Advertising Strategy in Oligopoly Market Competition Using Game Theory Approach

Muhammad Abdul Hafizh[1,*], Erwin Widodo[2]
[1,2] Department of Industrial and Systems Engineering, Faculty of Industrial Technology and Systems Engineering, Institut Teknologi Sepuluh Nopember

Email: [1,*]m.abdulhafizh05@gmail.com

DOI: https://doi.org/10.31284/j.jtm.2026.v7i1.7252
Received January 30th 2025; Received in revised August 29th 2025; Accepted September 8th 2025; Available online January 10th 2026

Abstract

In an oligopolistic market characterized by homogeneous products, competition among producers generates intense rivalry. This study seeks to analyze the competitive dynamics within the Indonesian mosquito coil market, which has exhibited signs of declining market share for dominant brands such as BYG, due to shifts in consumer preferences and competitor strategies. These developments highlight the need for an in-depth examination of market competition. To secure market dominance, producers adopt various strategies to boost product sales, with advertising serving as the primary tactic. Such strategies are intended to enhance market awareness of their offerings. The objective of this study is to analyze the competitive behavior of producers in an oligopolistic market. The research employs a game theory model to examine competitive strategies among firms in the oligopoly, with a particular focus on advertising as a strategic variable. The decision-making scheme is based on the Stackelberg model, in which the leader determines the initial strategy, subsequently followed by the followers. The findings indicate that larger firms possess greater resilience in maintaining their market share compared to smaller firms. Predatory advertising strategies are found to be effective for firms with substantial market shares in sustaining their dominance. Conversely, for firms with smaller market shares, adopting cooperative advertising strategies is recommended to enhance product image without incurring the risks associated with excessive advertising expenditures.

Keywords: *Oligopoly, competition, advertising, game, stackelberg*

1. Introduction

An oligopoly market can be defined as a scenario where a small group of large firms simultaneously gain control over a significant market share with a good understanding of the effect of the nature of the correlation between firms on profits and market share [1]. Some economists think that oligopoly markets are closer to competition, as there are few players or producers in them, while others equate them with monopolies [2]. Whereas price competition in this market should only be superficially apparent, it does not exist in reality [3]. The competition of several producers producing almost identical products in the market is something that is often found in several primary or secondary products. This triggers the occurrence of quite attractive market dynamics in each producer so that each industry player is required to be able to face the exposure of competition to survive in the market [4].

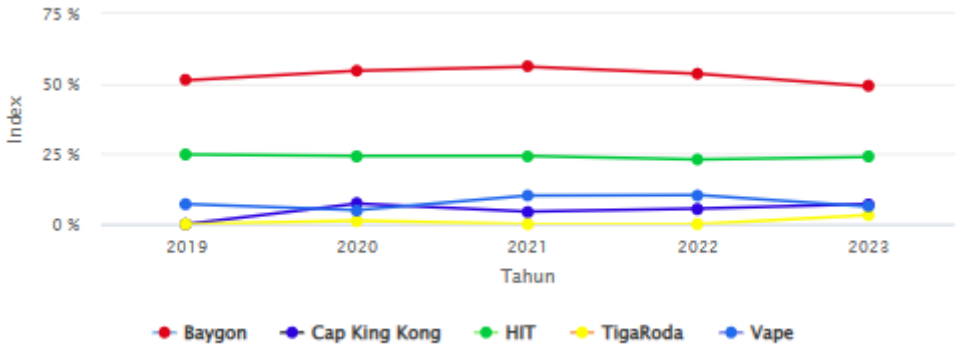


Figure 1. Top brand mosquito coils in Indonesia
Source: Top Brand Award

The present study uncovers a phenomenon that has emerged within the Indonesian mosquito coil industry market. Numerous manufacturers within this sector engage in a competitive dynamic, striving to surpass one another. This competitive landscape is evident in the results of the Top Brand Award survey, as depicted in Figure 1. The data reveals a decline in the performance of one particular mosquito coil product, accompanied by an increase in the performance of other products. This phenomenon is further exacerbated by a concurrent decline in demand, thereby creating a direct proportional relationship between product performance and demand.

