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How Advertising Helps Luxury Companies Charge an Expansive Price: Relationship between Advertising and Price

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ABSTRACT
This paper analyzes the influence of advertising on price and how advertising helps luxury companies create an expensive price in the market. We first use the profit-maximization model and cost-minimization model to calculate the equilibrium advertising expense and the increased amount of profit after adding advertising as a new variable. We then use the OLS regression model and panel data regression model to test the relationship between advertising expense and total revenue. Finally, the result of the empirical models strongly supports our hypothesis that an increase in advertising expense will lead to an increase in total revenue.

Keywords: *luxury companies; OLS regression model; styling; advertising*

1. INTRODUCTION

As the economy grows rapidly these recent years, people's material world got fulfilled. There is a huge market left for people's spirit world that needs to be fulfilled by ideal, status, or luxury. Luxury is the thing that is not necessary for people's lives, but people buy it for social status. Luxury products always have expensive prices that are much higher than the market price compared to similar products. Luxury fashion companies can provide better consumer service, better materials, and better experience. However, the most important reason that people want to buy luxury is because of its brand. Consumers will set up long-term brand loyalty with a luxury brand when they first have a good experience with these brands. The brand image behind these brands can fulfill people's spirit word by providing them higher social status or satisfaction of the vanity.

There is a common question people might ask about advertising: Why do consumers respond to advertising: There are three explanations to that. First, advertising is persuasive that can change consumers' tase through product differentiation and brand loyalty. Second, advertising is information that can reflect information and experience of the product. Some initial research on advertising is offered by Marshall (Marshall, 1890 & 1919) [1]. Marshall state that advertising plays an important role to provide information to consumers. Chamberlin also gives an additional point that advertising can provide information about the quality or the price of the product to change the taste of consumers (Chamberlin, 1933) [2]. Third, advertising is complementary to the advised product. "The welfare effects of advertising are often measured under the assumption that advertising causes market demand curves to shift in a parallel fashion." (Kinnucan and Zheng, 2004) [3]

Different from normal companies, luxury companies will mainly advertise their brand to attract more loyal consumers. The difference between the price of luxury fashion companies and normal companies can be seen as the price of their brand. Besides some small differences in the raw material of the product, the luxury company mainly has the same product as the normal company. Since the biggest reason why people buy luxury is the brand, the difference in the price of the luxury company and the normal company can be seen as the brand value. Different ways and amounts of advertising and the price strategy can all influence the brand image and brand value of the luxury company. Vela and Voss show that the greater the decrease of the price of a luxury good, the weaker consumer can perceive unanimous between brand image and self-image. The weaker consumer can perceive brand image and self-image consistently, the smaller the loyal consumer to the luxury brand (Vela and Voss, 2015) [4].

Persuasive advertising can increase the brand loyalty of the firm that also has an entry-deterrence effect. When advertising increases brand loyalty, it also increases the barrier to entry because current firms can increase their price and gain profit without the problem of entry (Armstrong and Porter, 2007) [5].

Brand advertising is something fresh and different from traditional advertising. Traditional advertising tends to reveal information, build a strong connection, and describe the product to consumers. However, brand advertising can increase brand value and allow consumers to purchase the product at a higher price. It is important to know how can brand advertising affect the price of luxury fashion companies and how companies can still maximize their profit and minimize their cost after the change of advertising.

This paper is trying to find out how advertising can influence the price of a company that can answer the question of why there is a huge difference between the price of a luxury company and a normal company with similar products. All firms will ultimately have the same goal in the market that is to earn more profit. Thus, it is also important to find out how the increase in advertising and the price increase can provide a higher profit for the company. After answering these two questions, there should be a clear picture that how advertising increases the brand value that led to a higher profit for a company. The hypothesis is that there is a positive relationship between advertising and price. There should be a point that advertising maximizes the profit because advertising has a decreasing marginal return. The return of the advertising should be greater than the cost of advertising until it reaches an equilibrium point. This paper hopes to calculate this equilibrium point and test the relationship between advertising and price through an empirical model.

The remainder of this paper is organized as follows. First, we discuss the theoretical model related to the research question. In section 3, we introduce the dataset and the model. We include a regular OLS regression model and panel data model for my empirical test in section 4. Finally, we conclude the paper.

