How does a firm's advertising expenditure depend on the inherent asymmetry in product quality?

Hao Ling[1*], Aibo Fang[2]

Abstract

The paper mainly wants to explore and explain the proportion of money and time spent by the two companies in the oligopoly on marketing, promoting their products, and advertising. To make one side benefit and worsen the other side. This work hopes to use formulas and calculations to deduce how much a company will spend on publicity and advertising to maximize its interests in oligopolistic competition.

Keywords: Oligopoly, Maximize benefit, Advertising expenditure.

1. Introduction

In a duopolistic competition, two firms compete for market dominance and full market power, and each firm wants to determine its optimal advertising budget becomes (Wang & Wu, 2001). Meeting this optimal for each firm is a critical decision for each firm to maximize its market share. This research study explores one game-theoretic strategies model that firms can efficiently use to allocate their advertising budgets and gain market dominance. By analyzing the interactions between a couple of duopolistic competition market firms and the impact and outcome of advertising expenditure on multiple factors, this research aims to provide valuable and progressive work in the complex dynamics of duopolistic competition [1]. Businesses frequently fight for market power and share in today's fiercely competitive business environment, especially in duopolistic marketplaces where only two large competitors hold most of the market share. Advertising significantly affects the firm's growth and changes consumer behavior and market outcomes. To achieve a competitive edge and increase their market share, two businesses in a duopolistic market strategically use advertising in this research study. That leads to the aim of this research. The research explores how two firms in a duopolistic market can strategically use advertising to gain a competitive advantage and maximize their market share. By analyzing game-theoretic models and real-world case studies, the paper aims to offer valuable insights into effective advertising strategies for achieving market leadership in such competitive environments. This research paper will contribute to the existing understanding of advertising and competition economics through theoretical analysis. This study's findings can potentially inform business leaders, marketing practitioners, and policymakers on the importance of adopting carefully devised advertising strategies in a duopolistic market setting. Overall, we conclude that the relationship between advertisement spending and market share in a duopolistic market can be modeled using a model derived from a game theory perspective. This results in advertising expenditures that greatly depend on each firm's natural advantage and advertising cost.

2. Literature review

2.1 A duopolistic model of dynamic competitive advertising

This literature review offers at least two threads from which theory and insights might be woven. These are research on the differential game model of competitive advertising decisions for non-durable products done by Qinan Wang. Zhang Wu, Qinan Wang, and Zhang Wu studies about modeling alternatives to the Lanchester model for the study of dynamic competitive advertising decisions, Jiao Lu's research on Study of Informative Advertising Competition Model in Duopolistic Market with Relative Profit Object. For each, this chapter reviews only the most relevant studies to understand what each thread can contribute to analyzing the phenomenon. What game-theoretic strategies can firms adopt to determine their advertising budgets while maximizing market share in a duopolistic market? [1]

2.2 Informative Advertising Competition Model in Duopolistic Market with Relative Profit Object

The review has shown that each stream of research is related to the topic addressed here, but the streams do not address the phenomenon as this research intended. The application of this study is limited, as relative profit does not always correlate with a company's market share, which is an objective explored in the paper. However, the research can be useful to draw parallels, and even though

profit is not directly correlated with market power, it can be used to develop the relationship between advertising spending and its effect on consumers. Consumer choice affects market power and is, therefore, crucial to the theory behind the model. Our model aims to bridge the gap between the advertising impact on relative profit and the impact on market share [2].

2.3 Application of game theory for duopoly market analysis

This paper explored different ways to model a duopolistic market using game theory, which is useful as game theory lies at the core of the model. While specific types of outlooks on game theory in a duopoly, such as Cournot, Stackelberg, and Bertrand's models, haven't been used, the foundation behind them - the "Prisoner's Dilemma" was used to model the behavior of two firms using advertising to gain a comparative advantage in a duopolistic market. This allowed us to use the assumption that both companies are already in a duopolistic state, not just started up, meaning they would have had a steady profit before advertising expenditure changes. This is significant since if advertising spending is achieved through the reallocation of resources from other parts of the company's spending, the market share could be impacted by other factors, such as the quality of the product, appeal to investors, and other spillover effects [3].

2.4 Formal Models of Domestic Politics

This book explored diverse methods to model the impact of domestic policies on elections, finance, and political climate. The book used the following classes of models to explore the applications of game theory in political economics: electoral competition under certainty and uncertainty, special interest politics, veto players, delegation, coalitions, political agency, nondemocracy, and regime change. While they may not have been all useful to the model, electoral competition under certainty is useful, as clear parallels can be drawn between lobbying for a political outcome and spending on advertising to influence consumers. Throughout the model development, the electoral competition has been adapted to align with the duopolistic scenario in a market where market share is closely tied to advertising. This has allowed us to identify and contextualize two main explanatory variables in the model: the relative cost of raising advertising expenditures and the natural advantage of an individual firm.