Consequently, the company is concerned about the consequences of a decrease in market demand, as it could result in a shift in market share toward competitors, potentially leading to an increase in the percentage of brand performance among other products. If this problem persists, Continued disregard of this issue will inevitably imperil the company's viability. Consequently, the company must formulate an effective strategy to contend with the oligopoly market dynamics. In the context of the mosquito coil industry, it has been observed that manufacturers tend to offer products at similar prices, leading them to refrain from price competition. Instead, they focus on other factors to enhance profitability and expand their market share.

Therefore, it is worthwhile to examine the phenomena occurring in the oligopoly market competition dynamics of the mosquito coil industry. Previous studies have sought to propose solutions to oligopoly market competition. An analysis of competition in manufacturing within an oligopoly market must be conducted using game theory [5]. This theoretical framework is instrumental in predicting the outcomes of interactions among firms, given the direct or indirect influence of one firm's actions on other firms [6]. Furthermore, game theory is employed to ascertain the estimation strategy that companies and competitors must implement to prevail in the market [7] . In the context of competition among market entities, advertising emerges as a pivotal strategy [8] . It has been explained that the purpose of advertising is to counteract any potential bias among consumers, thereby ensuring a more equitable distribution of consumer preferences across both products [9].

Advertising serves the crucial function of mitigating consumer bias, thereby facilitating a more equitable distribution of consumer preferences across diverse products. In the context of homogeneous product competition, advertising emerges as a pivotal strategy employed by companies to promote their products or services. Advertising is used as a means of combating consumer bias, thereby ensuring a more equitable distribution of consumer preferences across the two products in question [10]. In the context of homogeneous product competition, advertising emerges as a pivotal strategy employed by companies to examine the behavior of two companies, where the efficacy of advertising in influencing demand becomes a critical factor [11]. Besides that, the study's findings reveal that an effective advertising strategy is influenced not only by market competition but also by the intensity of business reputations' impact on market competition [12]. The study's objective is to analyze the competition in an oligopoly market structure by considering advertising as a strategy for increasing profits and market advantage.

This article discusses the urgency and phenomena occurring in oligopolistic markets, which are elaborated in the introduction. The research methodology was carried out through several

systematic stages, beginning with the identification and description of the problem related to the decline in market share within the oligopolistic structure of the homogeneous product industry, specifically the mosquito coil sector. This was followed by the collection of secondary data on prices, quantities, and market shares of three major companies (AA, BB, and CC). Subsequently, strategic interaction modeling was conducted using a game theory approach, particularly through the Stackelberg framework (to account for asymmetric conditions). Each combination of advertising strategies was simulated to identify the equilibrium points among players. In the results and discussion section, the analysis focuses on the dynamics of advertising strategies employed and the interpretation of findings, with the aim of drawing conclusions regarding the most effective competitive strategies for sustaining or capturing market share.

2. Method

In this study, the context under examination involves three mosquito coil industries that produce homogeneous products, operating under the assumption that they share a standard cost function and that each company's utility is distinct. Additionally, each company formulates its advertising strategy autonomously, without awareness of the strategic decisions made by its competitors. It is crucial to note that the presence of multiple firms implies that, from the perspective of a single firm, there is no possibility to alter the market price of a good without prior consideration. The decision variable in this competition is the firm's profit, and the parameters and variables employed in this research model include.

Table 1. Model parameters and variables

Parameters and variabels	Definition
β_i	Coefficient of the effect of firm price
γ_i	Coefficient of the effect of firm cross-price
a_i	The firm's maximum price constant
c	Unit variable cost of the company
p_i	The price of the company's products
ρ	Interaction factors of advertising action
φ	Advertising effectiveness
q_i	Quantity of products produced by the company
A_i	Advertising expenditures made by the company
ηA_i	Advertising elasticity
η_i	Price elasticity of demand
π_i	Profits of the company
i, j	Company (player), i =j=1,2,3; i ≠ j

The objective of this study is to examine the dynamics of competition within an oligopoly market, with a particular focus on the Indonesian mosquito coil industry. It is hypothesized that the market under study is comprised of three major producers, each with distinct company sizes, namely AA, BB, and CC. These producers operate within a mature market characterized by the tendency of companies to exhibit slow growth. In the context of competition, one of the strategies employed by companies is the implementation of advertising efforts, with the objective of maintaining or even increasing their market share.

