.} \ C_i(s_i, q_i) = M_i \tag{6}$$

Z_i is the number of sales per period, p is the price of the product, and $D_i(q_i, s_i)$ represents the demand per both periods. The demand is an increasing function of the quality of advertisement and share of people reached.

Lastly, the discounted profit maximization problem of the marketing department is:

$$\max_{s_1, s_2, q_1, q_2} (\pi_1 + \pi_2) = p * D_1 - cs_1 - dq_1 + \delta \pi_2(s_2, q_2) \tag{7}$$

π_1 and π_2 are the profit levels in periods 1 and 2, respectively, whereby $\pi_2(s_2, q_2) = p \cdot D_2 - cs_2 - dq_2$. δ is the discount rate, c, and d are the cost parameters for the number of ads and their quality, respectively.

5. __Analysis__

The optimal decision values of our model have been derived numerically and according to the backward induction method. The budget constraint $M_i(s_i, q_i)$ faced by the marketing department has been incorporated into the model such that:

$$q_i = \frac{M_i - c * s_i}{d} \qquad (8)$$

For the saturated[7] baseline numerical analysis with the following values of the relevant parameters; $r = 4, p = 3, \tau = 3, b = 2, c = 1, d = 1, \delta = 1, M_i = 1,$ the solutions to the optimal decisions for the amount of advertisement (s_i^*) and the associated quality (q_i^*) of them per period are:

$$s_1^* = 1 \qquad (9)$$

$$q_1^* = 0 \qquad (10)$$

$$s_2^* = \frac{1}{2} \qquad (11)$$

$$q_2^* = \frac{1}{2} \qquad (12)$$

Hence, the optimal demands (D_i^*) and sales (Z_i^*) are:

$$D_1^*(s_1^*) = \frac{1}{3} \qquad (13)$$

$$D_2^*(s_1^*, s_2^*) = \frac{5}{12} \qquad (14)$$

$$Z_1^*(s_1^*) = 1 \qquad (15)$$

$$Z_2^*(s_1^*, s_2^*) = 1\frac{1}{4} \qquad (16)$$

Finally, the profit is:

$$\pi^* = \frac{1}{4} \qquad (17)$$

The results above suggest that the number of ads should be highest in period 1, whereby the monopolist sends ads to all the consumers. The optimum quality of those ads is equal to 0. In the second period, the monopolist should reach just half of the consumers. However, the optimal quality of the ads should be higher than in period one and equal to ½.

The comprehensive results that will be discussed in the next section, we present in the table below. The first "part" of the table represents the results obtained with the baseline numerical analysis, whereby $b = 1$ (marked with an S) and the second "part" of that table contains the results calculated with $b = 2$ (marked with a B). The reason for the two "baselines" is, of course, to see what happens in the case of a higher contrast between the effectiveness of the quality of advertisement and the purely informative effects, especially against the background of equal costs. But more importantly, the two "baselines"

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[7] We take the example of a saturated baseline, since the optimal values here are esthetically pleasing and more convenient.

represent different degrees of saturation of the market. As the results given by the calculation with $b = 1$ often will provide a corner solution, we can state that we observe a (more) saturated market, meaning that everyone already knows about the product and so only the perception of these customers can be influenced. As the correction for a corner solution can blur or conceal the original predictions of the model, we also study the case with $b = 2$, where the dynamics of the model are put in a less extreme situation. Here the market saturation is significantly lower, evicting almost all the need for a corner solution. This case will be referred to as our baseline. For the detailed calculation of the model and extensions see the Appendix for the "Blueprint".