2. THEORY

In the traditional model of the firm, a firm maximizes its short-term profit, where profit is the difference between total cost and total revenue. Companies select the optimal price and output to achieve the profit maximization point. The profit maximization model can provide useful information for firms to allocate their resource and select the right amount of price and output.

In the profit maximization model, price is fixed because the company won't change its price frequently and quantity is variable. To maximize the profit, the firm needs to calculate the max output first. The Cobb-Douglas production function is commonly used to explicitly model the firm. The traditional Cobb-Douglas production function is $Y = L^{\alpha}K^{\beta}$, where physical capital and labor are the only factors that will influence the output.

To maximize the profit, total revenue minus total cost.

$$\pi = TR - TC \tag{1}$$

$$\pi = \sum_{i=1}^{n} P_i Y_i - \sum_{j=1}^{m} W_j X_j. \tag{2}$$

π means the profit of the company. P_i is the price of product i. Y is the production function of product i. X_j is the normal input of product i. W_j is the cost of input j. X_h is the advertising on products i. Revenue means price times output. Cost means all material costs and labor cost. For normal calculation, profit equals the revenue, price times quantity, minus cost, labor cost and capital cost.

To maximize profit, $Max\pi = Pf(K,L) - W_1K - W_2L$, marginal revenue equals marginal cost. Taking the first-order condition to find out the optimal point for labor and capital that can maximize the company's profit.

$$\frac{\Delta\pi}{\Delta K} = \frac{p\Delta f(K,L)}{\Delta K} - W_1 \tag{3}$$

$$\frac{\Delta\pi}{\Delta L} = \frac{p\Delta f(K,L)}{\Delta L} - W_2 \tag{4}$$

In order to profit maximize, marginal revenue needs to be equal to marginal cost, which means one additional revenue equals the cost of that product.

$$\frac{p\Delta f(K,L)}{\Delta K} = W_1 \tag{5}$$

$$\frac{p\Delta f(K,L)}{\Delta L} = W_2 \tag{6}$$

This is the optimal point that profit maximizes. The firm should keep producing until the point where marginal revenue equals marginal cost because the firm has a negative return if the firm produces one more output, where the marginal cost will be greater than the marginal revenue.

Brand advertising plays an important role in a company's sales and decisions. Luxury companies will need to increase the value of their brand in order to increase their price. Consumers will be attracted by the image of the company instead of the products. After becoming the loyal consumer of the company, their demand curve will become more inelastic than before, which means the company can easily increase their price and not worry about losing their main consumers. Thus, it is important to add advertising as a new variable to the

profit maximization model to show that how can advertising influence profit.

After doing advertise, the revenue and cost of the company will all change because the price of the product has increased since the brand value increased after doing advertise and the cost of the product also increased because the company would pay for advertising. Normally, the company will set advertising expenses as a fixed cost. Companies won't change the amount they invest in advertising based on their output. For example, the firm won't increase the amount of advertising if their output have increased by 1 unit. Advertising is a function of the price and as the amount of advertising increases, the amount of price that is increased by advertising will also increase.

The new profit maximization model would be:

$$\pi = \sum_{i=1}^{n}(P_i + f(A_i))Y - \sum_{j=1}^{m} W_j X_j - WA \quad (7)$$

A_i is the brand value or the advertising expenditure of product i and $f(A_i)$ is the function of advertising that can increase the price exponentially due to the diminishing return. A is the cost of advertising. $\sum_{i=1}^{n}(P_i + f(A_i))Y$ is the revenue of the company after doing advertise. The price of product is increased by advertising, and the cost of input is also increased by advertising. Thus, the price of product should be the original price plus the brand value, which is $P_i + f(A_i)$, and the total cost should be normal cost, capital and labor, plus the cost of advertising, which is $\sum_{j=1}^{m} W_j X_j - WA$.

