

BUDGET DISTRIBUTION FOR ONLINE ADVERTISEMENT ON DIFFERENT SOCIAL MEDIA PLATFORMS

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ABSTRACT

The importance of digital marketing is rising rapidly day by day in this competitive world. As most of the people are now shifting to digital world, consequently firms should strategise their expenditure in a way to attract maximum customers by advertising about their products online on different social media platforms like Facebook, Instagram etc known as Social Media Marketing. Different companies may have different end goals while advertising i.e. Brand Awareness, User Engagement & Lead Generation. This has been an area for research by many of the articles, blogs and websites but, still no scientific model has been designed to determine the budget allocation strategy. This research suggests a Game Theoretic Model for marketing managers for selecting the optimal strategy for distributing budget over different platforms. The model focuses on a duopoly market where two competing firms want to invest in the most efficient & effective way so as to maximize their overall revenue or influence on the market. An extensive form game has been developed to solve the game and Nash Equilibrium notion has been used to determine the best strategy by the firms. The results have been computed by using the designed model and other possible addons are introduced.

Keywords - Digital Marketing, Social Media Marketing, Extensive form game, Nash Equilibrium

1. INTRODUCTION

Digital marketing is a form of internet marketing that is used to create brand value and promote products/services of a firm. The end goal of advertising is to increase sales and revenue of the firm. Online advertisement is an effective way for a business to expand and flourish. Hence, the firm can strategically devise methods to engage the potential customers and turn them into a loyal ones.

Social Media Marketing starts with making people aware about the brand such that it leaves an impact on the mind of the masses. After reviewing the brand a few times, the consumer then visits the website of the marketer being interested in the product. This will lead to either buy some product or sign up for promotional or other events. Now is the time when the client turns into a potential customer.

Henceforth, the firm can strategically devise methods to engage the potential customers and turn it into a loyal one.

1.1 Background

In traditional marketing, billboards and flyers were used as modes of marketing, but it did not ensure the effectiveness of the method. A lot of money and time was spent on those platforms that did not bring in expected results. But social media marketing lets you segment your audience and invest in only those platforms that will bring in results targeting the right audience.

With the advent of social media and various ecommerce platforms, nearly 90% of the market and its audience has shifted online. And social media platforms are the perfect way to directly interact with the audience and understand their requirements. Different platforms have different kinds of people, therefore it is important to analyze your market & each platform that will maximize your profit if budget invested wisely.

1.2 Motivation

Over the years, very little research has been done that focuses on how budget should be distributed over platforms that would be client focused and platform oriented. Usually the marketing managers use the historical data of the company and compare it with that of the competitor to decide how to invest, but this process can be cumbersome and time consuming. In most cases, their years of experience or intuition plays a major role in deciding the same. But even after all these efforts they are uncertain of their success. There is no definite model that proposes a strategy which yields outcomes better than your competitors outcome. The work here intends to use the application of Game Theory and the model will support marketing managers to take a better decision of the investment.

2. PROBLEM STATEMENT

The main objective behind solving this problem is to propose a strategy that allocates each platform with the best distribution of the total budget that the company has assigned for the marketing campaign. In order to assist the

market managers in their decision making process, the main objectives of the research are as follows:

- (a) Create and develop a model by using the application of game theory to propose the best strategy to distribute budget over different platforms.
- (b) To propose the best strategy for distribution of total budget on several Social Media Platforms. We have considered Youtube, Facebook, Instagram & LinkedIn based on statistics shown in Table 1.
- (c) To estimate the new market influence by following the proposed strategy by the model.
- (d) To estimate the total revenue generated by the company by adhering to the strategy devised by the model.

Usually there are multiple advertisers in the market but for our model, we have taken only the duopoly market into consideration. The budget is distributed over four social media platforms: Youtube, Facebook, Instagram and LinkedIn. We have focussed on the B2C market type wherein the customer is the end user of the product. We have used the notion of Nash Equilibrium to determine the best strategy which will be discussed in later sections.

3. RELATED WORK

Social media marketing affects the brand value of a firm upto a great extent as it is a two way communication between the client and the business. It takes into consideration the various drivers that play a major role in the brand, value, customer and relationship equity. It focuses on how engagement with the customer can affect your firm. The more you are visible to you potential customers, the more you create awareness. It leaves an impact on your clients mind, which is an important factor which it comes to them buying products that are similar to your product. Brand awareness helps in resolving the misunderstandings about the brand and at the same time gives the clients a mode to interact with the company[1].

The Budget Allocation Problem with Multiple Advertisers analyzes the market of different advertisers and how the different users respond to their activities under various circumstances. It starts with its implementation for one advertiser and later extending it over multiple ones. The budget allocation problem is highly influenced by the bipartite model in which one set is the set of media channels & other set is the set of customers. Each edge connected indicates that each customer is influenced by some probability depending on the budget allocated on each media. The ultimate goal of the firm is to maximize the number of influenced customers with some budget

constraints posed on each media channel. Initially they independently propose their strategies that would yield them the best strategy irrespective of their competitor. Later, the game is extended over multiple players such that they choose a strategy that is best for all of them thus yielding them a pure strategy nash equilibrium[2].