Table 2

Scenario	B/S	$s_1^* = \frac{39}{64} = 0.61$	$q_1^* = \frac{25}{64} = 0.39$	$D_1^* = \frac{741}{2048} = 0.36$	$Z_1^* = \frac{2223}{2048} = 1.09$	$s_2^* = \frac{3}{4} = 0.75$	$q_2^* = \frac{1}{4} = 0.25$
Baseline $b=2$	B	$\frac{39}{64} = 0.61$	$\frac{25}{64} = 0.39$	$\frac{741}{2048} = 0.36$	$\frac{2223}{2048} = 1.09$	$\frac{3}{4} = 0.75$	$\frac{1}{4} = 0.25$
	S	$\frac{3}{4} = 0.75$	$\frac{1}{4} = 0.25$	$\frac{3}{8} = 0.375$	$\frac{9}{8} = 1.125$	$\frac{15}{16} = 0.94$	$\frac{1}{16} = 0.06$
$d=2$	B	1	0	$\frac{1}{3} = 0.33$	1	$\frac{1}{2} = 0.50$	$\frac{1}{4} = 0.25$
	S	$\frac{3}{2} = 1.50$; $\mathbf{1^*}$	$-\frac{1}{4} = -0.25$; $\mathbf{0^*}$	$\frac{3}{8} = 0.375$; $\frac{\mathbf{1^*}}{\mathbf{3}}$	$\frac{9}{8} = 1.125$; $\mathbf{1^*}$	$\frac{3}{8} = 0.375$; $\frac{\mathbf{1^*}}{\mathbf{2}} = \mathbf{0.50}$	$\frac{5}{16} = 0.31$
$M_2 = 2$	B	$\frac{3}{4} = 0.75$	$\frac{1}{4} = 0.25$	$\frac{3}{8} = 0.375$	$\frac{9}{8} = 1.125$	$\frac{31}{32} = 0.97$	$\frac{33}{32} = 1.03$
	S	1	0	$\frac{1}{3} = 0.33$	1	1	1
$M_1 = 2$	B	$\frac{5}{4} = 1.25$; $\mathbf{1^*}$	$\frac{3}{4} = 0.75$; $\mathbf{1^*}$	$\frac{25}{24} = 1.04$; $\mathbf{1^*}$	$\frac{25}{8} = 3.125$; $\mathbf{3^*}$	$-\frac{1}{32} = -0.03$; $\mathbf{0^*}$	$\frac{33}{32} = 1.03$
	S	$\frac{3}{2} = 1.50$; $\mathbf{1^*}$	$\frac{1}{2} = 0.50$; $\mathbf{1^*}$	$\frac{3}{4} = 0.75$; $\mathbf{1^*}$	$\frac{9}{4} = 2.25$; $\mathbf{2^*}$	$-\frac{1}{8} = -0.12$; $\mathbf{0^*}$	$\frac{9}{8} = 1.125$
$M_i = 0.5$	B	$\frac{1}{2} = 0.50$	0	$\frac{1}{6} = 0.17$	$\frac{1}{2} = 0.50$	$\frac{3}{8} = 0.375$	$\frac{1}{8} = 0.125$
	S	$\frac{3}{4} = 0.75$	$-\frac{1}{4} = -0.25$	$\frac{3}{16} = 0.19$	$\frac{9}{16} = 0.56$	$\frac{15}{32} = 0.47$	$\frac{1}{32} = 0.03$
$M_i = 3$	B	$\frac{7}{4} = 1.75$; $\mathbf{1^*}$	$\frac{5}{4} = 1.25$; $\mathbf{2^*}$	$\frac{49}{24} = 2.04$; $\frac{\mathbf{5^*}}{\mathbf{3}}$	$\frac{49}{8} = 6.13$; $\mathbf{5^*}$	$\frac{7}{32} = 0.22$; $\frac{\mathbf{1^*}}{\mathbf{2}} = \mathbf{0.50}$	$\frac{89}{32} = 2.78$
	S	2; $\mathbf{1^*}$	1; $\mathbf{2^*}$	$\frac{4}{3} = 1.33$; $\mathbf{1^*}$	4; $\mathbf{3^*}$	0; $\frac{\mathbf{1^*}}{\mathbf{2}} = \mathbf{0.50}$	3
$r = 5$	B	1	0	$\frac{2}{3} = 0.67$	2	$\frac{1}{2} = 0.50$	$\frac{1}{2} = 0.50$
	S	$\frac{3}{2} = 1.50$; $\mathbf{1^*}$	$-\frac{1}{2} = -0.50$; $\mathbf{0^*}$	$\frac{3}{4} = 0.75$; $\frac{\mathbf{2^*}}{\mathbf{3}}$	$\frac{9}{4} = 2.25$; $\mathbf{2^*}$	$\frac{3}{8} = 0.375$; $\frac{\mathbf{1^*}}{\mathbf{2}} = \mathbf{0.50}$	$\frac{5}{8} = 0.625$
$p=4,\ r=3.5$	B	$\frac{3}{8} = 0.375$	$\frac{5}{8} = 0.625$	$\frac{3}{32} = 0.094$	$\frac{3}{8} = 0.375$	$\frac{39}{128} = 0.305$	$\frac{89}{128} = 0.70$
	S	$\frac{1}{4} = 0.25$	$\frac{3}{4} = 0.75$	$\frac{1}{48} = 0.021$	$\frac{1}{12} = 0.08$	$\frac{7}{32} = 0.22$	$\frac{25}{32} = 0.78$
$p=4.5,\ r=4$	B	$\frac{3}{8} = 0.375$	$\frac{5}{8} = 0.625$	$\frac{3}{32} = 0.09$	$\frac{27}{64} = 0.42$	$\frac{39}{128} = 0.30$	$\frac{89}{128} = 0.70$
	S	$\frac{1}{4} = 0.25$	$\frac{3}{4} = 0.75$	$\frac{1}{48} = 0.021$	$\frac{3}{32} = 0.09$	$\frac{7}{32} = 0.22$	$\frac{25}{32} = 0.78$
$p=1.5,\ r=1$	B	$\frac{3}{8} = 0.375$	$\frac{5}{8} = 0.625$	$\frac{3}{32} = 0.09$	$\frac{9}{64} = 0.14$	$\frac{39}{128} = 0.30$	$\frac{89}{128} = 0.70$
	S	$\frac{1}{4} = 0.25$	$\frac{3}{4} = 0.75$	$\frac{1}{48} = 0.021$	$\frac{1}{32} = 0.03$	$\frac{7}{32} = 0.22$	$\frac{25}{32} = 0.78$
$r = 3$	B	$\frac{1}{2} = 0.50$	$\frac{1}{2} = 0.50$	$\frac{1}{6} = 0.167$	$\frac{1}{2} = 0.50$	$\frac{3}{8} = 0.375$	$\frac{5}{8} = 0.625$
	S	$\frac{1}{2} = 0.50$	$\frac{1}{2} = 0.50$	$\frac{1}{12} = 0.08$	$\frac{1}{4} = 0.25$	$\frac{3}{8} = 0.375$	$\frac{5}{8} = 0.625$
Saturation $b=1$		$s_1^* = 1$	$q_1^* = 0$	$D_1^* = \frac{1}{3}$	$Z_1^* = 1$	$s_2^* = \frac{1}{2}$	$q_2^* = \frac{1}{2}$

	D_2	Z_2	TotSale	π	C
	$\dfrac{1041}{2048}=0.51$	$\dfrac{3123}{2048}=1.52$	$\dfrac{2673}{1024}=2.61$	$\dfrac{625}{1024}=0.61$	2
	$\dfrac{3}{8}=0.375$	$\dfrac{9}{8}=1.125$	$\dfrac{9}{4}$	$\dfrac{1}{4}=0.25$	2
	$\dfrac{5}{12}=0.42$	$\dfrac{5}{4}=1.25$	$\dfrac{9}{4}=2.25$	$\dfrac{1}{4}=0.25$	2
	$\dfrac{1}{4}=0.25$	$\dfrac{3}{16}=0.19$ / $\mathbf{\dfrac{1}{3}=0.33}$	$\dfrac{9}{16}=0.56$ / $\mathbf{1^*}$	$\dfrac{27}{16}=1.69$ / $\mathbf{2^*}$	$-\dfrac{5}{16}=-0.31$ / $\mathbf{\dfrac{1}{8}=0.125}$	2 / $\mathbf{2^*}$
	$\dfrac{1537}{1536}=1.00$	$\dfrac{1537}{512}=3.00$	$\dfrac{2113}{512}=4.12$	$\dfrac{577}{512}=1.12$	3
	$\dfrac{2}{3}=0.67$	2	3	0	3
	1^*	$\dfrac{1601}{1536}=1.04$ / 1^*	$\dfrac{1601}{512}=3.13$ / 3^*	$\dfrac{3201}{512}=6.25$ / 6^*	$\dfrac{1665}{512}=3.25$ / 3^*	3 / 3^*
	1^*	$\dfrac{145}{192}=0.76$ / $\mathbf{\dfrac{2}{3}=0.67}$	$\dfrac{145}{64}=2.27$ / 2^*	$\dfrac{289}{64}=4.52$ / 4^*	$\dfrac{97}{64}=1.52$ / 1^*	3 / 3^*
	$\dfrac{25}{96}=0.26$	$\dfrac{25}{32}=0.781$	$\dfrac{41}{32}=1.28$	$\dfrac{9}{32}=0.28$	1
	$\dfrac{267}{1024}=0.261$	$\dfrac{801}{1024}=0.782$	$\dfrac{1377}{1024}=1.345$	$\dfrac{353}{1024}=0.345$	1
	$\mathbf{\dfrac{5}{2}=2.50}$	$\dfrac{3185}{1536}=2.07$ / $\mathbf{\dfrac{11}{6}=1.83}$	$\dfrac{3185}{512}=6.22$ / $\mathbf{\dfrac{11}{2}=5.50}$	$\dfrac{6321}{512}=12.3$ / $\mathbf{\dfrac{21}{2}=10.50}$	$\dfrac{3249}{512}=6.35$	6 / $\mathbf{6^*}$
	$\mathbf{\dfrac{5}{2}=2.50}$	$\dfrac{4}{3}=1.33$ / $\mathbf{\dfrac{13}{12}=1.08}$	4 / $\mathbf{\dfrac{13}{4}=3.25}$	8 / $\mathbf{\dfrac{25}{4}=6.25}$	2 / $\mathbf{\dfrac{1}{4}=0.25}$	6 / $\mathbf{6^*}$
	$\mathbf{\dfrac{1}{2}=0.50}$	$\dfrac{5}{6}=0.83$ / $\mathbf{\dfrac{3}{4}=0.75}$	$\dfrac{5}{2}=2.50$ / $\mathbf{\dfrac{9}{4}=2.25}$	$\dfrac{9}{2}=4.5$ / $\mathbf{\dfrac{17}{4}=4.25}$	$\dfrac{5}{2}=2.50$ / $\mathbf{\dfrac{9}{4}=2.25}$	2 / $\mathbf{2^*}$
	$\dfrac{51}{64}=0.80$	$\dfrac{153}{64}=2.39$	$\dfrac{297}{64}=4.64$	$\dfrac{169}{64}=2.64$	2
	$\dfrac{1275}{8192}=0.16$	$\dfrac{1275}{2048}=0.62$	$\dfrac{2043}{2048}=0.998$	$-\dfrac{2053}{2048}=-1.00$	2
	$\dfrac{113}{3072}=0.04$	$\dfrac{113}{768}=0.15$	$\dfrac{59}{256}=0.23$	$-\dfrac{453}{256}=-1.77$	2
	$\dfrac{1275}{8192}=0.16$	$\dfrac{11475}{16384}=0.70$	$\dfrac{18387}{16384}=1.12$	$-\dfrac{14381}{16384}=-0.87$	2
	$\dfrac{113}{3072}=0.04$	$\dfrac{339}{2048}=0.166$	$\dfrac{531}{2048}=0.26$	$-\dfrac{3565}{2048}=-1.74$	2
	$\dfrac{1275}{8192}=0.16$	$\dfrac{3825}{16384}=0.23$	$\dfrac{6129}{16384}=0.37$	$-\dfrac{26639}{16384}=-1.63$	2
	$\dfrac{113}{3072}=0.04$	$\dfrac{113}{2048}=0.06$	$\dfrac{177}{2048}=0.09$	$-\dfrac{3919}{2048}=-1.91$	2
	$\dfrac{25}{96}=0.26$	$\dfrac{25}{32}=0.78$	$\dfrac{41}{32}=1.28$	$-\left(\dfrac{23}{32}\right)=-0.72$	$C^*=2$
	$\dfrac{25}{192}=0.13$	$\dfrac{25}{64}=0.39$	$\dfrac{41}{64}=0.64$	$-\dfrac{87}{64}=1.36$	2
	$D_2^* = \dfrac{5}{12} = 1\dfrac{1}{12}$	$Z_2^* = 1\dfrac{1}{4}$	$TotSale = \dfrac{9}{4}$	$\pi^* = \dfrac{1}{4} = 0.25$	$C^* = 2$