To maximize the profit after adding advertising, $Max\pi = \big(P + f(A)\big) * f(K,L) - W_1K - W_2L - W_3Ad$. Taking the first-order condition to find out the optimal point for labor, capital and advertising that can maximize the company's profit.

$$\frac{\Delta\pi}{\Delta K} = \big(P + f(A)\big) * \frac{\Delta f(K,L)}{\Delta K} - W_1$$

$$\frac{\Delta\pi}{\Delta L} = \big(P + f(A)\big) * \frac{\Delta f(K,L)}{\Delta L} - W_2$$

$$\frac{\Delta\pi}{\Delta A} = \Delta f(K,L) * \frac{\Delta f(A)}{\Delta A} - W_3$$

Marginal revenue equals marginal cost:

$$P * \frac{\Delta f(K,L)}{\Delta K} + f(A) * \frac{\Delta f(K,L)}{\Delta K} = W_1 \quad (8)$$

$$P * \frac{\Delta f(K,L)}{\Delta L} + f(A) * \frac{\Delta f(K,L)}{\Delta L} = W_2 \quad (9)$$

$$\frac{\Delta\pi}{\Delta A} = \Delta f(K,L) * \frac{\Delta f(A)}{\Delta A} = W_3 \quad (10)$$

This means the marginal revenue of one additional input is equal to the marginal cost of one additional input. This is the optimal quantity of capital, labor, and advertising that can maximize profit.

Compare profit maximize point before and after adding advertising. The marginal cost for labor and capital will remain the same since advertising is considered as a fixed cost when doing partial derivatives for labor and capital. $f(A) * \frac{\Delta f(K,L)}{\Delta K}$ is the amount of marginal revenue of capital increased after adding advertising. $f(A) * \frac{\Delta f(K,L)}{\Delta L}$ is the amount of marginal revenue of labor increased after adding advertising.

The optimal output will be increased after adding advertising as a new variable. The marginal cost curve will remain the same because partial derivate only considers inputs' own marginal cost. The increase of advertising cost is considered as a fixed cost and will be eliminated from the partial derivative function. However, the marginal revenue curve has shifted up because advertising is a function of price and it will also influence the partial derivate function of price.

Once the firm selects the optimal quantity of inputs to maximize their profit, it must then determine the optimal allocation of inputs to minimize their costs. Profit maximization does not necessarily correspond to the cost minimization point; the conditions will depend on the model and the market. The cost minimization model can help the firm to select the most effective labor and capital to maintain a desired level of output at their lowest cost. The cost minimization contains the isocost line and the Cobb-Douglas production function.

The isocost line, C=$P_kK + P_LL$, where P_k is the price of capital and P_L is the price of labor. Cobb-Douglas production function, $Q = K^{\alpha}L^{\beta}$, where capital and labor are the only factors that will influence the output, and α and β should be between 0 and 1.

Cost minimizes where isoquant is just tangent to the isocost line. Isoquant, $\bar{Q} = f(K,L)$, shows all the combinations of capital and labor at a given amount of output. Firms need to choose the optimal inputs to minimize its cost. Generally, the cost minimize point is the same as the profit maximizing point, just look in a different perspective.

To find out the min-cost, the firm can use cost minimization to find out the optimal inputs at a desired level of output.

$$Min\mathcal{L} = P_kK + P_LL + \lambda(f(K,L) - Q) \quad (11)$$

P_k is the price of capital, P_L is the price of labor, $f(K,L)$ is the production function, Q is the total output, and λ is the Lagrange that help calculate the optimal point.

Taking the first-order condition to find out the optimal point for labor and capital that can minimize the

company's cost. The partial derivative should equal 0 when the isoquant is just tangent to the isocost line because the slope of these two equations is the same number but with a different sign.

$$\frac{\Delta \mathcal{L}}{\Delta K} = P_K + \lambda * \frac{\Delta F}{\Delta K} = 0 \qquad (12)$$

$$\frac{\Delta \mathcal{L}}{\Delta L} = P_L + \lambda * \frac{\Delta F}{\Delta L} = 0 \qquad (13)$$

The cost minimization point occurs when the marginal product of labor divided by the wage equals to the marginal product of capital divided by the rental price of capital. The production should be most efficient when the additional output per dollar spent on each of the inputs is the same.

$$\frac{MP_{L*}}{P_L} = \frac{MP_{K*}}{P_k}$$

Rearranging the partial derivative of labor and capital based on the cost minimization rule shows:

$$L^* = \frac{P_K * \beta * K}{P_L * \alpha} \qquad (14)$$

$$K^* = \frac{P_L * \alpha * L}{P_K * \beta} \qquad (15)$$

This is the optimal labor and optimal capital that the firm needs to select to minimize the cost.

After adding advertising to the cost minimization model, the production function will remain the same because advertising will only affect the price and the cost. Advertising will be considered as a fixed cost in a certain period for the company. Companies won't change the amount of advertising frequently based on their output. Thus, the only factors that will influence output are still labor and capital. The isocost line will contain advertising as a new variable, $C = P_k K + P_L L + P_A A$.