The social media marketing has resulted in change in customer habits, as well as the strategies employed by the marketers. The game theory model “GameOn” focuses on different market segments based on the specific end goals of the user. The goal of the GameOn presents dissertation to assist the marketing managers while making decisions on digital marketing strategies, by analyzing the number of online leads they should have generated in a certain period of time to achieve their goal, in the most effective and efficient manner such that the profits are maximised. GameOn helps to achieve different goals depending on the objectives of the marketer. Since it is a complete information game therefore they have assumed that the firm knows the statistics of its opponent. It takes input from the previous leads generated by its own firm as well as the estimated number of online leads generated by the competitor and helps to estimate the number of online leads, profit, number of contracts, estimated Nash & Stackelberg equilibrium. The outcome has been compared over nash equilibrium and Stackelberg Equilibrium and it shows that stackelberg equilibrium results in a strategy that maximizes the profit[3].

Digital Marketing and Lead Generation for Duopoly Markets focuses on generating the number of lead generations to achieve a target in a given period of time. A lead is generated whenever a user signs up or download some information from the firm’s website. User filling out a survey form on the marketer’s website can also be considered as lead generation. The model takes into consideration that firm’s own data is exact while the data of the competitor is estimated as in the real world scenario. The firm analyzes the moves of its competitor to come up with a strategy that would yield the maximum leads. The model takes into account the strategies of the opponent along with the desired strategies of the firm. The model then analyzes the strategies of both the firms and proposes the strategy that yields the maximum expected outcome[4].

Last decade has experienced a drastic shift from traditional marketing to digital marketing techniques. Markets have opted new platforms for advertising giving customers empowerment to participate in marketing relationships. The degree of participation of each firm depends on how their market is getting affected by social media. The game theoretic approach is used to evaluate application of the social media marketing tools depending on the marketers &

customers self interests. The traditional direct marketing can be expressed as a zero-sum game, but the advertisement has brought much more transparency in marketing disrupting the informational advantages of this model. Prisoner's Dilemma model is used to explain why social media has the potential to bring cooperation between marketers and customers. The author also introduces the concept of self command in which the competitor constraints its actions influenced by the actions of the other player. This practice will help customers to participate actively in shaping the brand's identity. This book has focussed on the area where the customers as well as marketers participate on blogs designed by the companies and hence the consumer's feedback on the blog affects the firm's utility. Hence, continual participation from customers as well as marketers is required in shaping the brand's identity[5].

The influence on the customers by firms is not only dependent on the other customers opinion but also the strategies that the two marketing firms opt for advertising. This paper has proposed a game theoretic model and conducted fair analysis for the equilibrium i.e. uniqueness, existence, determination. The analysis is focussed on the practical insights that how marketers should use the information about the social media to distribute their budgets among their customers on social media. It has been observed that by distributing the budget by considering the influential power of customers referred to as agents and the revenue gained by targeting potential customers is highly profitable as compared to the uniform distribution among agents.[6]

Viral marketing focuses on a selected group of influential people that can impact the market. This paper focuses on finding the seed nodes and distributing the money on those nodes so that they can maximize the overall influence of the product on the market. This model focuses on maximizing the influence generated by all the firms competing in the market so that the business can flourish. Secondly, the model proposes a strategy in a way such that the one investing more money gets higher return and vice versa. Finally the mixed strategy nash equilibrium is obtained based on the total budget investment by the firms.[7]

4. METHODOLOGY

The dissertation follows the structure as described. First, we describe various types of business model along with the statistics of usage of social media. The next section provides a basic overview of the end goals of the marketing campaigns and the importance of optimal budget distribution. After that, the later section describes how game theory has been used to formulate the model, as it will be essential to understand the mathematical formulation of the

model. Some of the work mentioned in the literature review section forms the basic foundation of the model designed. In the last section, results obtained from the game theoretic model have been depicted by using graphs for better understanding. Finally in the last chapter, the conclusions, limitations and recommendations for future work are presented.

4.1 Business Model

There are four major kinds of services that define the market structure: Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B) and Consumer to Consumer (C2C). Each of these services are initiated by the former and targeted towards the later. For our model, we have taken into consideration only the B2C market in which the process is initiated by the business and is targeted towards the consumer who is the end user.

There are many social media platforms that influence the marketing strategies and the overall revenue of any company. For the B2C market we have considered the following four platforms based on the 2019 statistics given in Table 1.

Social media platform	Influence on the market
Youtube	73%
Facebook	68%
Instagram	35%
LinkedIn	25%

Table 1: Statistics of usage of Social Media in 2019
<https://socialmedianewstime.com/2018/01/22/latest-social-media-stats-for-2019/>

Youtube majorly focuses on the video advertisements or the clickable pop ups that redirect the user to the company's website. Facebook encompasses all types of advertisements, therefore it provides the user with more variety to engage the audience. Instagram works on the same lines as facebook but has more number of filters before the user could reach the audience. LinkedIn has advertisements that are more professional and industry oriented, Therefore this platform would yield lesser but more influential audience.

