Applying Game Theory to Real-Life Situations: Competitive Corporate Marketing and Modern Health Issues

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Abstract

Game Theory, or in specific strategic interactions, is important in determining an individual's choice in everyday life. In this research paper, we looked at the different factors that can affect people's choice in the real world. For the first scenario, we applied the principles of Game Theory to determine whether it's better for modern technology to release their products before or after competitors, considering the benefits and negatives of both scenarios as well as underlying factors. The second scenario was with a modern virus as of 2020: COVID-19. Looking into whether people will choose to wear a mask or not given the benefits and negatives, we were able to apply game theory calculations to determine the results.

First Scenario

I. Introduction

The first scenario is using Game Theory to determine the launching of new models between two highly competitive firms in the phone industry. The scenario was based on an article we read, 'Samsung, Apple to Change Dates of New Product Launches'. This is regarding the decision of Samsung to release Galaxy Note 9 in July or August of 2018 and its foldable smartphone early the following year. The article mentions that in response to this move, Apple is likely to move up its launching date of its next model, which is the Iphone XS. In understanding this move, it is good to note that the global smartphone market has slowed down. Based on the research by Bay Street, the average user replaces smartphones in 31 months in 2014 from 23 months. It also mentions that the replacement period will be longer.[1]

Based on this scenario we will use game theory to analyze how the launching of products is determined. The purpose of this study is to evaluate the belief that first mover always has the advantage and will always win. However based on our research. there are advantages and disadvantages of being a first or second mover.[2]

II. Advantages of Being the First Mover

A. Development of competitive advantage making it costly for competitors to get in.

B. Building of brand loyalty and repeat demand.

C. Habitual consumer behavior. Once a consumer buys a certain product it becomes

[1] http://www.businesskorea.co.kr/news/articleView.html?idxno=22451
[2] https://www.tutor2u.net/economics/reference/game-theory-first-mover-advantage:

difficult to shift to another one

III. Risks of Being the First Mover

A. Intellectual transfer risk from employees of first mover companies.

B. Being first movers it can be unprofitable as they need to spend on product development and research and the second mover can just copy it.

C. Second-movers can launch better products by learning the weaknesses of the products of the first movers.

IV. Research Problem

Is being the first mover always the best option for a tech company?

V. Purpose

Launching products entails a lot of costs. It goes through extensive product development to ensure being able to answer consumer needs in a highly competitive industry. Given the huge costs to the company, it aims to maximize its payoff from the products developed. Hence it is important for the company to look into the aspect of first mover advantage and second mover advantage to see what maximizes profit .

VI. Choice of Methodology

In this study we tried to read literature on the benefits of being a first mover and second mover. We mainly used the internet to do the study. As the focus was on Samsung and Apple, we also read articles regarding their product launches and the features of their smartphones.

Based on our research first movers has higher successes under the following circumstances:[3]

1) Technological Leadership
2) Brand Loyalty
3) High Buyer Switching Costs

Meanwhile for second mover, it tends to have higher successes under the following scenario:

1) Free rider effects which lowers research costs as they can just imitate some features
2) Learning from consumer preferences especially if there is market and technological uncertainty. Given for instance that the features of the phones are already too advanced that it has answered the market needs, the additional features may not give as much utility as before due to the concept of diminishing marginal utility. The more that a consumer gets from a product the satisfaction increases at a diminishing rate. Given this knowledge from the reception of the first movers product, the second mover will know which one has an impact on the market

VII. Hypothesis

If a tech company were to be the first mover, then it will be successful if the product being produced is technologically more advanced than its competitor. If it is less technologically advanced, then it will be better off being the second mover.

[3] https://www.diva-portal.org/smash/get/diva2:229467/FULLTEXT01.pdf

VIII. Situation

Two players (competitors) Company A (Samsung) and Company B (Apple) are preparing the launch of their new smartphone which are almost similar in features that it similarly covers what consumers want. They need to decide whether to launch their product before or after the other. The decision is whether to take advantage of being the first mover which has a higher chance of attracting product users, thereby gaining market share. Meanwhile being a second mover, the company can learn from the mistakes or shortcomings of the competitor's new products. It also has an opportunity to offer an improved version based on the reception of the market. Samsung's product is advanced in terms of technological features and is releasing a phone highly different from their previous models. However, Apple is launching an improved version of its Iphone with improved battery life and more clear LED and camera features. What then will be the optimal strategy for each company? Should one be a first or second mover?