To find out the min-cost, the firm can use cost minimization to find out the optimal inputs at a desired level of output.

$$Min\mathcal{L} = P_k K + P_L L + P_A A + \lambda(f(K, L) - Q) \qquad (16)$$

After taking the first order condition and rearrange the equation based on the cost minimization rule, the optimal labor and optimal capital remain in the same proportion since advertising did not affect the production function meaning it did not affect the derivative of the production function.

However, the actual number of the optimal labor and optimal capital will change even though the equation remain the same because the isocost line shift left since advertising uses part of the budget.

Actually, the isocost line will become a three-dimensional simplex after adding advertising as a new variable and the cost minimization model should become a three-dimensional model. However, it is difficult to graph and calculate the three-dimensional model. It would be easier to modify the model and change it back to the two-dimensional model. The answer will be slightly different when using the two-dimensional model instead of the three-dimensional model, but the idea is the same that the optimal labor and optimal capital will decrease since advertising use part of the budget and the isocost line for labor and capital decreases.

3. MODEL SPECIFICATION

Derive from the theory chapter, advertising, capital, and labor are the main factors that will influence profit. Thus, we decide to include advertising, capital, labor, and some other control variables into our regression equation to have a precise estimation. The regression equation is shown below:

$$\text{Price} = \beta_0 + \beta_1 * Advertising + \beta_2 * Total\ Assets + \beta_3 * Number\ of\ Employees + \beta_4 * Gost\ of\ \ Good\ Sold + \beta_5 * EPS + \epsilon \qquad (17)$$

The dependent variable should be price based on the regression equation above. However, it is hard to find the price data online since there is no public dataset that includes prices for public companies. One way to solve this problem is to collect prices manually online from the different companies' websites. However, this would raise a new problem that there are different prices for different products in one company and how to turn hundreds of different prices into one variable. The calculation would be too complicated, and the methodology would be wrong. It would easily cause an error during the calculation and misinterpret the result. Total revenue and profit are all related and derive from price. Based on the theoretical chapter above, the company maximizes their profit by selecting the appropriate labor, capital, and advertising. However, profit equals total revenue minus total cost. Since we include cost of goods sold as our control variable in the regression equation, using profit as the dependent variable will cause endogeneity. Thus, we decide to use total revenue as a substitute for price as the dependent variable. Total revenue equals price times quantity. Thus, it can somehow represent the price since total revenue derives from price. However, there is some limitations of using total revenue as the dependent variable. Total revenue cannot predict the model as precisely as price. Thus, we need first to determine how total revenue is affected by the price.

The main independent variable should be advertising expense since advertising is the main factor we want to analyze. The advertising expense for different companies can be found in either annually financial report or the U.S. Security and Exchange Commission.

However, there are still some limitations for using advertising expense as the independent variable. Advertising expense is not the only way to estimate the

effect of advertising. How, where, and what content of the advertising may also influence the effect of advertising. However, it is hard to quantify and estimate other different ways advertising has been used. Thus, the most appropriate way to estimate advertising is to use advertising expense. The data was collected from Yahoo finance and the U.S. Security and Exchange Commission. The dataset includes 99 observations from 33 different companies in 2018, 2019, and 2020. After gathering the data, we specify regular OLS and panel data as the appropriate model.

4. EMPERICAL RESULT

Before running the model, it is important to test the econometric problems that might influence the accuracy of the results. One of the most common ways to eliminate multicollinearity is to remove all but one collinear independent variable. another way to eliminate multicollinearity is to combine two or more collinear variables into one single variable.

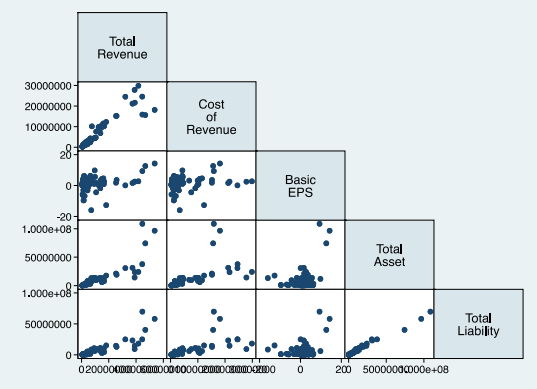

Figure 1 Matrix shows the relationship between each variable

Based on figure 1, it is clear to see that there is almost a positive linear relationship between total assets and total liabilities. Thus, we decided to eliminate the variable total liabilities because we want to use total assets since it is included in the theoretical model.