4.2 End Goals of Social Media Marketing

Based on the market services and the different social media platforms, the companies could have different end goals that they want to achieve. The major ones can be categorized as follows: Brand awareness, User engagement and Lead

Generation. Brand awareness involves letting the audience at large, know about the product/service they are selling. These kinds of ads or campaigns involve impressions which means the number of times the ad was viewed by people. Therefore, the more the number of views the better the influence on the market. User engagement involves interaction of the user with the ad or campaign in any form. This could involve liking the advertisement, sharing the advertisement or commenting on it. A customer visiting the website of the company by following the advert on social media is also considered as user engagement. Lead Generation is more focused on gathering the user information. Any advert or campaign that involves the user to give away any form of contact details such as phone number or email is a part of generating potential customers. All of these end goals follow a funneling process as described in Fig 1.

For this model, we are focusing on the bottleneck of the funnel i.e. the lead generation as the increase in revenue is dependent directly on the number of targets becoming loyal customers and similar can be done for the other two as well.

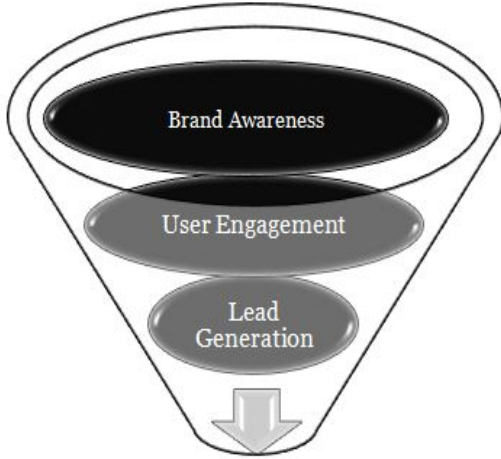


Fig 1: End goals of Social Media Marketing

4.2. Game Model

4.2.1. Input/Output Game Theoretic Model

Our designed model will take the total budget to be invested by both firms and the existing influence of both the firms on the market as inputs. These inputs are then fed into the game theoretic model which then proposes budget distribution on each platform for both the firms. The model also predicts the estimated influence the firms will gain on each of the platforms if it invests according to the proposed strategy. It also calculates the estimated revenue each of the firms will obtain at the end of the investment as shown in Fig 2.

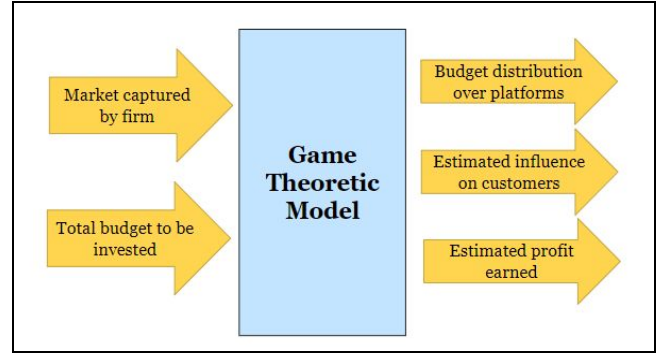


Fig 2: Input/ Output of Game Theoretic Model

4.3 Formulated Models

4.3.1 Game Model I - Maximizing market share

This model focuses on maximizing the market share of the firms. In this model it is assumed that the total market size is constant and both the firms are competing to capture the maximum market. Also, both the firms play sequentially such that the action taken by one firm is known to the other taking the action after the first firm.

The game can be formally defined as follows:

Players: Firm 1 & Firm 2

$$I = \{1, 2\}$$

Distribution of budget over 4 social media platforms

$$n = \{1, 2, 3, 4\}$$

Action Space (Budget Distribution over each platform)

$$A_{ij} = \{a_{ij} : \sum_{j=1}^n a_{ij} = B_i\} \quad \forall j \in n, i \in I$$

B_i is the total budget that firm i wants to invest

The model proposes a distribution for each platform which will be proportional to the difference of targeted market share and the current market share before the investment.

$$a_{ij} \propto (X_{ij}^{new} - X_{ij}^{old})$$

X_{ij} is the market share of i^{th} firm on j^{th} platform

The budget allocated to each firm is dependent on the old and new market shares. It is proportional to the market share of firm i for platform j after the budget is invested minus the

market share of firm i for platform j before the budget is invested. The market share lies between 0 and 1, therefore the outcome of market share is a continuous distribution. But for simplification, we have simulated the model for five discrete values.

The game designed is of the form of extensive form game where the firms take actions sequentially. The model can be verified using the backward induction which suggests that this model has the last mover advantage. The firm that invests at the end has an upper hand on capturing the major part of the market as compared to its opponent. The detailed results are discussed in the results section of the report.

4.3.2 Game Model II - Maximizing the revenue

This model focuses on maximizing the overall revenue of the firms. This model is more realistic, as it is known that new people are joining social media platforms every day. So, it is assumed that at each stage both the firms are taking actions simultaneously and new people are joining the social media platform. At each stage the overall market size increases due to new people, but the leads captured by each of them is still the same as previous stage. This results in a dip in the market share of both the firms. Then the model proposes a strategy that defines how the budget shall be distributed over the platforms such that both the firms can maximize the revenue gain at that stage.