Given that each company seeks to maximize profit, the following equation can be used to analyze the situation.

$$\Pi_i = p_i q_i - c_i - A_i, \qquad i = 1,2,3 \tag{1}$$

In the initial phase, the advertising strategy employed in oligopoly competition is modeled after the approach outlined by [13]; this model elucidates the interplay of competition within a

duopoly, with advertising conceptualized as a corporate strategy. The equation quantifying the amount of advertising expenditure by the company can be expressed as follows.

$$A_i = R_i \frac{\eta A_i}{\eta_i} \tag{2}$$

In this model, R_i denotes the revenue obtained from the price x quantity produced by company *i*. Furthermore, under the assumption that advertising is capable of shifting the demand function outward, as referenced in [13],[10], it can be written as follows

$$\Delta a_i = \varphi_i A_i + \rho_{ij} \varphi_j A_j, \qquad i = j = 1,2,3;\ i \neq j \tag{3}$$

Given Δa_i s a change from the maximum market price to the form of advertising; A_i is a representation of advertising costs incurred by the company *I, i* = 1, 2, and 3. This equation describes the price changes caused by the interaction between advertising strategies carried out by each company.

Each company has an advertising option indicated through ρ, which is an interaction factor. When the value is set to 0 (zero), the advertisement is considered generic, lacking any impact on other companies. Conversely, a positive value of (1) indicates a cooperative advertisement, where competitors receive equivalent benefits to those obtained by the advertiser. Finally, a negative value of (-1) signifies a predatory ad designed to exploit competitors' market share.

In the second stage, the changes in demand sold will be revealed based on each company's advertising efforts. In this study, the model developed by [14] is adopted, wherein each company sets its advertising expenditure or cost with the objective of increasing market share. Assuming that the company is in a mature market condition, the following equation can be used to calculate each change in sales based on the Lancaster model.

$$q_i \mid q(t) = -\varphi_j \sqrt{A_j(t)}\, q_i + \varphi_i \sqrt{A_i(t)} q_j, \quad i, j = 1,2;\ i \neq j \tag{4}$$

Where $q(t)$ denotes the aggregate quantity in the market, which is derived as the sum of $q_i + q_j = q(t)$, where *i* and *j* are companies in the market, while ρ is the effectiveness of advertising and m is the amount of advertising spent by the company. In this case, the equation is used to determine the respective quantities that will change due to advertising efforts made by each company interacting with its competitors.

The objective of this study is to analyze the manner in which advertising efforts function as a competitive strategy employed by companies in the oligopoly market. In this case, the experiment utilizes a numerical simulation to illustrate the interaction of advertising strategies in each company. In the following stage of the research, numerical simulation is employed to calculate the profit of each company in its competition in the oligopoly market with advertising efforts made. The result of the simulation is the profit value that will be input to the payoff matrix in game theory, where it will be processed to find the equilibrium point based on the combination of strategies owned by each company (player). The flow of data processing and analysis can be shown in Figure 2 below.