6. <u>Discussion</u>

In this section, we will firstly, discuss the outstanding features of the model and the analysis, and in the Conclusion, suggestions for future research and limitations will be mentioned.

The way in which we will discuss the results is as follows. We will look at the effects of the numerical changes in *reservation values*, *price, budget, costs,* and *effectiveness* by analyzing the specific situations caused by the new parameters and compare those to both our baseline equilibrium ($b = 2$) and to the situation of saturation ($b = 1$). Additionally, we will examine how those numerical changes in parameters have impacted the specific situations in question from period 1 to period 2. Lastly, we look at the proportional changes in budget allocation between informative ads and their quality. Furthermore, we will try - when possible - to give an intuition for the results generated by the model.

The table with the results of the optimal values can be found in part V, and for the proportions table between the informative and qualitative components of the advertisements, see table 3 in the Appendix

6.1. Reservation value and price

The major observation from our results with regards to the reservation value and price is that the level of quality and number of advertisements are determined by the relative difference between the reservation value r and the price p, regardless of the absolute price and reservation value. As long as $(r - p)$ is unchanged, the division of the budget between q and s stays the same. When there is no difference between r and p ($r = p = 3$), the budget is split equally between quality and people reached. Neither of the instruments is given more importance; s and q are both set to ½ in the first period. As the relative difference becomes bigger, meaning r-p increases, more emphasis is put on the number of advertisements (i.e., s becomes bigger) versus the quality of advertisements. In the extreme case, when the relative difference between $r - p$ is highest ($r - p = 2$, when $r = 5$, $p = 3$), 0 is spent in the first period on q_1, which is very logical from an efficiency point of view. The customers are already very willing to buy, merely informing them is sufficient; there is no need to invest further in the quality to move the indifferent consumer to the right. Hence, when the clients are very interested in the firm's brand or product anyways, there is little pressure to persuade them. And the opposite is true as $r - p$ becomes increasingly negative, i.e., the reservation value surplus becomes smaller or even negative. In that case, we see that more importance is given to the quality of advertisement. The quality must increase to move the indifferent consumer to the right and compensate for the lack

of surplus of the reservation value. Only informing is no longer enough to realize sales; the consumer needs to be also more persuaded by better advertisements. Hence, the lower the reservation value, the more it makes sense to increase the quality of advertisement for the (fewer) people that have been informed. This is quite logical since spending the entire budget to inform people that are certainly not interested in the brand or product is quite wasteful; instead, it would be more profitable to reach a smaller group and intent to persuade them by increasing the quality of those (smaller number of) advertisements. These results above confirm the previously mentioned literature review, which states that it is especially important to use persuasive advertisement when the willingness to pay/ reservation value of a consumer is relatively low (Keller, 2007; Armstrong, 2010; Hackley, 2017).

Furthermore, the results indicate that the absolute price level, rather than the relative, plays a crucial role in the determination of positive profits. When we take into account a surplus of the reservation value that is not too negative to be unrealistic (i.e., the values for s are not negative), positive profits can be generated at a sufficiently high price. This is, for example, the case where $r - p = -\frac{1}{2}$. Here we find no negative values for s, and if we set the price high enough (i.e., p is equal or higher than 8), the profits of the firm become positive. The driving force behind these results is most likely the fact that the costs remain in every scenario equal to 2.

The results in period 2 are a bit less obvious about their division between quality and the number of advertisements. However, they do follow the general pattern whereby more importance is put on the quality of advertisement and less on the number of advertisements. This latter observation is in line with the literature review that states that generic (or in our case informative) advertising should be promoted relatively more at the beginning (compared to later periods), and brand advertising should be given relatively more priority in the later periods (Bass et al., 2005). We will see more of such tendencies in the following extensions.

In the saturated case, we see more or less the same patterns and observations as in the baseline case. When $p = r = 3$, demands, sales, and profits are twice as small. And in the hypothetical case when $p = 5$ and $r = 4$, which makes no sense in real life, since it suggests a negative number of advertisements should be spread (i.e., s_1 is negative), the model still shows the intuition of the model clearly. That is that when r is relatively small, the marketing department should focus relatively more on reaching fewer people and putting relatively more effort in convincing them.

