PRICE WAR: AN EMPIRICAL STUDY IN INDONESIAN MARKETPLACE

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ABSTRACT

The goal of this research is to create a price war model for the Indonesian market and examine actual data from price competition in the country (Shopee Indonesia). According to the Bertrand basic model, if two sellers have similar cost structures and offer homogenous items, the seller must establish a price at marginal cost and cannot change it. The company will be unable to sell its own items if the price is raised. The Bertrand model for differentiated products then demonstrates that if the differentiated commodities are comparable, the price choice is influenced by the cost structure. If a company's cost structure is consistent, the price set will be consistent as well. Empirically, it is difficult to locate suppliers that match the Bertrand basic model's criteria, particularly when it comes to the same cost structure. The result of this research said that empirically price wars occur in homogenous product marketplaces, even when prices are not same owing to cost structure variations. In a differentiated product market, on the other hand, the pattern of price fluctuations tends to vary from one another.

Keywords: price war, e-commerce, oligopoly, Bertrand model

INTRODUCTION

E-commerce transactions in Indonesia have increased in recent years. E-commerce transactions during 2020 reached US$ 32 billion, a significant increase from 2019, which was only US$ 21 billion. The increase was due to Indonesia's growth in internet use, the number of new payment alternatives such as the pay-later system, and social restrictions due to the COVID-19 in 2020 (Katrina & Benedict, 2021). The growth of e-commerce has caused many conventional sellers to switch to e-commerce. Many sellers who previously had stores in markets, malls, and shopping centers turned to marketplaces to increase exposure and sales (Das et al., 2018). This certainly causes increased competition between sellers in the marketplace.

The ease of being a seller in the marketplace causes many sellers to sell the same goods, either precisely the same or differentiated. This causes fierce competition in the marketplace, especially in price or what is often referred to as a price war. This is exacerbated by the ease with which one seller sees the prices of goods sold by other sellers and how buyers compare prices across many sellers in the marketplace (Volna, 2018). This fact is undoubtedly fascinating to discuss economically. The economy has a model that can

be used to analyze the price war between two companies, which is often called the Bertrand model (Pepall et al., 2014).

Many researchers have researched price war. For example, Silveira & Oleivera (2008) examined the price war model for the Brazilian airplane industry. Then, research on price wars in e-commerce and marketplaces has also been carried out by many researchers. For example, Liu (2021) simulated the competition between two marketplaces in China (JD.com and Suning). Next, Chen et al. (2016) researched the pricing strategy at Amazon. However, there has been no research on the pricing war that focuses on the Indonesian marketplace.

Research on price competition, especially in the marketplace in Indonesia, is interesting to study. This is due to the growth of e-commerce transactions in Indonesia and the rampant price competition in e-commerce, leading to predatory pricing (Dewaranu, 2021). Therefore, researching how sellers in the marketplace set the price and how the price changes could affect sales is fascinating.

This study aims to explain a model that can describe price competition between sellers in the marketplace. In addition, this research will also empirically see the price competition in the marketplace and the effect of price change on sales change. This research is expected to be pioneer research that discusses the price war in the Indonesian marketplace. This research begins with the background then continues with forming a price competition model in the Indonesian marketplace. Furthermore, this study will discuss the empirical facts of price competition in the marketplace, and finally, this study will close with conclusions.

LITERATURE REVIEW

Price War Model

Basic Bertrand model

In economics, a model called the Bertrand Model can explain the price war in the marketplace. Jehle & Reny (2011) explain that this model has several assumptions. There are only two firms in the market. Both firms produce homogeneous goods and have identical marginal costs, there is no fixed cost in the two companies, and two firms will choose their strategy simultaneously. Pepall et al. (2014) describe the quantity to be produced by the two firms as follows:

Assume the market demand function is below:

$$Q = a - bP$$

Q is the quantity produced/demanded, and P is the market price. Now suppose that firm 1 lowers the price, because the goods being sold are homogeneous, then when firm 1 lowers the price, and firm 2 does not lower the price, all market demand will be supplied by firm 1, and firm 2 cannot sell the goods at all. Similarly, when firm 2 lowers the price, when firm 1 does not lower the price, all demand will be supplied by firm 2, and firm 1 will not be able to sell its goods. Finally, when the prices set by firm 1 and firm 2 are the same, then market demand will be divided equally by the two firms. Mathematically, this case can be written in the illustration below. Suppose P_1 is the price set by firm 1, P_2 is the price set by

firm 2, Q_1 is the output of firm 1, Q_2 is the output of firm 2, and C is the marginal cost (in this case, marginal cost is equal to average cost). So, from the firm 1 side, the output of firm 1 (Q_1) is as follows:

$$Q_1 = a - bP_1 \text{ if } P_1 < P_2$$
$$Q_1 = 0 \text{ if } P_1 > P_2$$
$$Q_1 = \frac{a - bP_1}{2} \text{ if } P_1 = P_2$$

Furthermore, the profit of firm 1 can be shown as below:

$$\Pi_1 = (P_1 - C)(a - bP_{1)} \text{ if } P_1 < P_2$$
$$Q_1 = 0 \text{ if } P_1 > P_2$$
$$\Pi_1 = (P_1 - C)(\frac{a - bP_1}{2}) \text{ if } P_1 = P_2$$

Jehle & Reny (2011) explain that when the price set by firm 1 (P_1) and firm 2 (P_2) exceeds the marginal cost (C), then there is no Nash equilibrium because firm 1 can lower the price slightly below the price set by the firm. 2 to get the output of the entire market. Therefore, in the Bertrand model, nash equilibrium will occur when P_1 and P_2 are equal to C. So, in this condition, firm 1 and firm 2 must set the price equal to the marginal cost and get zero economic profit.

Bertrand model with differentiated product

Although the Bertrand model assumes that the goods sold by two companies are homogeneous, the model can also be applied to similar products, but there are differentiations, such as design, raw materials, performance, and durability of these products (Pindyck & Rubinfeld, 2013).

In the case of differentiated goods, it is assumed that the demand for firm 1 and firm 2 is as follows:

$$Q_1 = a - bP_1 + cP_2$$
$$Q_2 = d - eP_2 + fP_1$$

The positive sign before the coefficients c and f, indicates that the goods sold by firm 1 and firm 2 can be substituted. That is, if the price offered by firm 1 increases, the demand for firm 2's goods will increase. On the other hand, if the price offered by firm 2 rises, the demand for firm 1's goods will also increase.

Then, assume that the total cost (TC) function could be represented as below:

$$TC_1 = gQ_1$$
$$TC_2 = hQ_2$$

Thus, the profit function for firm 1 could be derived as below:

$$\Pi_1 = TR_1 - TC_1$$
$$\Pi_1 = (P_1Q_1) - gQ_1$$
$$\Pi_1 = P_1(a - bP_1 + cP_2) - g(a - bP_1 + cP_2)$$
$$\Pi_1 = aP_1 - bP_1^2 + cP_1P_2 - ag + bgP_1 - cgP_2$$

After that, we could find the price which satisfies the profit maximization of firm 1 as follow:

$$max(\Pi_1) = max(aP_1 - bP_1^2 + cP_1P_2 - ag + bgP_1 - cgP_2)$$

$$\frac{\partial \Pi_1}{\partial P_1} = 0$$

$$a - 2bP_1 + cP_2 + bg = 0$$

$$2bP_1 = a + cP_2 + bg$$

$$P_1 = \frac{a + cP_2 + bg}{2b}$$

Continue to firm 2, the profit function for firm 2 could be presented as follow:

$$\Pi_2 = TR_2 - TC_2$$

$$\Pi_2 = (P_2Q_2) - hQ_2$$

$$\Pi_2 = P_2(d - eP_2 + fP_1) - h(d - eP_2 + fP_1)$$

$$\Pi_2 = dP_2 - eP_2^2 + fP_1P_2 - hd + ehP_2 - fhP_1$$

Then, we could find the price that satisfies the profit maximization of firm 2 as below:

$$max(\Pi_2) = max(dP_2 - eP_2^2 + fP_1P_2 - hd + ehP_2 - fhP_1)$$

$$\frac{\partial \Pi_2}{\partial P_2} = 0$$

$$d - 2eP_2 + fP_1 + eh = 0$$

$$2eP_2 = d + fP_1 + eh$$

$$P_2 = \frac{d + fP_1 + eh}{2e}$$

Recall the price of firm 1's product as below:

$$P_1 = \frac{a + cP_2 + bg}{2b}$$

We can compare the prices set by firm 1 and firm 2, the price equations above are similar. Suppose firm 1 and firm 2 sell similar goods even though they are differentiated, so we can assume that the coefficients are a=d, c=f, and b=e. Thus, P_1 and P_2 can be converted as below:

$$P_1 = \frac{a + cP_2 + bg}{2b}$$

$$P_2 = \frac{a + cP_1 + bh}{2b}$$

Based on the two equations above, it can be seen that the difference between the two equations above is in the coefficients g and h which represent average cost or marginal cost (in this case, the average cost is equal to marginal cost). If firm 1 and firm 2 have the same cost structure, it can be assumed that g = h, and the P_1 could be represented as follow:

$$P_1 = \frac{a + cP_2 + bg}{2b}$$

$$P_1 = \frac{a + c\left(\frac{a + cP_1 + bg}{2b}\right) + bg}{2b}$$

$$2bP_1 = a + c\left(\frac{a + cP_1 + bg}{2b}\right) + bg$$

$$2bP_1 = \frac{2ab + ac + c^2P_1 + bcg + 2b^2g}{2b}$$

$$4b^2P_1 = 2ab + ac + c^2P_1 + bcg + 2b^2g$$

$$4b^2P_1 - c^2P_1 = 2ab + ac + bcg + 2b^2g$$

$$(4b^2 - c^2)(P_1) = 2ab + ac + bcg + 2b^2g$$

$$(2b + c)(2b - c)(P_1) = 2ab + ac + bcg + 2b^2g$$

$$(2b + c)(2b - c)(P_1) = (2b + c)(a + bg)$$

$$(2b - c)(P_1) = (a + bg)$$

$$P_1 = \frac{a + bg}{2b - c}$$

Then, the P_2 could be represented as follow:

$$P_2 = \frac{a + cP_1 + bg}{2b}$$

$$P_2 = \frac{a + c\left(\frac{a + cP_2 + bg}{2b}\right) + bg}{2b}$$

$$2bP_2 = a + c\left(\frac{a + cP_2 + bg}{2b}\right) + bg$$

$$2bP_2 = \frac{2ab + ac + c^2P_2 + bcg + 2b^2g}{2b}$$

$$4b^2P_2 = 2ab + ac + c^2P_2 + bcg + 2b^2g$$

$$4b^2P_2 - c^2P_2 = 2ab + ac + bcg + 2b^2g$$

$$(4b^2 - c^2)(P_2) = 2ab + ac + bcg + 2b^2g$$

$$(2b + c)(2b - c)(P_2) = 2ab + ac + bcg + 2b^2g$$

$$(2b + c)(2b - c)(P_2) = (2b + c)(a + bg)$$

$$(2b - c)(P_2) = (a + bg)$$

$$P_2 = \frac{a + bg}{2b - c}$$

$$P_1 = P_2 = \frac{a + bg}{2b - c}$$

Therefore, it can be concluded that $P_1 = P_2$. Based on this, there will be a Nash equilibrium in the Bertrand model for two firms that have differentiated products where P_1 is equal to P_2, on the condition that both firms have the same cost structure. Therefore, the profit function for firm 1 and firm 2 is represented as follow:

$$\Pi_1 = \left(\left(\frac{a + bg}{2b - c}\right) - g\right)Q_1$$

$$\Pi_2 = ((\frac{a + bg}{2b - c}) - g)Q_2$$

METHODS

This research uses qualitative and descriptive method to analyze the price war in Indonesia Marketplace. The author gathered the data from Shopee Indonesia using Aliprice application. This application was used for gather the price data automatically. The population of this research is all sellers in Shopee Indonesia. In this research, the author take the top seller of "Nuvo hand sanitizer 50ml" as a sample since the product is homogeneous goods which is proper with Bertrand model characteristics.