3. Methodology

In a duopolistic market, two firms compete for market dominance, and advertising plays a crucial role in shaping their market share. Firms must strategically determine their advertising budgets to maximize their market share while considering their rival's responses to gain a competitive edge. This section composes a study that will compare two companies' advertising strategies, aiming to discover an optimal value of advertising expenditure, given that there are inherent asymmetries in the quality of the products [4]. Firstly, we consider the market only with companies A and B and note their advertising expenditures with Ea and Eb. Let π be the percentage of market share each company holds, where $\pi \in (0, 1)$, and $\pi(EA, EB)$ be the percentage of market share company A holds given advertising expenditures EA and EB; the percentage market share company B holds is therefore $1 - \pi (EA, EB)$. In this model, we assume the percentage of market share gained strictly increases with its advertising expenditure [3].

α is the natural advantage company A has over company B and $\alpha \in (0, 1)$; hence, if EA = EB = 0, company A will own α percent of the market share, hence $\pi(EA, EB) = \alpha$. When EA = EB, company A wins α percent market share, and company B wins $1 - \alpha$ percent of the market share. Assuming EA + EB > 0, and assuming π weakly increases as EA increases, π decreases as EB decreases. However, if the percentage of market share held is defined with that model, both companies would simply increase advertising expenditure to infinity. Hence, a refinement has to be made. In this case, we only consider advertising expenditure for cash flowing out, not considering production costs, e.g., wages, raw materials, capital, etc. Companies i = A, B, choose expenditure Ei ≥ 0, and the cost of advertising is denoted as λEi, where $\lambda > 0$. The best response from company A is when company B chooses some EB > 0, company A solves.

There is a best response for each company. This shows that E*B and E*A could be found if market share distribution and the marginal cost of advertising are known for each company where λA and λB are the corresponding costs. However, because λA and λB are two separate variables now, profit also becomes a function, and the assumption of having a steady profit stream would not hold up. The new equilibrium position is achieved where the marginal benefit of advertising = marginal cost. Those cannot be found, as they depend on each firm's derivative of the profit formulas, which would require a lot more information to find. However, the model could be contextualized to fit a specific market situation, where it might be possible to find the equilibrium.

4. Discussion

After concluding that the only factors affecting the equilibrium advertising expenditure are their natural advantage α and the value for λ, which is the relative cost of raising advertising expenditures, the equilibrium

advertising expenditure is the highest when both companies have equal natural advantage, which is when α is equal to 1/2. When one company has a much higher or lower natural advantage than the other, when α is close to 1 or 0, respectively, both companies will spend less on advertising than when they have a similar natural advantage(α is close to 1/2). This can be seen in the model by looking at how the equilibrium advertising expenditure changes with different values of α and λ.

If contextualized, it may be possible to find an equilibrium for varying relative advertising costs if the cost of advertising is also modeled. To model the cost of advertising, we would require a profit function for both firms, as the assumption of a fixed profit stream would not hold up with variable advertising costs since expenditures would need to be varied as well. A profit function could be modeled, which could be further manipulated to find marginal costs and benefits. However, that is only possible with further contextualisation, and it may be impossible to model it otherwise.

During the development of the model, due to complex environments of duopolistic competition in the real world, the model had to be simplified to include two main explanatory variables. Our assessment indicates that the resulting model is an acceptable way to approximate the outcomes in a duopolistic market. However, a regression analysis may be required to determine the fit of the model and ensure the homogeneity of the variables. As in many cases in the real world, in one market, there may be more variables than in another; hence, some explanatory variables may not be included in the model. Despite that, this could be deemed as an advantage of the model since it provides high adaptability, as the model is unspecified, meaning that the error term and coefficients could be adapted and regressed to suit a specific scenario, which would broaden its application beyond just advertising spending and market share. For example, it could also be useful as an extension to one of the references - Jiao Lu's paper, where it could be used to express the total share of profit within a market. This could lead to further analysis of market conditions in a duopoly, exploring the magnitudes of the changes in variables such as advertising spending or other factors influencing the dependent variable [2].

5. Conclusion

This research has made it easier to understand the important influence of inherent product asymmetry on firm advertising expenditure. Through an analysis of the methodology of duopolistic competition, it becomes evident that the advertisement spending and the total benefit of the two firms stay at an equilibrium when advertising expenditure for both companies is identical. The findings of this paper highlight products with inherent asymmetry, where there are substantial differences in features, performance, or attributes between competing options. All of these trigger a change in a company's natural advantage, which, according to our model, changes the advertising expenditure. Another factor influencing advertising spending is the relative cost of advertising, which would determine how likely a company is to keep raising advertising expenditures for every additional 'unit' of advertising. Lastly, we refined the model by looking at an edge case where the relative cost of advertising is a separate variable for both companies, which allowed us to model the best response for each company in that situation. However, there is room for refinement of the model by adding more variables, such as the inception date of a company and its past growth, to expand the application of the models to companies that may not have an established profit stream. Autoregressive integrated moving average (ARIMA) models can be used to model such unstable revenue streams. Integrating a form of a moving average correction to estimate a company's future profits would allow the model to estimate future advertising spending capacity to determine the maximum expenditure on advertising without harming other areas of a firm's operation. This would model the rational behavior of any firm in a duopoly market willing to spend some of its revenue on advertising.

Additionally, the factor of consumer confidence and consumer preference in the duopoly markets may need special attention. Despite appearing to be a reasonable inclusion in the model, they are both influenced by the advertising expenditure. While not directly correlated in the real world, in most cases, greater expenditure results in more productive or more voluminous advertising, which influences consumer behavior, including consumer confidence and trends.

References

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