But, the remarkable difference between our baseline and the results from the more saturated market, is that the original strategies suggested by the model become more extreme/aggressive. Meaning that if in the baseline model, q_1 was relatively smaller than s_1, for the same relative reservation value surplus, in the saturated case, it would become even smaller in comparison to s_1. Unfortunately, though, there is less to gain in a saturated market. So even when the more extreme values for q and s are set, the overall sales and profits in the saturated market are lower than in our baseline results.

However, if $r = 5$ and we look at the non-corner solution (so consider that market expansion is allowed) there, the profits do become slightly higher than in the baseline situation. The intuition behind it could be that because there is less "room" in the market, one must "work" harder to attain the same results. However, when there is room in the market, the original strategy appears to be more profitable. Therefore, $r = 5$ yields higher profits in the saturated market without restrictions than $r = 5$ in the baseline setting. So, one can state that extremer strategies reach higher profits if given the opportunity. Furthermore, regardless of the $r - p$ difference, again, generally, more focus is put on quality in the second period ($q_1 < q_2$) and less on the number of advertisements ($s_1 > s_2$).

In summary, the relative difference between the price and reservation value controls the relative emphasis put on the quality of advertisement or the informative component. Furthermore, the absolute price determines whether the profit will be positive or not, and the number of advertisements is given more importance in period one, whereas the quality of advertisement receives relatively more funds in period two.

6.2. Budget

The few general and most apparent observations concerning the budget are first that its amount controls the absolute values of all the other variables. Meaning that when the budget is low, all the other values are also low. And in the case of a higher budget, all the other values become bigger as well. Secondly, it is the only parameter that changes the cost variable, which is expected since we have defined that the entire budget is spent at the equilibria. Lastly, we see that the quality of advertisements receives relatively more attention in period two, and relatively more advertisements are spread during the first period, precisely as we have seen before in the numerical extensions regarding the price and reservation value.

As we look more into detail at the results, we notice that when the budget is tiny ($M_i = 0{,}5$), the focus is mainly put on the number of advertisements. In practice, this could be an entirely

logical strategy since at least informing non-knowing customers about the existence of the firm or product would increase the chance to realize sales, rather than spending limited funds on a secondary activity such as enhancing the quality of the advertisements.

On the other hand, when the budget is high ($M_i = 3$), relatively more focus or also (some) focus is put on quality. This mainly occurs if we consider the values given by the corner solutions that put a limit to the number of advertisements, which on their turn, result in a compensating effect that increases the emphasis on the quality of advertisement. However, even without corner solutions, we observe a more balanced distribution of the budget between the number of advertisements and the quality of them. We could interpret the latter as in that there is simply more money available to dedicate to both instruments. The marketing department is not constrained to investing only in the most prioritized variable, which in the case of a small budget, is the number of advertisements.

We also see that a high budget, besides generating corner solutions, also saturates the market regardless of the value for b. We could argue that the budget is the "strongest force" when it comes to capturing the market. Even stronger than a high reservation value. See the case when $r = 5$ and $b = 2$, here the market remains unsaturated. However, with a high budget, the marketing department manages to obtain the entire market immediately. Confirming the literature review that marketing departments are stronger when having bigger funds[8] (Wirtz et al., 2014).

When the budget is higher in period one and lower in period two or vice versa, during the period with the larger budget, the funds are (more) equally divided between informative advertisements and their quality. However, when the resources are scarcer in period 1, then all the funds tend to be spent on informative advertisements and the quality of advertisement when the budget is smaller in period 2. Hence, the model tends to promote informative advertisements for the first period compared to the second and during times with smaller budgets. The quality of advertisement is usually more critical in the second period and or if relatively more money is available.

So, put it in other words: in the period with the lower budget, the "stronger" variable gets relatively bigger than the "weaker" one. So far, we have seen that s is given more importance in period 1 (i.e., it is the stronger variable in this case) and q in period two, and when faced

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[8] We acknowledge that the references provided mention the relative strength of the marketing department within the firm in proportion to designated budgets. However, as we consider here only one firm with only one department, a logical way to measure the power of the firm here would be in terms of its ability to capture market share. Hence, our statement.

with a constraint, the strategically crucial instrument will be given more weight. When $M_1 = 2$, q is given extremely high importance in period 2. And when $M_2 = 2$, in period 1, 75% of the budget is spent on s, compared to 62,5% when $M_1 = 2$.

An extreme example of the tendencies described above is the result in the extension of $M_1 = 2$ when $q_2 = 1.03$ and $s_2 = 0$. At first glance, this kind of result would not make sense, but here it shows perfectly the intuition of the model when it comes to the prioritized variable per period; the quality of advertisements appears to be consistently given more importance in period 2. Moreover, it confirms the statements in the literature review that in the extreme case that the entire market is captured, which in this case happened already in period 1, generic/informative advertisement is zero and all the efforts will be put into brand advertisement (Bass et al., 2005).

Furthermore, a practical explanation for this rather strange result, whereby a significant amount is spent on the quality of advertisement but nothing to reach customers, is that a marketing department with a fixed budget would not be able to let the budget remain uninvested (assuming there is no flexible funds policy between the various departments within the company). Consequently, the marketing department would invest in the quality at least to have something to report to the board about its activities[9].

Lastly, when we consider the results in case of saturation (i.e., $b = 1$), we see that the same general observation described earlier apply here as well. However, the main difference would be the fact that the results appear again "extremer" with lower profits. Meaning that the overall tendencies of the model still apply, but, when for example, s is relatively small in the baseline model and q is relatively larger, in case of saturation, the number of advertisements becomes even smaller, and the value for q increases. And that is exactly what we see when, for instance, $M_1 = 2$ and $M_2 = 2$, the relative distributions are roughly the same as the baseline, but extremer and with lower overall profits. The intuition for the latter results might be that in a saturated market setting, the same optimal strategies must be even more aggressive to reap similar profits. Say when for example, the optimal tactic is to spend relatively more on informative advertisements than on their quality, a more aggressive strategy would mean to make that

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[9]We would like to disclose an anecdote from personal experience during a brand management internship at a Dutch multinational dairy firm. Here in the marketing department, the portfolio manager instructed a brand leader to change the design of the packaging of the product because "if" the sales would decrease in the future, he would not get the blame for not having invested in the marketing/advertising of the product. Note that such small packaging changes are not cheap by any means. The costs go in the tens of thousands of euros easily. The changes made were just based on having something to report. Because no prior research, for example, in the form of a pilot with the target group, was performed to investigate the effects of packaging.

relative difference in investment between the informative advertisement and the quality even larger (i.e., choose extremer values for q and s). And since the market is saturated, there is less (potential) demand, which leads to lower sales and logically to lower overall profits as well.

The difference between the profits in the baseline setting and the saturated market is the largest when the budget is biggest. On the contrary, when the budget is very small, the difference between the profits in the two settings is minimal, even though the values for the strategic instruments are extremer. An explanation for this fact could be that regardless of the opportunities in the market "when you have little, you can do little". Hence, having little funds to invest leads to the profits being relatively more proportioned to the budget. However, in the case of a large budget, the most significant limitation the firm in this model could face is a saturated market.