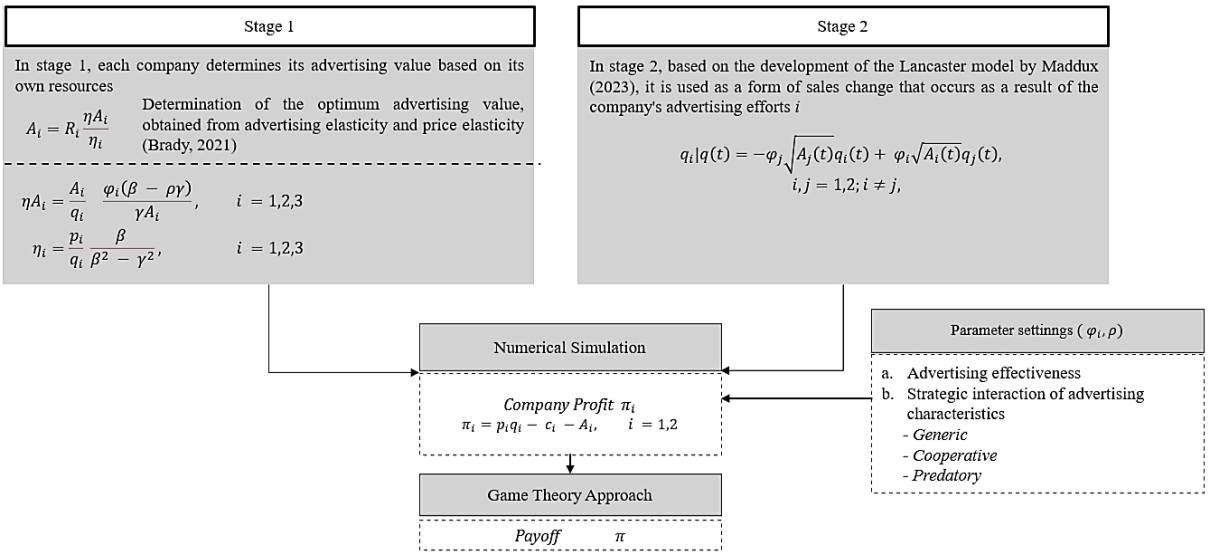
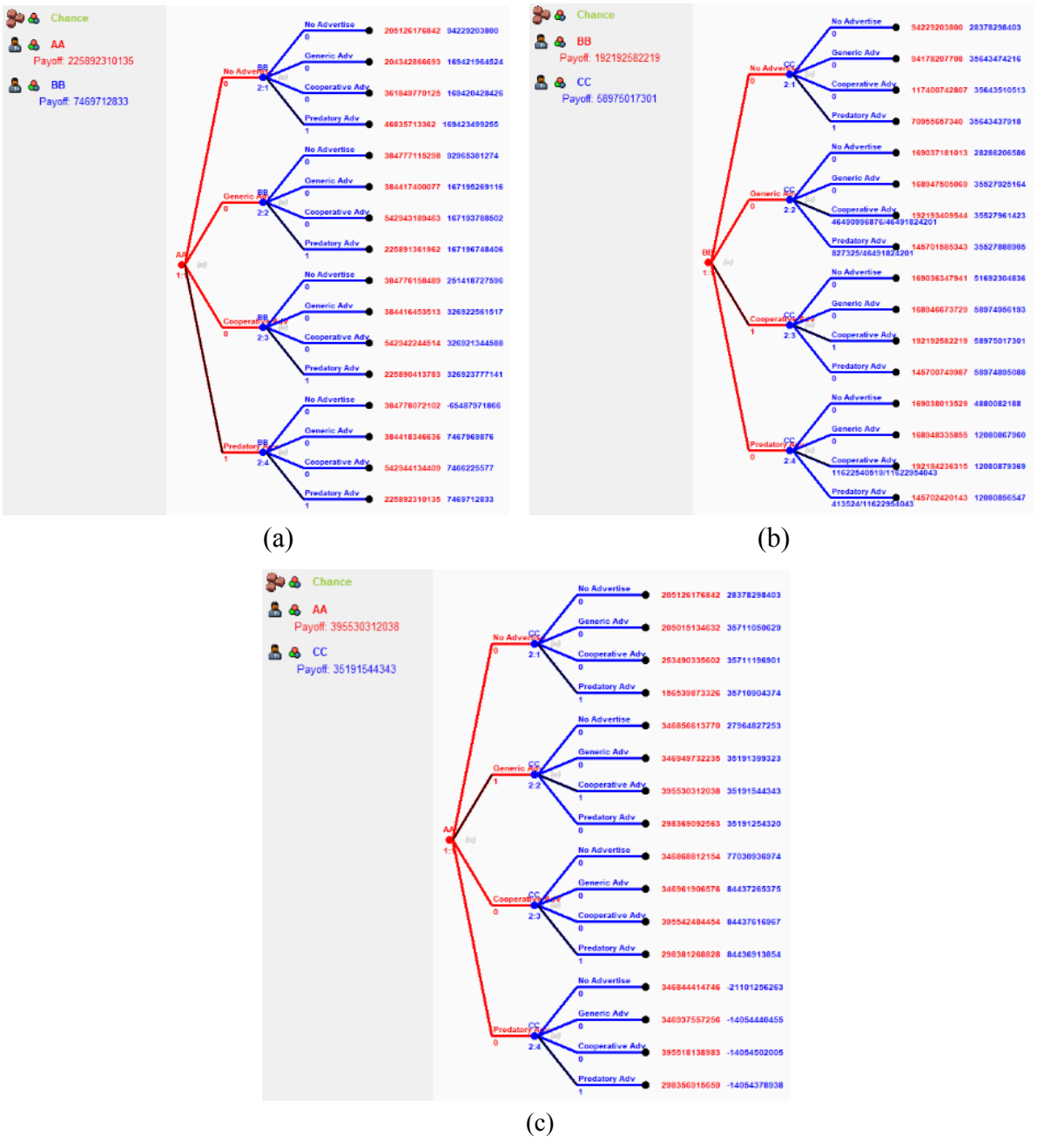