In the initial stage, the firm 1 inputs the number of leads of both the firms i.e. Y_1 & Y_2 respectively on platform 1, using which the market share (X_{11} , X_{21}) of each firm is calculated.

$$(X_{11}, X_{21}) = \left(\frac{Y_1}{(Y_1 + Y_2)}, \frac{Y_2}{(Y_1 + Y_2)} \right)$$

In the next stage, new entrants Y enter the market. Now the firms observe a dip in their market shares as the market size increases but the number of leads generated remains the same. So, the new market share will be:

$$(X_{11}, X_{21}) = \left(\frac{Y_1}{(Y_1 + Y_2 + Y)}, \frac{Y_2}{(Y_1 + Y_2 + Y)} \right)$$

Once the market size has been determined, the influence over the market is calculated by using the following formula:

$$X_{ij}(R+1) = \frac{X_{ij}(R) + a_{ij}}{1 + a_{ij} + a_{-ij}}$$

The influence is dependent on the influence of the firm in the previous stage and the budget invested by both the firms. R represents the number of rounds played and $R+1$ represents the current stage. Also a_{ij} & a_{-ij} are the budget distributions of firm i and its competitor respectively.

The utility of the firms is defined in terms of the revenue generated by both the competing firms given as:

$$u_{ij}(R+1) = \gamma_{ij}(X_{ij}(R+1)) - \lambda_{ij}(a_{ij})$$

Where γ_{ij} represents profit generated per customer per platform and λ_{ij} represents advertising efficiency. The best response for each of the firm is to maximize their utilities so as to gain maximum profit.

$$B_i(a_{-ij}) = \arg\{ \max(\gamma_{ij}(X_{ij}(R+1)) - \lambda_{ij}(a_{ij})) \}$$

Solving for the above equation, we get the best responses of both the firms as below where a_{1j} & a_{2j} are the budget distribution by firm 1 & 2 over platform j .

$$a_{1j}(a_{2j}) = \sqrt{\frac{\gamma_{1j}}{\lambda_{1j}}(1 - X_{1j} + a_{2j})} - 1 - a_{2j}$$

$$a_{2j}(a_{1j}) = \sqrt{\frac{\gamma_{2j}}{\lambda_{2j}}(1 - X_{2j} + a_{1j})} - 1 - a_{1j}$$

The best responses for both the firms tell each of them how they shall invest on each of the platforms to maximize their profits. There exists a Nash equilibrium at the point where the lines of best responses intersect. Both the firms will follow Nash Equilibrium strategy given the strategy of the opponent.

This model can also be verified using one shot deviation which shows that any deviation from the point of nash equilibrium will result in utility lower than the one expected at nash point.

5. EXPERIMENTAL RESULTS

5.1. Game Model I - Maximizing market share

According to the definition of the model, it can be represented as an extensive form game. For this case, we have discretized the whole market into five segments: (0.2,0.8), (0.4,0.6), (0.5,0.5), (0.6,0.4) & (0.8,0.2). Each firm at the time of making a decision have five actions to choose from. The extensive form game described is shown in Fig 3.

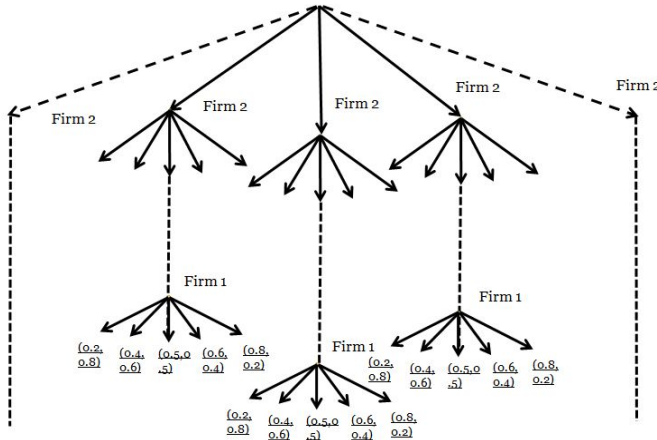


Fig 3 : Extensive Form Game for Model I

On using backward induction, we observe that the best response of firm 1 is to maximize its market share i.e. 0.8 for all actions. As we go a stage above where firm 2 is taking the decision, it would be indifferent between taking any decision as all of them would result in the same outcome at the last stage. Therefore the one taking the last action will have a say in the game as it will maximize its market share and choose a utility that has maximum value. The game relies on the notion of Last Mover's advantage in which the firm investing at the last will get much proportion of the market share.

5.2. Game Model II - Maximizing the overall revenue

According to the model definition, the best responses of both the firms are plotted by choosing values of $\gamma=5$ and $\lambda=0.1$. For any values of γ and λ , the plot will look similar to the plot shown in Fig 4.