Furthermore, given a higher budget, the market tends to be immediately saturated ($s_1 = 2$) and shows a very high level of quality of advertisement in period two and a very high number of advertisements in period 1. The corner solutions diminish this effect because s_1 is forced to have a maximum value of 1, and q can be unlimitedly high. The intuition behind it could be that given r is high enough, the marketing department aggressively wants to just inform and capitalize on it immediately. Therefore, later and less focus is placed on quality.

In closing, the model shows that the highest profits are reached when the firm can saturate and conquer the entire market as fast as possible.

6.3. Cost

As we observe the extension with regards to the costs, we see that major mechanisms again stay rather unchanged. And similar to the results in the saturated settings, the values become extremer.

Furthermore, when the costs double for the quality of advertisement, we expect that less would be spent on q and relatively more on s. However, even when we see that the value for q decreases, the actual part of the budget that is dedicated to the quality of advertisement remains the same. And when the market is saturated, the values become even more extreme. And here again, half of the budget is spent in period 2 to q, but q is twice as small now.

Demand and sales decrease in period two because even though if it is not profitable, one would still tend to invest in q at a higher price, and indeed half of the budget is spent on the quality of advertisement. This occurs because, just as we have seen by now in every other extension, in

period 1, the model promotes investments mainly in s and period 2 requires a relatively higher investment in q. A corner solution is needed, which smooths out the vast differences between the periods and the proportions of the budget dedicated to both instruments.

Not surprisingly, the profits with $b = 1$ are twice as low as with $b = 2$. The intuition is again similar to the other extensions in a saturated market, which is that a saturated market is more stringent, and therefore, adverse effects, such as a more expensive instrumental variable, are visible faster. $d = 2$ in the s market immediately results in a decrease in demand and sales in period two compared to period one as to the non-saturated market.

6.4. Effectiveness

When we assume that the quality of advertisement becomes twice as effective, we see a decrease in the number of advertisements and an increase in the quality, demand, and sales in period 1 in comparison to the equilibrium values calculated with b=1. However, in period 2 the pattern does not persevere and the mirror image of period 1 occurs: all the variables decrease while increases. Therefore, the results are only partially in line with our literature review, whereby Bass et al. (2005) stated that the budget allocation is primarily dependent on the relative effectiveness of both types of advertising. So given an advertising budget, in the case that a specific advertisement component becomes more effective, the optimal level of that advertisement increases and the optimal level of the other component decreases.

An explanation for the fact that the quality of advertisement decreases relative to the number of advertisements in period two could be that since the quality of advertisement becomes more effective, less is needed to achieve the same effects (i.e., demand and sales from period to period stay the same). It is interesting, though, why a substitution effect takes place between the informative and the qualitative components, taking into account the same costs for both. We would expect that the increases in the effectiveness would lead to higher sales and not be incorporated into the model to such an extent that the total sales (and profits) remained the same as before of the increase in effectiveness. This being said, we are aware of the perhaps superficial nature of our observations, since the informative advertisements are not modeled to have an effectiveness parameter.

6.5. *Discount Factor*

Not much changes in the numerical analysis when we take into account a discount factor of delta=0.5. As expected, only the total sales and profits decrease, since the future value of sales decreased in the eyes of the marketing department.

6.6. *Discussion extension*

An elaborated extension would be out of the scope of this paper. However, we would like to hypothesize a bit about the possible dynamics of a duopoly. For this we assume that the two firms first set their number of advertisements simultaneously and later decide on the quality of those advertisements during two periods, leaving all else equal.

In our primary monopoly model, we already established a few main variables and parameters with their interactions that determine the outcomes to our research question. Hence, depending on their (relative) magnitudes we obtained the optimal number of advertisement and their quality.

An additional dynamic in a duopoly with regards to informative advertisement is the interaction between on one hand extending one's market and on the other hand increasing the area of fully informed customers, which results in lower prices because of the negative competitive effects. As for the persuasive advertisement, firms are better off coordinating their advertisement decisions (Belleflamme et al.,2015).

Therefore, in the case of symmetric firms, we would expect the findings of the model to be very similar to an analysis of classic informative advertisements in a hoteling setting. However, we have agreed on a fixed price, which means that it cannot be pushed down due to competition and the firms would maximally want to expand their market share by informing as many people as possible. Hence, relatively more focus on the number of advertisements will be placed, compared to a model where the price is not given. In addition, we would expect informative advertising costs, contrary to the original analysis by Stigler (1961), to be not positively related to the firm's profit. When it comes to the quality of advertisement, as it is modeled to some extent in a similar way to persuasive advertisement, it is plausible that the two firms would end up in a prisoner's dilemma when deciding to invest in the quality or not.

Again, similar to the persuasive advertisements and in line with the findings of Bass et al. (2005) we expect the quality of advertisement to receive relatively more attention when the market

becomes more saturated and in case the relative difference between the price and reservation value decreases.

Furthermore, we would expect in a duopoly first informative then qualitative investments since it makes sense to first inform the consumers and then to adjust the quality of those ads. As the main mechanisms of our model would remain unchanged, we still expect to see a substitution effect between the number of advertisements and their quality in a duopoly. Besides we see in a similar study by Bass et al. (2005) that even with an unlimited budget the optimal amount of generic advertisements and brand advertisements are still substitutes in case one of the two becomes more or less beneficial (e.g., one of the strategic instruments becomes more effective or more or less costly). Future research could focus on a model that can partially eliminate the substitution effect.

In case of asymmetric firms, we could state that the stronger firm will act more like a monopolist. The main driver for being the strongest firm will probably be the budget. A higher budget will give the freedom to the firm of expanding its market and having the luxury to invest relatively more in the quality of advertisement since a higher budget allows for a more balanced allocation of informative ads and their quality. In case the firms produce the same or very similar products, the informative advertisements will serve as generic advertisement, and therefore free-riding by the weaker firm will be present. For more detailed outcomes on the latter case, one can see the analysis by Bass et al. (2005) as they examine the dynamics of generic advertisements in a very similar setting as described in this paper.

In conclusion, marketing departments should assess the situation at hand and depending on the relevant factors choose the optimal allocation between the number of informative advertisement and their optimal quality.

7. <u>Conclusion</u>

Marketing departments around the world engage daily in various advertisement strategies to build brand equity and eventually boost sales. Not surprisingly, vast amounts of marketing literature have been dedicated to the factors that make advertisements effective. In other words, one could state that that research is essentially concerned with (the analysis and enhancement of) the *quality* of advertisements. However, most theoretical papers rarely emphasize the actual quality of advertisements, even though they do elaborate heavily on the various types and

effects of advertisements. Therefore, one of the contributions of this paper was to highlight the importance of the quality of advertisement in a theoretical setting and to provide an answer to the question: "What is the optimal quality of advertisement vs. the number of informative advertisements a firm should disseminate, and how does this optimal allocation between quantity and quality change over time?" With this, explicitly taking into account the diminishing role of the marketing department and the fact that advertisements rarely are made up of just one type of advertisement.