Figure 2. The flow of data processing and game stages

In addition, the game theory approach is expected to provide an overview of competition in the oligopoly market. Each player has its strategy to deal with competition or actions taken by its competitors that seek to increase their profits [15] . It is known that the characteristics of each company are different in terms of market size and other resources. This positions the company with a dominating market position to be the leader and the smaller company to be the follower. Thus, the decision-making scheme will be in accordance with the Stackelberg game; the leader will determine its strategy first, and after that, the follower will provide the best response it has in accordance with the strategic decision taken by the leader. In addition, in this study, the game studied between companies is carried out partially between companies.

3. Results and Discussion

The analysis is conducted to determine the strategy equilibrium point among the players. It is based on the best strategy choice that each player has given the strategy choices of other players. At this stage, it is analyzed whether there is a stable strategy where no player wants to change his strategy unilaterally because the change does not improve the results obtained. The results of the analysis will be described more clearly below based on the game with the Stackelberg decision-making scheme. The game results include the following.



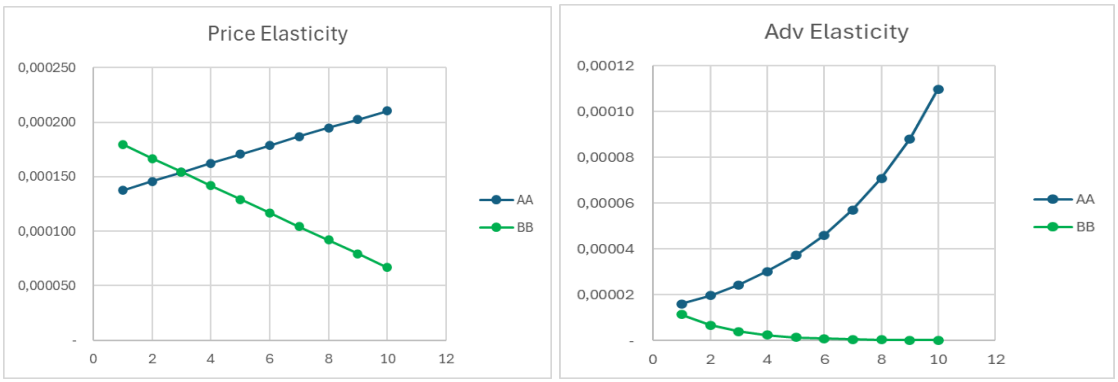
(a) (b)