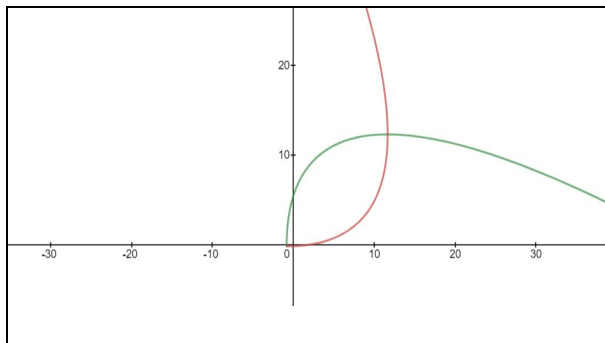


Fig 4: Best Responses of both the firms

As it is known to us that the nash equilibrium is a result of the intersection of the best responses of both the competing firms, therefore, the point at which the lines representing the best responses for the budget invested on the given platform intersect, results in nash equilibrium. Both the firms will

distribute their budget according to this point of Nash Equilibrium.

For each of the platforms, the market share for each of the firm is known along with the total budget that has to be distributed. The number of new people influencing the market is also known. As new people enter the market, the market share for each firm comes down. The strategy proposed gives the ratio in which the budget shall be invested so that both the firms can maximize their profits.

The model has been simulated for all the four platforms where each of the firm has some initially captured market and the model has to propose a strategy using which the firms can capture the new audience and maximize their overall revenue. The input and output for facebook, instagram, youtube and linkedIn has been calculated and plotted on the graphs. Finally the budget factor from each of the platforms is combined and distribution factor is calculated. This distribution factor is multiplied with the budget factor which results in the amount that should be invested on that platform.

These are the input/output table for the four social media platforms which contain the market share as the input and gives the budget factor and the expected market share as the output. For this model we have assumed the value of λ to be 0.1 for all platforms and γ to be 5 for facebook, instagram and youtube and 3 for linkedIn for firm 1 and the value of λ to be 0.1 for all platforms and γ to be 5 for facebook, instagram and youtube and 4 for linkedIn for firm 2.

For this case, we have assumed that the advertising efficiency of both the firms is the same and the profit generated from facebook, instagram and youtube is also same. We have varied the profit generated for each customer from linkedIn. This way, we have simulated the model such that it covers all the possible cases and outcomes for every case can be compared.

For Facebook:

Input X1	Input X2	Distribution a1	Distribution a2	Output X1	Output X2
0.2	0.8	11.7	12.3	0.476	0.524
0.238	0.262	12.233	12.257	0.489	0.491
0.326	0.327	12.171	12.172	0.493	0.493
0.370	0.370	12.129	12.129	0.495	0.495
0.396	0.396	12.103	12.103	0.496	0.496
0.413	0.413	12.086	12.086	0.497	0.497
0.426	0.426	12.074	12.074	0.497	0.497
0.435	0.435	12.065	12.065	0.497	0.497
0.442	0.442	12.058	12.058	0.498	0.498
0.448	0.448	12.052	12.052	0.498	0.498

Table 2: Distribution of budgets over Facebook

For Instagram:

Input X1	Input X2	Distribution a1	Distribution a2	Output X1	Output X2
0.6	0.4	12.1	11.9	0.508	0.492
0.254	0.246	12.239	12.241	0.490	0.490
0.327	0.327	12.171	12.171	0.493	0.493
0.370	0.370	12.129	12.129	0.495	0.495
0.396	0.396	12.103	12.103	0.496	0.496
0.413	0.413	12.086	12.086	0.497	0.497
0.426	0.426	12.074	12.074	0.497	0.497
0.435	0.435	12.065	12.065	0.497	0.497
0.442	0.442	12.058	12.058	0.498	0.498
0.448	0.448	12.052	12.052	0.498	0.498

Table 3: Distribution of budgets over Instagram

For Youtube:

Input X1	Input X2	Distribution a1	Distribution a2	Output X1	Output X2
0.3	0.7	11.8	12.2	0.484	0.516
0.242	0.258	12.237	12.253	0.490	0.491
0.326	0.327	12.171	12.171	0.493	0.493
0.370	0.370	12.129	12.129	0.495	0.495
0.396	0.396	12.103	12.103	0.496	0.496
0.413	0.413	12.086	12.086	0.497	0.497
0.426	0.426	12.074	12.074	0.497	0.497
0.435	0.435	12.065	12.065	0.497	0.497
0.442	0.442	12.058	12.058	0.498	0.498
0.448	0.448	12.052	12.052	0.498	0.498

Table 4: Distribution of budgets over YouTube

For LinkedIn:

Input X1	Input X2	Distribution a1	Distribution a2	Output X1	Output X2
0.85	0.15	9.646	6.497	0.612	0.388
0.306	0.194	9.665	6.964	0.566	0.406
0.377	0.271	9.571	6.917	0.569	0.411
0.427	0.308	9.524	6.88	0.572	0.413
0.457	0.330	9.495	6.858	0.574	0.414
0.478	0.345	9.475	6.843	0.575	0.415
0.493	0.356	9.461	6.832	0.576	0.416
0.504	0.364	9.45	6.824	0.576	0.416
0.512	0.370	9.442	6.818	0.577	0.416
0.519	0.375	9.436	6.813	0.577	0.417

Table 5: Distribution of budgets over LinkedIn

Given the inputs and outputs for each of the platforms, graphs are plotted individually for each of the platform for firm 1. The graph corresponding to the outcome has two lines where the red line in the input market share and blue line is the output market share. The input market share is the market share of the firm when new influencers enter the market and the budget has not been invested whereas the output market share is the market share of the firm when both firms have invested according to the proposed strategy and the new influencers have been captured by the firms.