To answer our research question, we analyzed a hoteling model where the monopolist's marketing department advertised during two periods. At its disposal, it had the freedom to choose the number of ads that it distributed, along with an appropriate level of quality, while facing a budget constraint and a fixed price.

By numerically solving the model for various extensions, we can observe from the generated results, that the majority of our hypotheses can be confirmed. This means that informative advertisements are indeed more critical at the beginning (i.e., first period) compared to later (i.e., second period) and that the quality of those advertisements is given significantly more importance in the second period. The latter observation is one of the most robust outcomes since this pattern was repeated across all of the extensions. Furthermore, as the market becomes more saturated, more emphasis is put on the quality of the advertisements since the firm is now only able to influence the consumer's preferences. Likewise, relatively more importance is given to the quality of advertisement when the willingness to pay of the customers could be regarded as low.

On the contrary, in case the customers are already very willing to buy, the marketing department can save itself the extra effort and focus on just informing the consumers. Additionally, the results demonstrate that informative advertisements are given relatively higher priority in case of a somewhat limited budget, and the funds are more equally divided between the informative and quality component when the budget is relatively high. This confirms our third hypothesis regarding the budget.

Lastly, the only hypothesis that could not be confirmed entirely was the second one, which argued that with an increase in the effectiveness of the quality of advertisement, a relatively more substantial portion of the budget should be dedicated to the quality of advertisement. This is most likely due to the restrictive character of our budget that dictates the maximum amount of costs spent at an equilibrium. By having a fixed budget, we were confronted with a strong substitution effect between the investments in the number of advertisement and their quality, which could be considered as one of the limitations of this paper. As it would have been more

intuitive for our model only to increase the quality of advertisement in case there were initially advertisements spread. As such, explicitly modeling a complementary effect could be an interesting topic for future research.

Another limitation of our paper could be considered the slightly exaggerated focus on the number of advertisements. This is because we mainly analyze a monopoly setting in which free-riding effects are minimized (Bass et al., 2005). Furthermore, our model does not take into account market segmentation, where, for example, the consumers' responses are modeled according to their tastes (Buratto et al., 2006). Also, no learning/memory factor or a variation in consumption reactions after the first trial were included in our analysis (Ambler & Burne 1999; Wedel et al., 2000; Ackerberg, 2003). And lastly, contrary to most papers that model informative and persuasive advertisement separately, we do not assign an effectiveness parameter for the informative advertisement. It would, however, be a more realistic approach to include them, since we can imagine that not all informative advertisements are equally effective.

Future research should consider incorporating the above-mentioned effects while maintaining the essence of our paper, which includes the emphasis on quality of advertisement and the heterogeneity in the set-up of advertisements. Moreover, future research could focus on modeling the restricted role of the marketing department more accurately, rather than only reflecting it in the fixed price and budget (which can lead to substitution effects). Lastly, our model can be tested empirically by examining advertisement effects in ads that vary from having merely informative content to increasingly personalized and higher quality advertisements. And by digitally generating the various advertisements, the analysis can be done rather efficiently.

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9. <u>Appendix</u>

9.1. *Table 1. From Homburg et al. (2015)*

Table 2 Influence of departments over specific issues: results of 1996 and 2013 (with t-tests comparing influence over time)

Decisions regarding	Marketing			Sales			R&D			Operations			Finance		
	1996	2013	Δ	1996	2013	Δ	1996	2013	Δ	1996	2013	Δ	1996	2013	Δ
Pricing	24	19	−5*	47	50	3	4	6	2	7	9	2	18	17	−1
New product development	31	24	−7**	26	30	4*	27	32	5*	8	8	0	8	6	−2
Strategic direction of the business unit	39	30	−9***	34	41	7**	8	11	3	5	6	1	13	12	−1
Major capital expenditures	14	11	−3*	14	16	2*	12	14	2	23	21	−2	37	38	1
Expansion into new geographic markets	36	21	−15***	49	61	12***	2	3	1	2	2	0	11	11	0
Choices of strategic business partners	27	18	−9***	53	57	4	6	10	4*	5	6	1	9	9	0
Design of customer service and support	29	26	−3	54	59	5	4	5	1	6	5	−1	6	6	0
Customer satisfaction improvement programs	42	45	3	41	45	4	5	3	−2*	5	3	−2*	6	5	−1
Distribution strategy	32	23	−9***	59	67	8**	2	2	0	3	4	1	5	4	−1
Advertising messages	62	70	8**	33	25	−8**	3	3	0	1	0	−1*	2	1	−1
Customer satisfaction measurement	54	56	2	37	37	0	3	1	−2*	3	3	0	3	3	0

*p<.05; **p<.01; ***p<.001

We present the decision areas in decreasing order of their importance for the success of the strategic business unit (assessed by our key informants). The number in each cell is the mean of the number of points given by the key informants to each department, using a constant-sum scale of 100. Sum may not add up to 100 due to rounding. Values for 2013 are adjusted by sales volume according to 1996. The "Δ-columns" display *t*-tests that were performed to compare the relative influence of each department between 1996 and 2013

9.2. *Blueprint*

This part will serve as the blueprint for the calculations shown in the Model, Analysis, and Discussion. We will start with the details of the model (Blueprint Model) and then go on to provide the final optimal numerical values based on an example in (Blueprint Calculations).

9.2.1. Blueprint Model

In the model, we suppose that there is one monopolist firm whose marketing department will be in charge to advertise during two periods. The advertising instruments that the department has at its disposal are the number of advertisements (s_i) and their quality (q_i).

The consumers are uniformly distributed along a homogenous line that has a maximum length of 1. The monopolist is located at point x from which it advertises in order to inform the consumer about its existence. We assume that the price p of the product is fixed. The consumers have a reservation value r for the monopolist's product, and they incur a linear transportation cost t. Furthermore, the $b * q_i$ in the equation represents the quality of advertisement that increases the *willingness to pay* (v_i) of the consumer by a factor b, with $i = 1,2$ always representing the periods. When the consumer buys a product, she receives a utility v_i (i.e. willingness to pay) in period 1 and 2, respectively:

$$v_1 = r + bq_1 - \tau|\theta_1| - p \tag{1}$$

$$v_2 = r + bq_2 - \tau|\theta_2| - p \tag{2}$$

By finding the indifferent consumers, represented by θ_1 in period 1 and by θ_2 in period 2, we can establish the particular demands. For the consumer that is indifferent between buying or not buying the product her willingness to pay in period 1 and 2 will be equal to the fixed price p and solving the two equations we get that the indifferent consumers are in periods 1 and 2, respectively:

$$v_1 = r + bq_1 - \tau|\theta_1| = p \quad > \quad \theta_1 = \frac{r+bq_1-p}{\tau} \tag{3a,b}$$

$$v_2 = r + bq_2 - \tau|\theta_2| = p \quad > \quad \theta_2 = \frac{r+bq_2-p}{\tau} \tag{4a,b}$$