(c)

Figure 3. Stackelberg game equilibrium (a) AA vs. BB, (b) BB vs. CC, (c) AA vs. CC

Based on Figure 3. above, it is known that the equilibrium point obtained in the game between AA and BB is when AA (leader) runs a predatory advertising strategy, and BB (follower) responds by carrying out a predatory advertising strategy as well. Thus, the profit value obtained by AA is IDR 225.975 billion, and for BB, it is IDR 7.469 billion. In the game between BB and CC, the advertising strategy carried out by BB (leader) is cooperative and is then responded to by CC (follower), which conducts cooperative advertising as well as its best response. Thus, the profit value obtained by BB is IDR 192.192 billion, and for CC, it is IDR 58.975 billion. Furthermore, in the game between AA and CC, AA (leader) runs a generic advertising strategy, and CC (follower) responds with a plan that is run to do cooperative advertising. Thus, the profit obtained for AA is IDR 395.530 billion, and CC is IDR 35.191 billion.

Furthermore, based on the equilibrium conditions in the game between companies, this study also seeks to analyze parameter changes caused by company competition.



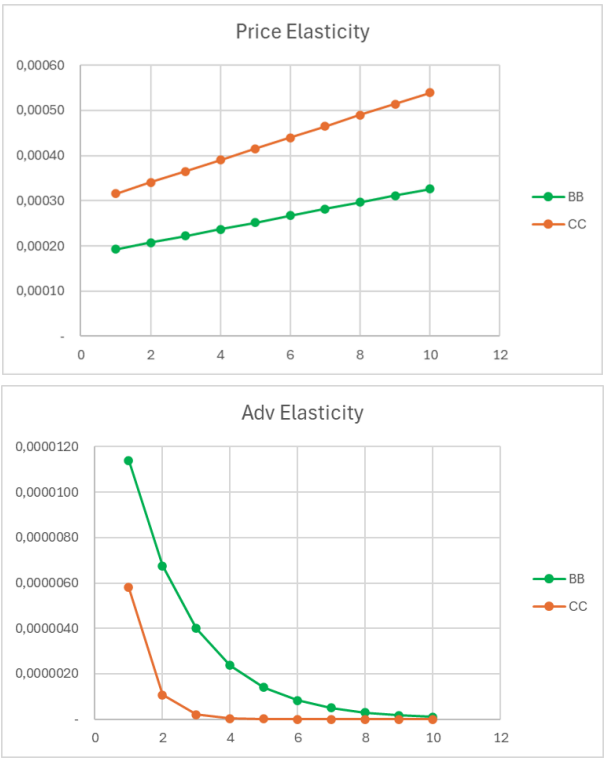
(a) (b)

Figure 4. (a) price elasticity AA vs. BB, (b) advertising elasticity AA vs. BB

In the AA and BB games, it is known through the price elasticity parameter that AA's predatory advertising strategy utilizes its reputation advantage and significant market share so that AA can attract more customers, including its competitors. This makes consumers less price-sensitive as they perceive AA products as the top choice in the market. Therefore, it increases the positive price elasticity of AA.

Through the advertising elasticity parameter, the elasticity of AA has increased while BB has decreased, which can be seen below. It is known in the figure above that the increase in AA's advertising elasticity is reflected in its strong brand reputation in attracting new consumers and strengthening customer loyalty. Meanwhile, the decrease in BB's advertising elasticity is due to its smaller market share, so there is a limit to how many new consumers can be reached through advertising. After a certain point, additional advertising no longer has a significant impact on sales. Thus, AA's position in the market is getting stronger, so any further investment in advertising continues to yield substantial results. In contrast, BB faces a smaller market and loses competitiveness, so its advertising is becoming less effective.

In addition, in the competition between BB and CC based on the equilibrium game, the tendency of the strategy chosen by BB (leader) is cooperative advertising followed by CC (follower), which also conducts cooperative advertising.