The following graphs have been plotted for Firm 1 for Facebook, Instagram, Youtube and LinkedIn respectively.

For Facebook:

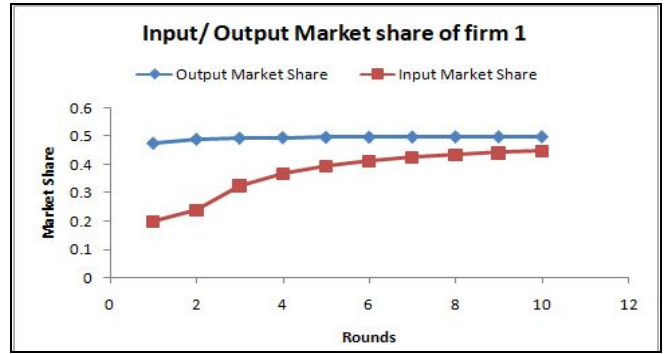


Fig 5: Market Share vs Round (Facebook)

For Instagram:

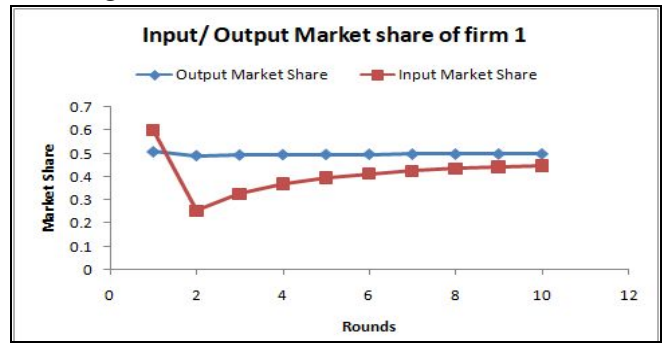


Fig 6: Market Share vs Round (Instagram)

For Youtube:

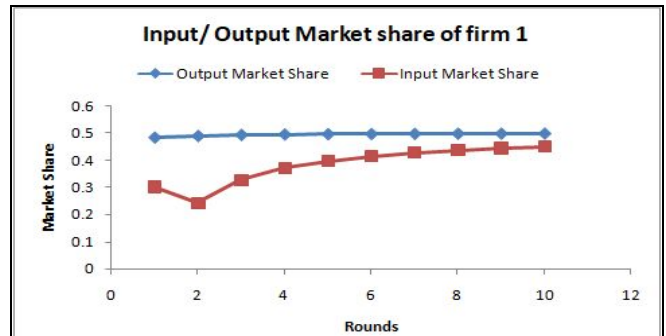


Fig 7: Market Share vs Round (YouTube)

For LinkedIn:

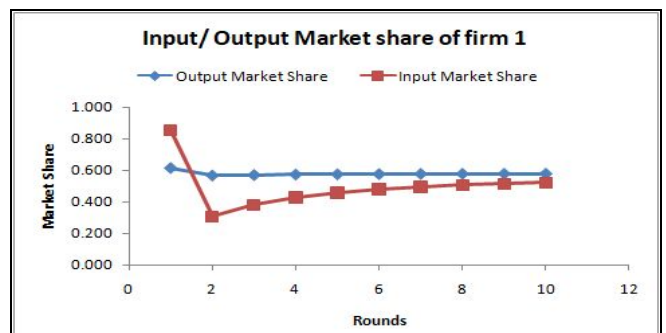


Fig 7: Market Share vs Round (LinkedIn)

The above graphs represent how the market share changes as each of the firms invested as per the proposed model.

Once the budget factor is determined for each of the platform, it is then used to determine the actual amount that has to be invested on each of the platform. The results for both the firms that how should their total budget be distributed have been represented in Table 6 & 7 where total budget of both the firms is assumed to be 1000000.

Firm 1:

Rounds	Facebook	Instagram	Youtube	LinkedIn
1	258586	267427	260797	213190
2	263790	263919	263876	208414
3	264105	264105	264105	207686
4	264185	264185	264185	207445
5	264235	264235	264235	207296
6	264273	264273	264273	207181
7	264300	264300	264300	207101
8	264322	264322	264322	207033
9	264337	264337	264337	206989
10	264345	264345	264345	206966

Table 6: Total budget distribution of Firm 1

Firm 2:

Rounds	Facebook	Instagram	Youtube	LinkedIn
1	286733	277409	284402	151456
2	280384	280018	280293	159305
3	280261	280238	280238	159264
4	280329	280329	280329	159013
5	280376	280376	280376	158871
6	280411	280411	280411	158767
7	280439	280439	280439	158684
8	280457	280457	280457	158628
9	280471	280471	280471	158588
10	280481	280481	280481	158556

Table 7: Total budget distribution of Firm 2

The budget distribution from each platform for both the firms can be compared from the following histogram in Fig 8 where total budget of both the firms is taken to be \$1000000.