The number of advertisements will be represented by the share of the people that are reached, i.e., s_i. In period 1, the number of customers is equal to all the people that have been informed by the firm, which is s_1. In period 2, the demand for the product consists of the people that already heard from the products in period 1 but did not receive any information about it in period 2 ($s_1 * (1 - s_2)$), plus the people that heard in both periods about the product ($s_1 * s_2$) and finally the consumers that saw an ad in period 2 ($(1 - s_1) * s_2$). See the graph below:

Figure 1.
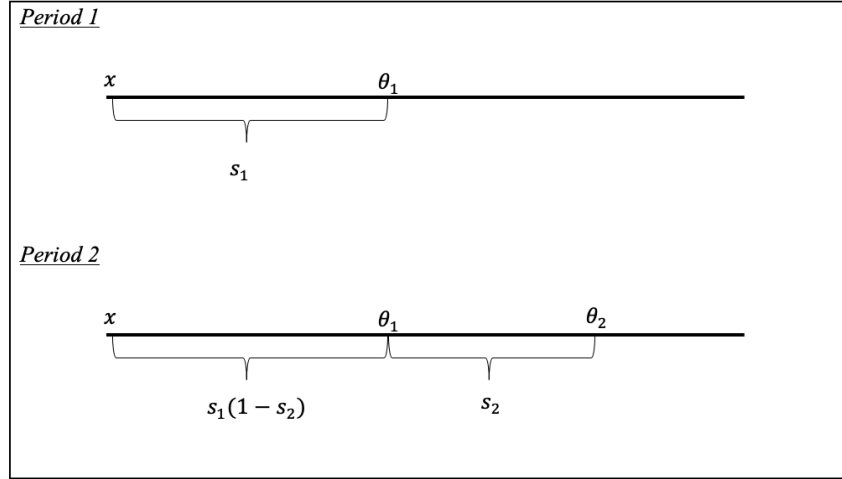
Having derived the indifferent consumers, it follows logically that the demands in period 1 and 2 equal to:

$$D_1(q_1, s_1) = s_1 * \theta_1 \tag{5}$$

$$D_2(s_2, q_2) = \{ \begin{matrix} s_1(1-s_2)*\theta_1+s_2*\theta_2 & if\ q_1<q_2 \\ s_2(1-s_1)*\theta_2+s_1*\theta_1 & if\ q_1>q_2 \end{matrix} \tag{6}$$

For the number of advertisements and the quality of them, the monopolist incurs a linear advertising cost:

$$C_i(s_i, q_i) = cs_i + dq_i \tag{7}$$

Furthermore, the marketing department is faced with a budget M_i that will be spent on the number of distributed ads and their quality per period. Note that because the marketing department aims to maximize sales, it will spend its entire budget, M_i, which results in $C_i(s_i, q_i) = M_i$ at the equilibrium. With this choosing $M \leq d$ ensures an interior solution. To introduce the budget into our model we by rewrite q_i in terms of M_i and substitute this formula into other relevant formulas that are to come:

$$C_i(s_i, q_i) = cs_i + dq_i = M_i \qquad \rightarrow \qquad q_i = \frac{M_i - c*s_i}{d} \tag{8a,b}$$

Considering the above mentioned, the sales function that the marketing department is aiming to maximize for the firm is as follows:

$$Z_i = p * D_i(q_i, s_i) \quad \text{s.t. } C_i(s_i, q_i) = M_i \tag{9a,b}$$

Z_i is the number of sales per period, p is the price of the product, and $D_i(q_i, s_i)$ represents the demand per both periods. The demand is an increasing function of quality of advertisement and share of people reached.

Based on the above, the sales functions for period 1, 2, and total sales become:

$$Z_1(s_1, q_1) = p\left[s_1 \frac{r + bq_1 - p}{\tau}\right] \qquad \rightarrow \qquad \begin{aligned} & Z_1(\boldsymbol{s_1}, M_1) \\ & = p\left[s_1 \frac{r + b\left(\frac{M_1 - cs_1}{d}\right) - p}{\tau}\right] \end{aligned} \qquad (10a,b)$$

$$Z_2(s_i, q_i) = p\left[s_1[1 - s_2] \right. \\ * \frac{r + bq_1 - p}{\tau} \\ \left. + s_2 \frac{r + bq_2 - p}{\tau}\right] \qquad \rightarrow \qquad \begin{aligned} & Z_2(s_i, M_i) \\ & = p\left[s_1[1 - s_2]\frac{r + b\left(\frac{M_1 - cs_1}{d}\right) - p}{\tau} \right. \\ & \left. + s_2 \frac{r + b\left(\frac{M_2 - cs_2}{d}\right) - p}{\tau}\right] \end{aligned} \qquad (11a,b)$$

$$TotSales^*(s_i^*, q_i^*) = Z_1 + \delta Z_2 \qquad (12)$$

The δ is the discount rate we assume to be equal to 1.

Furthermore, logically, our final profits are defined as follows:

$$\pi^* = TotSales^*(s_i^*, q_i^*) - C^*(s_i^*, q_i^*) \qquad (13)$$

Whereby $C^*(s_i^*, q_i^*) = cs_1^* + dq_1^* + cs_2^* + dq_2^*$).

9.2.2. Blueprint Calculations

In order to arrive to the equilibrium values of our model, we proceed according to the backward induction method. By taking the first-order conditions with respect to s_2 of the sales in period

2, setting it equal to zero, and solving it, we obtain the optimal quality number of ads $s_2^*(s_1)$ in

period 2.

$$\frac{\partial Z_2}{\partial s_2} = 0 \qquad \rightarrow \qquad \frac{p\left(d\ (p-r)(-1+s_1)+b\left(M_2-M_1s_1+cs_1^2-2cs_2\right)\right)}{dt} = 0 \qquad (14a,b)$$

Solving for $s_2(s_1)$ we get:

$$s_2(s_1) = \frac{d\ (p-r)(-1+s_1)+b\left(M_2+s_1(-M_1+c\ s_1)\right)}{2\ b\ c} \qquad (15)$$

At this stage we can insert the numerical values of our baseline such as: $r = 4, p = 3, \tau = 3, b = 2, c = 1, d = 1, \delta = 1, M_i = 1$

$$s_2(s_1) = \frac{-3\ s1+2s1^2+3}{2} \qquad (16)$$

Substitute $s_2(s_1)$ in the total sales equation $TotSales(s_1, s_2)$, in order to have it all in terms of

s_1:

$$s_2(s_1) = \frac{-3\ s1+2s1^2+3}{2} \qquad \rightarrow \qquad TotSales(s_1, s_2) = p\left[s_1\frac{r+b\frac{M_1-cs_1}{d}-p}{\tau}\right] + p(s_1(1-s_2) *$$

$$\frac{r+b\frac{M_1-cs_1}{d}-p}{t} + s_2 * \frac{r+b\frac{M_2-cs_2}{d}-p}{t}) \qquad (17a,b)$$

$$\rightarrow \qquad TotSales\left(s_1, Z_2\ (s_1)\right) = 3\left(s_1 * \frac{4+2*\left(\frac{1-1*s_1}{1}\right)-3}{3}\right) + 1 * \left((3-2\ s1)s1\right)$$

$$= 6\ s1 - 4\ s1^2 \qquad (18)$$

Now we differentiate the total sales equation with respect to s_1 and set it equal to 0:

$$\frac{\partial TotSales}{\partial s_1} = 0 \qquad \rightarrow \qquad \frac{\partial TotSales}{\partial s_1}6 - 8\ s_1 = 0 \qquad (19a,b)$$