After eliminating total liability, we decide to use the VIF test to test whether there is multicollinearity in the model or not. The result of multicollinearity is a little bit over 5 in the first three models. However, the highest multicollinearity comes from the cost of goods sold. Thus, 23 believe multicollinearity is not a big problem in this situation.

Heteroskedasticity is another econometric problem that may influence the result of the model. Based on the matrix above, there is some heteroskedasticity that exists between total revenue and the cost of goods sold. To reduce the heteroskedasticity, we decide to transform all variables to log versions.

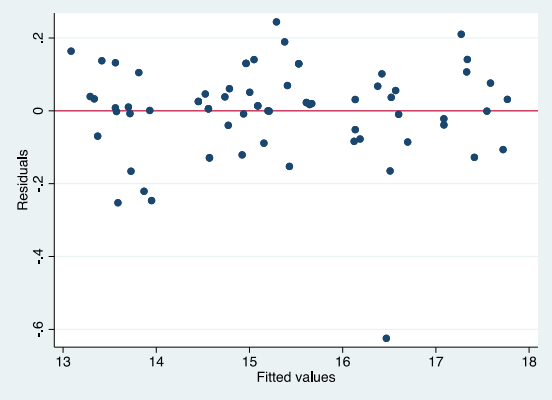

Figure 2 Residual plot for regular OLS model after transforming variables

From the residual plot, we can see that there is basically a constant variance over time. Even though there is an outlier, we believe it is not significant since we have enough variables to predict the result.

To test heteroskedasticity, we decide to use the Breusch-Pagan test. The result shows that the p-value is greater than 0.05, which means failing to reject the null hypothesis that there is homoscedasticity present in the model.

Table 1. Regression table of Panel Data Model

	(1)	(2)
VARIABLES	Drop 2020	Regular
AdvertisingExpense	2.138***	3.102***
	(0.446)	(0.356)
CostofRevenue	1.071***	1.088***
	(0.0757)	(0.0732)
BasicEPS	103,572	96,922***
	(70,324)	(27,695)
TotalAsset	0.187***	0.100***
	(0.0375)	(0.0224)
Numberofemployees	13.73	10.31
	(8.672)	(7.716)
Constant	24,890	208,137
	(230,407)	(178,311)
Observations	66	98
Number of Name	33	33

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1 shows the regression result for the regular panel data model and for panel data that drop 2020. From the regular panel data model, there is a positive

coefficient for advertising expense, indicating one unit of increase in advertising expense will increase 3.102 units of total revenue. For the panel data model that drops 2020, there is a positive coefficient for advertising expense, indicating one unit of increase in advertising expense will increase 2.138 units of total revenue. The result of both panel data models proves our hypothesis that advertising expense will have a positive effect on total revenue. After controlling for time variable and category variable, an increase in advertising expense will lead to an increase in total revenue for each individual company in each year.

There is also a positive coefficient for cost of revenue and total assets in both regular panel data model and panel data model that drop 2020, which means adding the cost of revenue and total assets as the control variables will increase the accuracy of the estimation of the coefficient for advertising expense. Since the cost of revenue and total assets are both statistically significant, adding these two variables as the control variables decrease the omitted variable bias because the coefficient of advertising will only represent the relationship between advertising expense and total revenue in this case and exclude the influence of other omitted variables.

Table 2. Regression table of Regular OLS Model

	(1)	(2)
VARIABLES	Regular	Drop 2020
logAdvertising	0.0234***	0.0203***
	(0.00491)	(0.00637)
logCGS	0.521***	0.504***
	(0.0587)	(0.0587)
logEPS	0.0316***	0.0190
	(0.00962)	(0.0114)
logAsset	0.314***	0.343***
	(0.0296)	(0.0329)
logEmployees	0.114***	0.114***
	(0.0399)	(0.0403)
Constant	1.480***	1.348***
	(0.251)	(0.265)
Observations	69	59
R-squared	0.990	0.989

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 shows the regression result for the regular OLS regression model and for the OLS model that drops 2020. For the first regular OLS regression model, the positive coefficient for log advertising expense means one unit of increase in log advertising expense will increase 0.0234 unit of log total revenue. For the second OLS regression model that drops 2020, the positive coefficient for log advertising expense means one unit of increase in log advertising expense will increase 0.0203 unit of log total revenue.