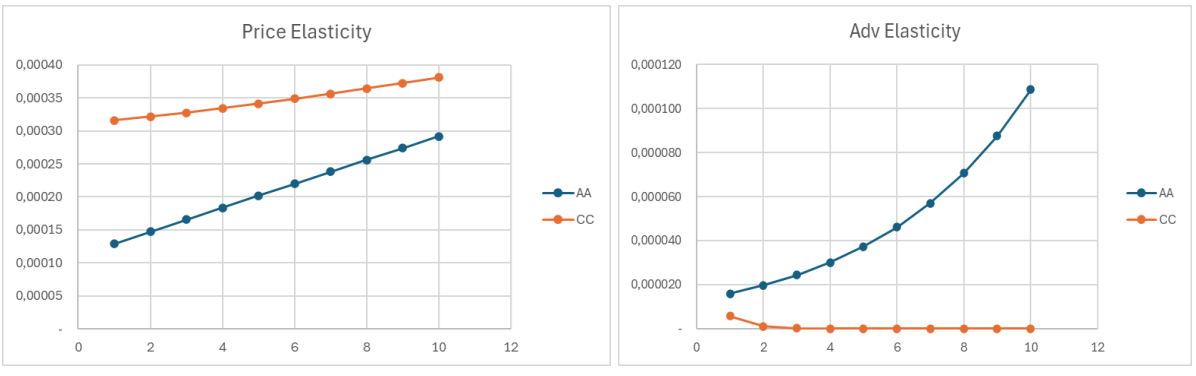
(a) (b)

Figure 5. (a) price elasticity BB vs. CC, (b) advertising elasticity BB vs. CC

It is known that BB's lower price elasticity indicates that consumers tend to be less sensitive to price changes due to the high perceived value of the brand. In addition, since BB already has a larger market, cooperative advertising efforts tend to have a more minor marginal effect in increasing price elasticity. In terms of competitive effects in each firm's cooperative advertising efforts, CC can ride on BB's reputation to increase its brand appeal.

The higher elasticity of advertising indicates that BB is more effective in utilizing the cooperative advertising strategy, especially at the beginning of the period. The gradual decline in elasticity indicates that additional advertising expenditures are less effective but still have a meaningful impact. In contrast, CC has a low and rapidly declining advertising elasticity, suggesting limitations in utilizing cooperative advertising. This is because CC has a smaller market reach and is less able to compete in attracting consumer attention from BB.

In the AA vs. CC game, AA's leader strategy is generic advertising. This advertising can have a more significant impact on demand, which is in line with its dominant position. CC focuses on a strategy that tries to form synergies within the market, so the direct effect of its advertising expenditure on demand is more limited. This can be seen in Figure 6 below.



(a) (b)

Figure 6. (a) price elasticity AA vs. CC, (b) advertising elasticity AA vs CC

AA's advertising strategy increases price elasticity linearly but to a lesser extent than CC's. This is because AA, as the leader, has higher market loyalty. AA consumers are more tolerant of price changes because the effect of generic advertising can create a strong brand impression. In contrast to CC, despite focusing on cooperative advertising strategies, CC still faces challenges that may be caused by its position as a follower and a more competitive target market. Cooperative advertising will create overall brand awareness.

In addition, through the advertising elasticity parameter, the elasticity of CC has decreased, and AA has increased. This is because AA has a larger market share and a strong reputation. Thus, AA's generic advertising efforts and CC's cooperative advertising further strengthen AA's competitiveness in the market and lead to a more significant increase in advertising sensitivity. The growth elasticity of CC's advertising is more sloping, indicating the limited impact of advertising on CC's growth. As CC may be more focused on cost efficiency rather than aggressively increasing demand through direct advertising, its advertising elasticity may be lower.

4. Conclusion

Based on the analysis and discussion, it can be concluded from the results of the research conducted that in the game in the asymmetric characteristics that occur partially in all players with the Stackelberg decision-making scheme, the competition between AA vs. BB is known that the strategy is in equilibrium when each company applies predatory advertising. While there is competition between BB and CC, the equilibrium strategy is when each company applies cooperative advertising. While there is competition between AA and CC, the equilibrium strategy occurs when AA applies generic advertising and responds to CC with cooperative advertising.