The concept of product launching involves a lot of factors. As such to make it simpler, we made these assumptions and represented them based on Game theory:

1) The companies will not be able to launch on the same day
2) Only one product is being launched by Samsung and Apple
3) Samsung is launching a more technologically advanced product from their current models Note 9 which has writing features setting it apart from previous models.
4) Apple is launching an upgrade from their previous models
5) Both companies are acting rationally

IX. Methods

To analyze this scenario, game theory is used. The optimal strategy is to be determined for each company. Also, we will also determine if there is a Nash equilibrium in the set of strategies where each company will not deviate from the strategies.

X. Game theory Model

In this scenario, if Samsung becomes first mover, the Company will gain greater market share hence the payoff of 2. This is because the product being released is not just an upgrade from previous models. This can be seen when it launched its Samsung Note 9 in 2018 which has better features than its counterpart model the Iphone X. Samsung taking further steps in their product line allows it to gain an immediate market share. Meanwhile if Apple would be the first mover but being behind in technology will only get a pay off of -1 because as Samsung releases its Note 9, the market pie can still be taken by Samsung being a more dominant product. With Samsung being a dominant product, it will overtake Apple. However, if Apple releases an improved product being a second mover, it will still be able to retain its Apple ecosystem that is run by IOS and integrates its other devices. If Samsung will be a second mover, it has a pay-off of 1. It is still positive because of the product's features but a portion of the pie has already been eaten by Apple. The scenario can be represented as per below normal form if the companies behave rationally:[4]

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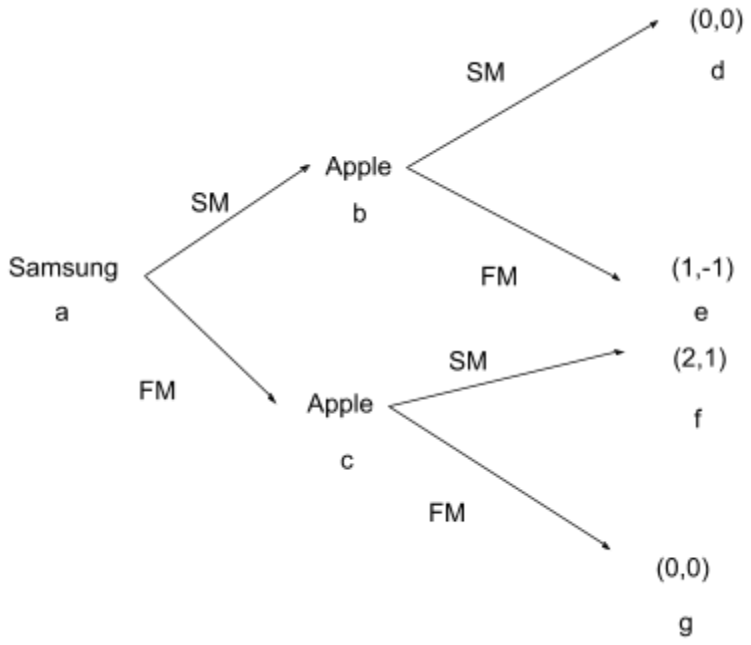
4 https://www.businessinsider.com/apple-iphone-x-vs-samsung-galaxy-note-9-2018-8#overall-youre-getting-more-with-the-galaxy-note-9-than-the-iphone-x-for-the-1000-price-tag-15

Normal Form

	Apple		
Samsung		First Mover (FM)	Second Mover (SM)
	First Mover	(0,0)	(1,-1)
	Second mover	(2,1)	(0,0)

This is an example of a sequential game (dynamic game) we have learned in class, where later players have some knowledge on the other's actions. This is because the release dates are normally announced, so Apple or Samsung can either choose to release first or second over the other. Being a sequential game, this is better represented by Extensive form as per below:



XI. Results

The nash equilibrium is {first mover, second mover}. Starting at the second stage, at node b, the optimal decision for Apple is to be second mover, while at node C, the optimal solution is still to go being the second mover. As we are assuming that Apple is rational, it will choose to become the second mover. Meanwhile, Samsung's optimal decision is to choose to be the first mover as it also knows that Apple is a rational company and will decide to be a second mover.

XII. Conclusion

Based on the experiment above it will be better off for a company with a more technologically advanced product to be the first mover. Then the company with less technologically advanced products is better off as a second mover. The outcome in the game is desirable as both will benefit and have positive pay-offs.