The result of the model shows that advertising expense still has a positive relationship with total revenue even when not controlling the time variable and category variable. Moreover, covid-19 did not influence the effectiveness of advertising expense based on the result of the first and the second model. Even during the covid period in 2020, an increase in advertising expense can still increase the total revenue. This result is reasonable because people tend to stay at home and prefer online shopping when covid start at the beginning of 2020. The most efficient way for people to know the product or the brand is through online advertising. Thus, companies that advertise more during the covid period will have a positive increase in their total revenue.

Table 3. Regression table of Regular OLS Model that Estimate the Difference

	(1)
VARIABLES	Difference
ChangeAdvertising	2.927***
	(0.674)
ChangeCGS	1.852***
	(0.178)
ChangeEPS	26,880
	(24,233)
ChangeAsset	0.0126
	(0.0207)
ChangeEmployees	-13.57
	(14.06)
Constant	70,228
	(160,470)
Observations	66
R-squared	0.831

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3 shows the regression result for the regular OLD regression model that estimates the difference between each variable. The positive coefficient for change of advertising expense means one unit of increase

in log advertising expense will increase 0.0234 unit of log total revenue. This result means the increase in the change of total revenue comes from the increase of the change of advertising expense. Thus, the total revenue has a positive relationship with the current advertising expense, not the advertising expense in previous years.

Combining all the results from different regression models above, it can be concluded that advertising and the cost of goods sold have a strong positive correlation with total revenue in all cases. Total asset has a positive correlation with total revenue in almost all cases, whereas basic EPS and number of employees are statistically insignificant in almost all cases.

The result of the empirical models strongly confirms the theoretical theory from this paper above that advertising can increase the company's total revenue because it can increase the company's brand value. Advertising expense will have a positive influence on total revenue no matter which type of model has been used. Advertising has become an essential factor if companies want to increase their total revenue and attract more loyal consumers.

However, there are some limitations of the empirical model. Even though there is a positive relationship between advertising expense and total revenue, companies should not continuously increase their advertising expense. The decreasing marginal return of advertising indicates that companies should stop their advertising when the marginal return of advertising equals the marginal cost of advertising. The five empirical models in this paper estimate the relationship between advertising expense and total revenue in linear regression. The result of the estimation will be more accurate when using a non-linear regression model. Thus, companies need to consider this diminishing marginal return when making decisions to advertise their brand and product.

5. CONCLUSION

This paper analyzes the effect of advertising on price and how advertising helps luxury companies to set an expensive price in the market. The initial hypothesis is that how advertising has been used, the content of advertising, and the amount of advertising expense will all have a positive influence on price that will create a high profit for the company. Advertising increases the brand value for luxury companies that lead to a high price and high profit in the market.

The theoretical chapter uses the profit maximization model and cost minimization model to estimate the influence of advertising on profit. By adding advertising into the original model, the equilibrium amount of advertising and the increased amount of profit can be calculated. Even though the cost minimization fails to establish a 3-D model, it still shows the influence of advertising on cost.

For the empirical model, we decide to use both the regular OLS regression model and the panel data model to test our hypothesis. The data have been collected by using NAIC code, yahoo finance, and the 10-k report on the U.S. Security and Exchange Commission. The result of all empirical models indicates that the increase in advertising expense can lead to an increase in total revenue. Moreover, it is surprising to see that there is still a positive relationship between advertising expense and total revenue during the covid period in 2020. This result strongly proves that advertising has become a necessary component in companies' operations. However, companies still need to be careful when deciding to advertise their brand and product because of the diminishing return of advertising.

Limitations of this paper include the small dataset and the change of model variables. Further research can include a larger dataset that includes worldwide companies from numerous years. The empirical model will provide a more precise result after adding more observations. Even though there is some significant result and meaningful interpretation, total revenue is not the most appropriate dependent variable for the empirical model. The result of the model can provide a more plausible explanation on the research question if using price as the dependent variable. Moreover, many other important variables need to be included in the regression equation, for example, quantity and market share. However, we did not include all the necessary variables due to the lack of dataset and unpublished information from companies. Thus, further research can include more control variables to provide a more precise estimation between the dependent variable and the independent variable.

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