Large companies with a strong reputation as leaders have more flexibility in choosing strategies and can utilize predatory advertising strategies to increase market share and maintain dominance in the market. In contrast, small companies, as followers, tend to use cooperative advertising strategies. Cooperative advertising offers potential benefits for companies with a loyal customer base, but its effectiveness is highly dependent on the strength of the brand and consumer relationships. In addition, the choice of this strategy is entirely appropriate to minimize losses from aggressive competition with the leader.

References

[1] S. Norozpour and M. Safaei, “An overview on game theory and its application,” *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 993, no. 1, 2020.

[2] J. K. Galbraith, “Market Structure and Stabilization Policy,” *The Review of Economics and Statistics*, 124-133, 1957.

[3] B. Horita, “Building a Win-Win Strategy Using Game Theory in a Competitive Environment (Subject to Antitrust Restrictions),”. *Науковий Вісник*, vol. 60, 2022.

[4] Y. Lin, “Applications of Game Theory in Microeconomics. Journal of Education,” *Humanities and Social Sciences*, 2, 137-143, 2022.

[5] A. Alothman & A. Alqahtani, A., “Analyzing Competitive Firms In An Oligopoly Market Structure Using Game Theory,” *Industrial & Systems Engineering Conference* (*ISEC*)., pp. 1-5, 2020.

[6] O. Azar, “The Influence of Psychological Game Theory” *J. Econ. Behav. Organ*., vol. 20, no. 2, p. 234– 240, 2018.

[7] E. Widodo & Januardi, “Noncooperative Game Theory in Response Surface Methodology Decision of Pricing Strategy in Dual-Channel Supply Chain,” *Journal of Industrial and Production Engineering.*, vol. 38, no. 2, p. 89-97, 2021.

[8] H. A. Mahdiraji, A. Hatami-Marbini, N. M. Moazed, M. Ansari, & A. A. A. Kamardi,

"Differential Game Approach to Pricing and Advertising Decisions," *Operations Research Letters*, 49(5), 688-695, 2021.

[9] F. Bloch & D. Manceau, "Persuasive Advertising in Hotelling's Model of Product Differentiation," *International Journal of Industrial Organization*., vol. 17, no. 4, p. 557-574, 1999.

[10] M. Brady, "A Game-Theoretic Model of Strategic Interaction Using Advertising: Simulating the Evolution of the Cournot Nash Equilibrium under Different Competitive Scenarios," *Games*, vol. 12, no. 4, p. 85, 2021.

[11] R. Amir, D. Machowska, & M. Troege, "Advertising Patterns in a Dynamic Oligopolistic Growing Market with Decay," *Journal of Economic Dynamics and Control*, 131, 104229, 2021.

[12] M. Q. Collins & E. Galbraith, "A study on advertising strategy based on the impact of a business reputation on the market," *International Journal of Smart Business and Technology*., vol. 9, no. 2, p. 107-118, 2021.

[13] J. Friedman, "Oligopoly Theory," *Handbook of mathematical economics.*, vol. 2, p. 491-534, 1982.

[14] A. M. Maddux, N. Pagan, G. Belgioioso, & F. Dörfler, "Data-Driven Behaviour Estimation in Parametric Games, " *IFAC-PapersOnLine*, vol 56, no. 2, p. 9330-9335, 2023.

[15] J. Ma, N. Ning & T. Xu, "Analyzing The Chinese Telecommunication Industry Based on Oligopoly Game and Dynamic Evolution, " *International Journal of Bifurcation and Chaos,* 31(14), 2150238, 2021.

How to cite this article:
Hafizh M A, Widodo E. Advertising in Oligopoly Market Competition Using Game Theory Approach. *Jurnal Teknologi dan Manajemen.* 2026 January; 7(1): 26-35. DOI: 10.31284/j.jtm.2026.v7i1.7252