The graph in Fig 8 shows the splitting of the budget over four platforms for each stage. It can be observed that firm 2 invests more than firm 1 on LinkedIn as it is getting more profit per customer than firm 1 from LinkedIn.

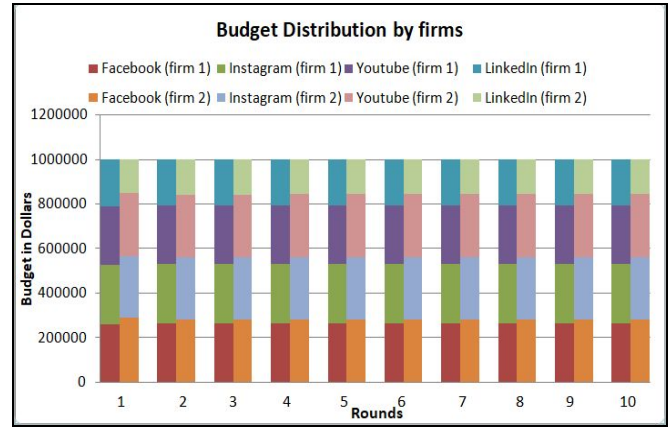


Fig 8: Total budget distribution of Firm 1 & Firm 2

The plots below from Fig 9 to 16 show the revenue generated by each firm on each social media platform with respect to number of rounds respectively.