This can be seen based on our research, when Apple released its Iphone Xs in 2018 as second mover in September 21, 2018 it sold well for Apple which as per records of Best Buy ranked within the top 5000 consistently to its every listed item. Meanwhile, looking at the similar 28 day period from the release date of Samsung Galaxy Note 9, which was launched the month before (first mover), the XS and XS Max did not perform well.[5] This means that Galaxy Note 9 was successful being the first mover but as second-mover Apple still has made good sales which shows the Nash Equilibrium as seen from below graphs:

[5] https://media.thinknum.com/articles/apple-iphone-xs-max-loses-to-samsung-note9/

It can be noted that the decision to be a first mover for Samsung even being technologically advanced is not necessarily the best option all the time. There may be additional factors that can come into play that need to be added in the decision tree. For instance, when they released the Samsung fold in 2019. It should have been revolutionary but it turned into a disaster. The CEO admitted that they were not ready and they rushed it to capture the market first.[6] This

[6] https://arstechnica.com/gadgets/2019/07/samsung-ceo-calls-galaxy-fold-launch-failure-embarrassing/

scenario would entail additional nodes in the game theory as to whether it should release prior to readiness and be ahead of everyone to capture the market or not.

Further, decisions can change when certain biases come in. As this is a repeated game in the industry certain factors can come to play like in the aspects of retaliation or reputational factors. For instance, sometimes even the pay-off would be higher for a company to take on a first or second mover strategy, it does not take the desired option due to acts of retaliation for instance. Competition in this industry is fierce and sometimes publicity being released that may or may not necessarily be true prompts a company to act based on these. For instance, earlier on, for instance, Apple was always the first mover in launching products and they benefited from it. Samsung then normally follows and releases an improvement based on Apple's new model which also gave an optimal pay-off. Given the positive pay-offs they had, one would think that this will be the continuing strategy. However, when Samsung was accused of being an imitator, a reputational risk factor came into play that they had to change to launch its product as the first mover as retaliation to these negative news which not necessarily is an optimal strategy.

It is also important to note that the situation displayed in our paper will be repeated. There will continue to be a "first mover" and a "second mover" so long as there are new inventions rolling out. Ultimately, from taking data obtained from this game theory assessment, companies and individuals alike will be able to apply this into their strategic market plan and figure out what will work best for their business model.

Launching decisions including timing is a repeated game given the competitiveness of the industry. Mobile companies have a need to release new products so as not to be left behind and

be outdated like what happened to Nokia. Game theory is a valuable asset of knowledge that can help in business decision making for a company as clearly illustrated in the above real-life scenario. It can help companies envision future plans because they can adapt to other company's actions thus making the best decision. They can also choose dominant strategies that will yield them satisfactory pay-off.

Second Scenario

I. Introduction

The second scenario is utilizing Game Theory to compare/contrast the results of wearing a mask and not wearing a mask. At the time of writing this paper, July/August of 2020, we felt that this was up with current events due to the state of the COVID-19 pandemic. The scenario is based on the pandemic and news report following it. In specific, we based our research on an CDC article, "Why Face Masks are Crucial Now in the Battle Against COVID-19." The article was in regards to the value of Face Masks in relation to the COVID-19 pandemic. The article mentions that to best protect one self and others, individuals must wear a mask.[7]

Based on this scenario, we will incorporate game theory to discuss the benefits and negatives of wearing a mask and how one will theoretically determine their actions. The purpose of this study is to evaluate whether it is beneficial for the individual to wear a mask and denote any preceding beliefs that may be proven wrong. To start off, based on our research, there are benefits/negatives of choosing to wear or not wear a mask.

II. Advantages/Disadvantages of Wearing a Mask

Advantages of wearing a mask are as follows:

1) Cloth face (masks) coverings will help COVID-19 patients prevent the spread of the virus to other people who have yet to get it. [8]

[7] https://www.healthline.com/health-news/face-masks-importance-battle-with-covid19
[8] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

2) Cloth face (masks) coverings are most likely to reduce the spread of COVID-19 as less people are opened to get it. [9]
3) Masks offer good protection to people from getting COVID-19

Disadvantages of wearing a mask are as follows:

1) Skin problems arise due to wearing masks
2) People with certain health issues have trouble breathing with a mask on

III. Advantages/Disadvantages of Not Wearing a Mask

Advantages of not wearing a mask are as follows:

1) May be beneficial to those with health issues
2) Lack of skin issues arising from masks
3) More freedom when no one is around

Disadvantages of not wearing a mask are as follows:

1) Lack of any protection against COVID-19
2) May be the cause for spread of COVID-19

IV. Research Problem

Is it beneficial more to wear a mask or not against the COVID-19 pandemic?

[9] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

V. Purpose

Wearing a mask has a lot of problems the media often do not cover. People who do not wear masks are looked down upon by the media without their personal stories ever getting light. They may have skin issues or health issues in general that could perhaps come as a priority over protection against COVID-19. Hence, it is important to consider both sides of the argument to determine whether it is truly more beneficial to wear a mask.