Solving for s_1, we get the optimal value:

$$s_1^* = \frac{3}{4} \qquad (20)$$

As we have obtained the optimal value for s_1, we can substitute $\boldsymbol{s_1^*}$ and the rest of the numerical values into the relevant equations and solve for the other optimal values as shown in the table below:

$q_1\left(s_1^* = \dfrac{3}{4}\right) = \dfrac{M_1 - c * s_1}{d} = \dfrac{1 - 1 * \left(\frac{3}{4}\right)}{1}$	$\rightarrow \quad \boldsymbol{q_1^*} = \dfrac{1}{4}$	(21)
$D_1\left(s_1^* = \dfrac{3}{4}\right) = s_1 * \dfrac{r + b\dfrac{M_1 - cs_1}{d} - p}{t}$ $= \left(\dfrac{3}{4}\right) * \dfrac{4 + 2 * \left(\dfrac{1 - 1 * \left(\frac{3}{4}\right)}{1}\right) - 3}{3}$	$\rightarrow \quad \boldsymbol{D_1^*} = \dfrac{3}{8} = 0.375$	(22)
$Z_1\left(s_1^* = \dfrac{3}{4}\right) = p * D_1^*(s_1^*) = 3 * \left(D_1^* = \dfrac{3}{8}\right)$	$\rightarrow \quad \boldsymbol{Z_1^*} = \dfrac{9}{8} = 1.125$	(23)
$s_2^*\left(s_1^* = \dfrac{3}{4}\right) = \dfrac{-3\,s1 + 2s1^2 + 3}{2}$ $= \dfrac{-3 * \left(\dfrac{3}{4}\right) + 2 * \left(\dfrac{3}{4}\right)^\wedge 2 + 3}{2}$	$\rightarrow \quad \boldsymbol{s_2^*} = \dfrac{15}{16} = 0.9375$	(24)
$q_2^*\left(s_2^* = \dfrac{15}{16}\right) = \dfrac{M_2 - c\,s_2^*}{d} = \dfrac{1 - 1 * \left(\frac{15}{16}\right)}{1}$	$\rightarrow \quad \boldsymbol{q_2^*} = \dfrac{1}{16} = 0.0625$	(25)
$D_2\left(s_1^* = \dfrac{3}{4}; s_2^* = \dfrac{15}{16}; q_1^* = \dfrac{1}{4}; q_2^* = \dfrac{1}{16}\right)$ $= s_1^*[1 - s_2^*]\dfrac{r + bq_1^* - p}{\tau}$ $+ s_2^*\dfrac{r + bq_2^* - p}{\tau} = s_1^* - \dfrac{2\,s_1^{*2}}{3}$ $= \dfrac{3}{4} - \dfrac{2 * \dfrac{3^2}{4}}{3}$	$\rightarrow \quad \boldsymbol{D_2^*} = \dfrac{3}{8} = 0.375$	(26)
$Z_2^*\left(s_1^* = \dfrac{3}{4}\right) = p * D_2^*(s_1^*, s_2^*) = 3 * \dfrac{3}{8}$	$\rightarrow \quad \boldsymbol{Z_2^*} = \dfrac{9}{8} = 1.125$	(27)
$TotSales^* = Z_1^* + \delta Z_2^* = \dfrac{9}{8} + \dfrac{9}{8}$	$\rightarrow \quad \boldsymbol{TotSales^*} = \dfrac{9}{4} = 2.25$	(28)

$$C^* \left(s_1^* = \frac{3}{4}; s_2^* = \frac{15}{16}; q_1^* = \frac{1}{4}; q_2^* = \frac{1}{16} \right) \qquad \rightarrow \quad C^* = 2 \tag{29}$$

$$= cs_1^* + dq_1^* + cs_2^* + dq_2^*) = \frac{3}{4} +$$

$$\frac{1}{4} + \frac{15}{16} + \frac{1}{16}$$

$$\pi^* = TotSales^* - C^* = \frac{9}{4} - 2 \qquad \rightarrow \quad \boldsymbol{\pi^* = \frac{1}{4}} \tag{30}$$

In case the optimum value for s_1 is higher than 1, we would need to introduce a corner solution, which means that we would need to set s_1^* equal to 1 and substitute this new optimal value into all the relevant formulas above as we had done before for the "normal" baseline extension. In case we have multiple solutions for s_1^*, we choose the value that yields the highest profits and check whether a corner solution is required or not. Furthermore, we are cautions with calculation whereby $q_1 > q_2$, since in this case we need to adjust the demand formula for period 2 a bit.

9.3.   Table 3. Proportions Table

Saturation					Baseline				
$M_i = 3$	s_1	1	q_1	2	$M_i = 3$	s_1	1	q_1	2
	s_2	1	q_2	5		s_2	1	q_2	5
$M_i = 0.5$	s_1	1	q_1	-1/3	$M_i = 0.5$	s_1	1/2	q_1	0
	s_2	1	q_2	1/15		s_2	3	q_2	1
$M_1 = 2$	s_1	1	q_1	1	$M_1 = 2$	s_1	1	q_1	1
	s_2	0	q_2	1		s_2	0	q_2	1
$M_2 = 2$	s_1	1	q_1	0	$M_2 = 2$	s_1	3	q_1	1
	s_2	1	q_2	1		s_2	1	q_2	1
$r = 5$	s_1	1	q_1	0	$r = 5$	s_1	1	q_1	0
	s_2	1	q_2	1		s_2	1	q_2	1
$r = 3$	s_1	1	q_1	1					
	s_2	3	q_2	5					
$r = 1, p = 1.5$	s_1	1	q_1	3	$r = 1, p = 1.5$	s_1	1	q_1	5/3
	s_2	7	q_2	25		s_2	1	q_2	89/39
	s_1	1	q_1	3					

$r = 3.5, p = 4$	s_2	7	q_2	25					
$r = 4, p = 4.5$	s_1	1	q_1	3	$r = 4, p = 4.5$	s_1	1	q_1	5/3
	s_2	7	q_2	25		s_2	1	q_2	89/39
					$r = 6.5, p = 7$	s_1	1	q_1	5/3
						s_2	1	q_2	80/39
$D = 2$	s_1	1	q_1	0	$D = 2$	s_1	1	q_1	0
	s_2	1	q_2	1/2		s_2	1	q_2	1/2
$B = 2$	s_1	3	q_1	1					
	s_2	15	q_2	1					