RESULTS

Based on the basic model of the Bertrand model, sellers in a homogeneous goods market will tend to set the same price as their competitors. Empirically, the author tries to compare the prices of goods at Shopee with the type of goods "Nuvo hand sanitizer 50 ml" in the Greater Jakarta area as an example for a homogeneous goods market. In figure 1 below, we can see that the seller with the most sales (more than 10,000 sales), set very similar prices between IDR 4,290 to IDR 4,390.
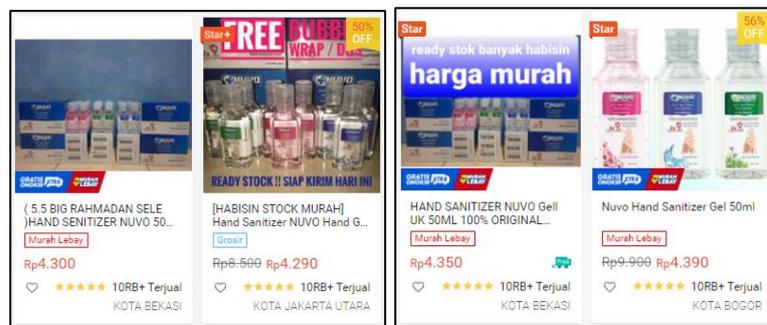
Figure 1. The Comparison of Price at Homogeneous Goods Market

Moreover, the Bertrand model also explains that when there is a seller who sells his goods at a higher price (in this case, much more expensive), then the seller will not be able to sell his goods (in this case, he can sell the goods with a quantity far below the competitors). This can be seen in the sellers below who set prices at IDR 5,500 and IDR 5,999 and it is proven that their sales were very low, which are 1 unit was sold, and 11 units were sold, respectively. This situation can be seen in figure 2 as below:

Figure 2. Examples of Sellers Who Sell Above the Normal Price

Then, the author tries to see how price changes made by the seller can affect sales. In figure 3, we can see that sellers are trying to increase the price on September 1, 2021 from IDR 4,400 to IDR 5,500. This increase in price significantly decreased sales because at the same time, other sellers did not increase their prices (still selling between IDR 4,300 - IDR 4,400). From September 1, 2021 to September 10, 2021, sellers can only sell 3 units of goods. Whereas, previously, sellers could sell approximately 100 units per day. Therefore, the sellers started to lower the price back to IDR 4,450 and then to IDR 4,250 so that the selling was back to normal.
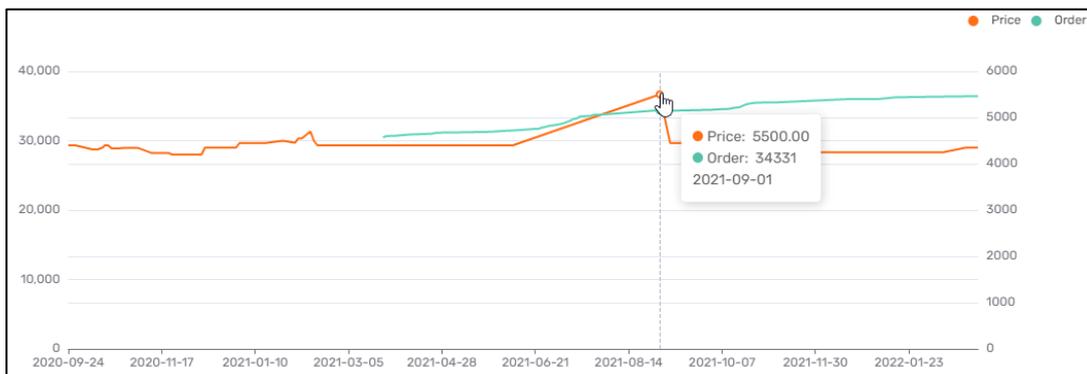