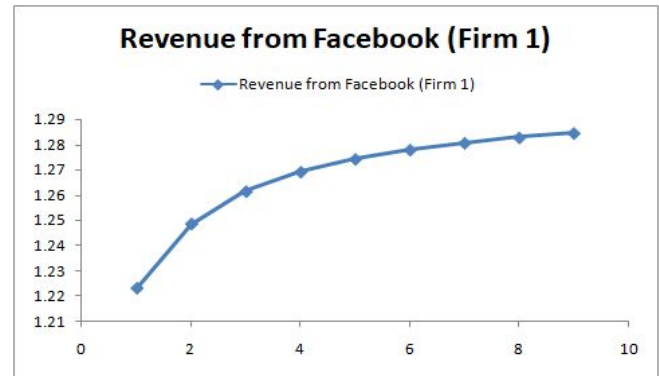


Fig 9: Revenue of Firm 1 vs Round from Facebook

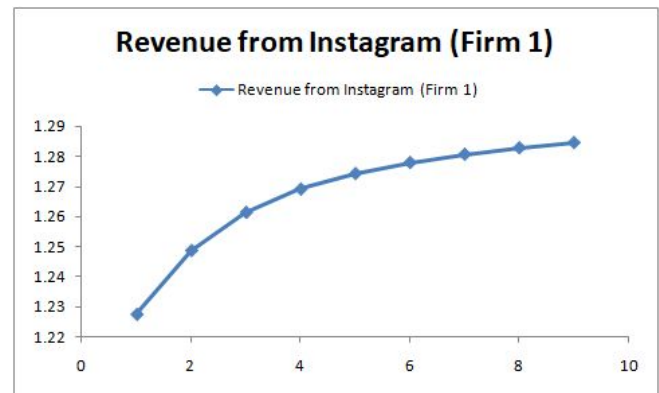


Fig 10: Revenue of Firm 1 vs Round from Instagram

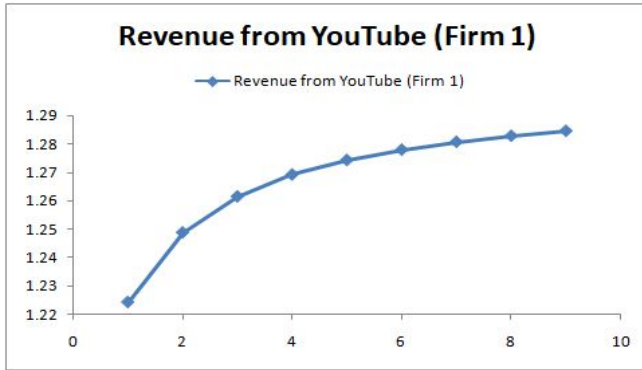


Fig 11: Revenue of Firm 1 vs Round from YouTube

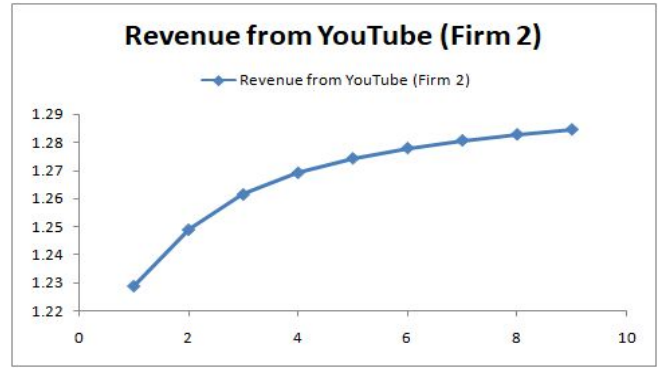


Fig 15: Revenue of Firm 2 vs Round from YouTube

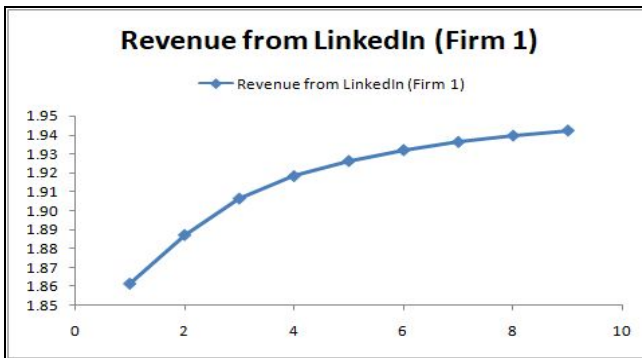


Fig 12: Revenue of Firm 1 vs Round from LinkedIn

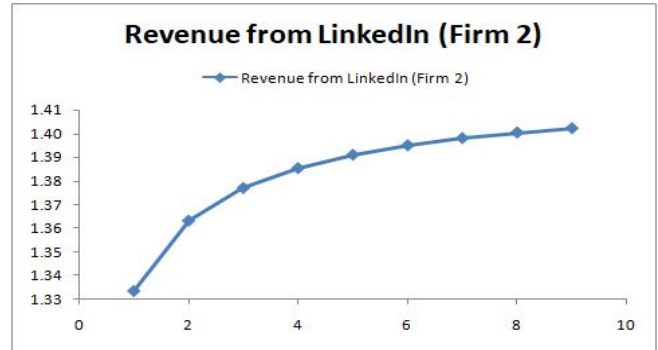


Fig 16: Revenue of Firm 2 vs Round from LinkedIn

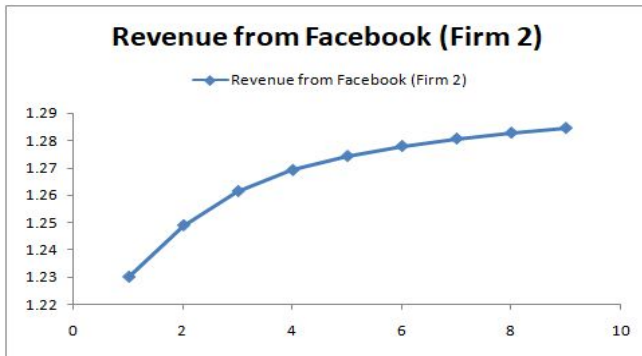


Fig 13: Revenue of Firm 2 vs Round from Facebook

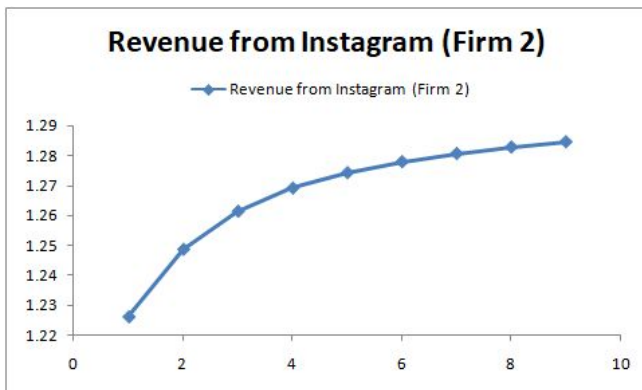


Fig 14: Revenue of Firm 2 vs Round from Instagram

The overall revenue of both the firms increases for all four platforms at each stage. Any deviation from the nash equilibrium strategy results in less revenue generated against the revenue generated following the nash equilibrium strategy.

6. CONCLUSION

From the above models and results, it can be observed that model I will result in an outcome that is always favorable for the last player but such a market where no new people are getting influenced by the firm is not realistic. Therefore, this model is only subjective. For the second model, it can be concluded that both the firms try to invest on new customers such that it maximizes the overall revenue. Market captured by firm is dependent on revenue generated for each platform per customer. Both can capture almost half of the market (given that profit generated for both the firms are equal). If the profit generated for both the firms is different then the expected market share would not be 0.5 for the firms. Both the firms will distribute their budgets according to the Nash Equilibrium as any deviation from Nash Equilibrium yields less profit. Hence, NE is the best allocation strategy. Our model provides an insight to marketing managers how the budget should be distributed over various social media platforms.

7. FUTURE WORKS

The future works involve the extension of the game including notion of learning in games. For this project, we have taken into consideration only the duopoly market. This can be extended for multiple advertisers. This model uses our social media platforms, therefore more social media platforms can be included. Only B2C market has been taken into consideration. This model can be extended for B2B (Business to Business) markets as well.

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