VI. Choice of Methodology

In this study, we've examined articles after articles to determine the advantages and negatives of wearing masks as well as the vice versa. We mainly used the internet to conduct the study. Because the focus was on the COVID-19 pandemic, we focused on major trusted sources such as the official CDC website.

Based on our research, we have found that there are more significant benefits to wearing a mask than not. Although there are significant reasons why one would be motivated to not wear a mask, the risk of obtaining or spreading COVID-19 is just too large. We did find smaller instances where not wearing a mask may be beneficial. Below are some possible situations:

1) The individual without a mask is alone
2) The individual without a mask has more significant and life-threatening health issues that must serve as a greater priority

VII. Hypothesis

For everyone to be safe, it is best if all players wear a mask. Generally speaking, there seems to be more advantages wearing a mask so if all players wear a mask, the spread of the COVID-19 pandemic may be contained.

VIII. Situation

There are two players, Player 1 (Timmy) and Player 2 (Sandy), determining whether or not they should wear a mask when they meet to shop.

IX. Method

To analyze this scenario, game theory is used. The dominant strategy is to be determined for each person who is given the option to wear or not wear a mask. We will also determine if there is a Nash equilibrium in the set of strategies within this scenario/model.

X. Game Theory Model

In this scenario, when Timmy and Sandy are both given the option to wear or not wear a mask, different points will be given out based on their options. When they choose to wear a mask, they will be given an addition of one point. This is because as proven in the previous sections, the benefits of wearing a mask outweigh the negatives of wearing a mask. In this specific scenario regarding the COVID-19 pandemic, the player's ability to be contaminated with the COVID-19 virus will decrease as they are protected better. On the other hand, when a player decides to not wear a mask, they will obtain a negative one point. This is because as

proven in the previous sections, the negatives of wearing a mask outweigh the positives of not wearing a mask. In this specific scenario, the person's ability to be contaminated with the COVID-19 virus will grow and their life will be put at risk. The scenario can be represented as per below normal form if the players behave rationally.

	Sandy		
Timmy		**Mask**	**No Mask**
	Mask	(1,1)	(1,-1)
	No Mask	(-1,1)	(-1,-1)

XI. Result

The Nash Equilibrium is {mask, mask}. For both players, the dominant strategy is to wear a mask. Both will obtain more points if they individually wear a mask.

XII. Conclusion

Based on the experiment above, it will be better off for a player/individual to wear a mask. In the specific example used, Timmy and Sandy should both choose to wear a mask because it is higher payoff for them. If the players behave rationally in this scenario, both Sandy and Timmy would wear a mask as it has a higher pay off. People will behave rationally because a pandemic is going on and people would not want to get the disease. However, there are biases that may take into play. One of the biases of wearing a mask would be that there is a pandemic

that can spread from sneezing and coughing. With this a person would have incentives to wear a mask because they are able to protect themselves from the virus better.

The outcome of the game is desirable because both people should want to wear a mask to be able to protect themselves from getting the disease. This will influence people's choices by making them more likely to wear a mask to then be less likely to catch the disease and thereby giving a higher payoff. Therefore Timmy and Sandy would just assume that everyone else will also be wearing a mask to protect themselves. Conclusively though, within this scenario, it is beneficial to players if they wear a mask.

It should be noted that there may be different situations when the results of this paper are not always beneficial. There may be cases in which it's better for both individuals/players to not have a mask on. For example, if two players are in a confined space, both have had no human interactions with anyone else for the past 14 days, and have gotten COVID-19 testing every single day for weeks while testing negative, it is safe to assume that comfort will outdo safety as they are both safe.

There may or may not be *biases* that come into play. While this may affect which decision a player chooses, it will not have any effect on how the end results turn out. Even if one prefers not to wear a mask or cannot wear a mask for some other reason, they will not be given any special treatment and will have to face significant risk of COVID-19.

Moreover, there is learning from this game. COVID-19 is the first global pandemic to have such lasting impact on the world. However, it is important to note that this will not be the last pandemic to have such impact. In the future, diseases such as the COVID-19 pandemic will

be continued and it is important that taking lessons away from this game theory assessment on COVID-19, we apply it to future repeated issues.

Wearing masks are essential in fighting off the COVID-19 pandemic. However, especially within the United States, there has yet to be enough motivation for individuals to wear a mask. Looking at this experiment and the Game Theory assessments, a valuable lesson can be learned: wearing masks, in general, are beneficial to all players. Not wearing a mask may hurt a player detrimentally but wearing a mask can only help a player.

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