Figure 3. Examples of The Effect of Change in Price

After that, the author tries to see the empirical facts of price competition in the market for differentiated goods. Based on the model that the author has presented in the previous section, in the case of differentiated goods, the price depends on the firm's cost structure. If the cost structure between the firm and its competitors is the same, the price set tends to be the same. On the other hand, if the cost structure differs, the prices set also tend to be different. To observe this case, the author uses the example of the item "cotton combed 30s T-shirt" because although the items sold are quite similar, there is room for differentiation, for example, in terms of color and quality of stitches. The empirical fact can be seen in figure 4 below:

Figure 4. The Comparison of Price at Differentiated Goods Market

In figure 4, it can be seen that the three sellers with the most sales (over 10,000 units) have varying prices. Although the middle and right products have similar prices, the left products have quite different prices. This is possible because the T-shirt market is a differentiated goods market, so the product on the left can have a different cost structure and result in different pricing from its competitors.

Furthermore, in terms of price changes, the left, middle, and right products have different price change patterns. The pattern of price changes for the three products above can be seen in figure 5 below:

Figure 5. The Comparison of Price Changes in Differentiated Goods Market

Then, the next interesting question is whether price changes (increasing or decreasing) can decrease or increase sales from sellers in the differentiated goods market or cannot. The answer is yes, it can. For example, when the seller of the middle-side product increases the price to IDR 28,900 on October 1, 2021, the seller can only sell 41 units of goods in the period October 1, 2021 - October 2, 2021. Whereas normally, the seller can sell goods between 60 - 80 units per day. On the other hand, the right seller once lowered the price on October 14, 2021, from IDR 23,000 to IDR 19,750. This resulted in sales on October 14, 2021, reaching 1,071 units, whereas normally, sales are around 500 - 800 units per day.

DISCUSSION

So, how can a seller in a homogeneous market sell goods at a higher price than competitors? Bertrand model explains that when a competitor has a price slightly above the competitor, he will not be able to sell his goods. However, in reality, it is very difficult to

find identical sellers with the same cost structure. So that even though the goods are the same, there can be differences in the cost structure, so the prices set by the sellers will be different. DiRusso et al. (2011) explains that the price of an item is influenced by the return policy, company logo, customer contact option, and so on.

In addition, the consumer's decision to buy an item is not as simple as comparing prices from one seller to another. Suwasono (2020) explains that a consumer's decision to buy is not only determined by the price, but also the location of the seller, delivery method, positive reviews from previous buyers, and others. As an illustration, suppose there is 1 item for IDR 4,000 and IDR 5,000. The first seller of goods is located in East Jakarta, while the second seller of goods is located in Bandung. Buyers who come from Bandung will certainly choose items that have a price of IDR 5,000 because if you consider shipping costs, the amount of money that must be paid to buy the first item will be more expensive. This means Bertrand's model is simplified, but in reality, pricing decisions and consumer decisions to purchase an item are complex decisions that consider various factors.

CONCLUSION

This study aims to develop a price war model in the Indonesian marketplace and observe empirical facts from price competition in the Indonesian marketplace (Shopee Indonesia). The Bertrand basic model shows that assuming two sellers have identical cost structures and sell homogeneous goods, the seller must set a price at marginal cost and cannot increase or decrease the price. If the firm raises the price, it will not be able to sell its own goods.

Then, the Bertrand model for differentiated goods shows that if the differentiated goods are similar, the pricing decision depends on the cost structure. If the cost structure is the same from one firm to another, the price set will also be the same.

Empirically, it is difficult to find sellers who meet the requirements of the Bertrand basic model, especially concerning the same cost structure. However, based on empirical facts, it is known that price wars occur in homogeneous product markets, even though prices are not exactly the same due to differences in cost structures. On the other hand, in a differentiated product market, the pattern of price changes tends to be different from each other.

In closing, the Bertrand model, both the basic and differentiated models, are simplified models. Pricing decisions and consumer decisions to buy goods are much more complex than simply comparing the cost structure and prices of goods, respectively. However, the Bertrand model is very useful in explaining how price competition exists in the market and how one firm reacts to price changes from another firm.

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