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Product Attributes, Product Differentiation, and
Market Segmentation

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Product Attributes, Product Differentiation, and Market Segmentation¹⁾

1. Vertical Attributes and Horizontal Attributes

Product attributes are the features of a product that are recognizable to consumers. Consumer evaluation of the products is dictated by how the values of the product attributes are combined. For example, if the screen size and picture quality of a television set of a certain brand are the only attributes recognizable to consumers, the feature of the television is represented as the value of these two attributes. Accordingly, consumer satisfaction is determined by the combinations of these values.

When you consider a product as a bundle of attributes, you can position the product within a space consisting of the multidimensional attributes. This space is called the “multiattribute space.” In the previous example, television sets of different brands can be positioned in the two-dimensional attribute space composed of screen size and picture quality.

There are two kinds of product attributes: vertical attributes and horizontal attributes. Vertical attributes represent the attributes most consumers agree upon when regarding a product’s merits and demerits. Horizontal attributes, on the other hand, are the attributes whose merits and demerits are evaluated differently by consumers. For instance, all consumers believe that it is better that the battery of a cellular phone last as long as possible. Therefore, in this respect, the attribute of a cellular phone is vertical. Similarly, the clarity of voices and images is vertical as well. However, for design, this is not the case. Some consumers may choose a simple design, but others may have a negative view of it. Hence, in respect to design, the attribute of a cellular phone is horizontal.

Generally speaking, the quality and performance of a product are vertical attributes because consumers believe that the higher their standard the better. Meanwhile, things that are different for different consumers, such as designs and tastes, can be considered horizontal attributes.

These two types of attributes are distinguished from each other because this distinction can cause differences in how to view product differentiation. Here, we can divide product differentiation into two kinds: One is vertical differentiation, which is differentiating a product in order to satisfy all consumers. The other is horizontal differentiation. This differentiation does not necessarily improve all consumers’ satisfaction. In fact, not a few consumers may become

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less satisfied than before.

First, imagine a product that has only a single attribute recognizable to consumers. Let us examine how product differentiation can be affected, depending on whether the attribute is vertical or horizontal.

When the single attribute is vertical, product differentiation according to the vertical attribute is, without fail, vertical. For example, when the single attribute (ex. strength) of packing tape is vertical, if a packing tape manufacturer can produce tape stronger than those of its competitors, the manufacturer can achieve vertical differentiation. This vertical differentiation signifies the advantageous product quality that has elements desirable to all consumers. Accordingly, the manufacturer can sell their tape at higher prices than their competitors, gaining profits or securing market share.

On the other hand, when the only attribute to differentiate products is horizontal, the product differentiation based on it is always horizontal. For instance, if the single attribute of household fragrance is the strength of scent, the attribute is horizontal. This is because some consumers prefer strong scents and others prefer mild scents. When a manufacturer sells the fragrance with a stronger scent than conventional fragrances, the differentiation of the product is horizontal. Whether this differentiation can gain profit or market share depends on the number of consumers who want the product. Therefore, this differentiation does not automatically put the product in a competitive position. It may even cause a loss of market share because consumers may find the scent too strong, therefore disliking the product.

2. Horizontal Differentiation within the Horizontal Attribute Space

The paper has so far discussed differentiation based on a single attribute. However, reality is a little more complex. Consumers usually make judgments based on more than one attribute. Therefore, the idea of vertical and horizontal differentiations needs to be considered with more than a single attribute.

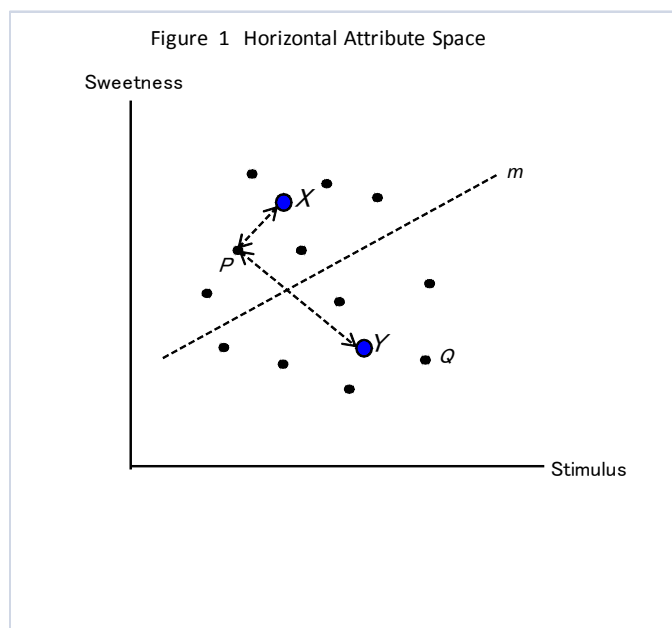
First, let us image a case where two attributes are both horizontal. Within the attribute space defined by these two horizontal attributes, each consumer has their ideal point, which is the combination of their ideal attribute values. This represents the point where the consumer is most satisfied. The farther away a point is from the ideal point, the lower his or her satisfaction is. Furthermore, since there is no agreement among consumers in the case of horizontal attributes regarding what they desire, those ideal points are scattered within the attribute space. Hence,

even if consumers are provided with a new combination of attribute values that are different from a conventional one, some of them will find this new combination satisfying, while others, who have different ideal points, will find it less satisfying than before. Therefore, product differentiation within a horizontal attribute space does not meet the condition of vertical differentiation, which is the agreement of almost all consumers. It is always horizontal differentiation.

Consumers measure the distance between their ideal point and the position of the attributes of conventional products. Then they compare it with the distance between their ideal point and the position of the attributes of the new product. When the latter distance is shorter than the former one, consumers feel more satisfied with the new product. This is true based on the premise that the contour regarding consumer satisfaction is circular and that satisfaction lowers in every direction.

Figure 1 shows the attribute space of two horizontal attributes: the sweetness and stimulus of carbonated drinks. X and Y , both of which are carbonated drink brands, are located in particular positions in Figure 1, according to the level of sweetness and stimulus in each. On the other hand, P represents the ideal point of a consumer P . This consumer selects X , rather than Y , because X is closer to his or her ideal point.

Another consumer Q selects the Y brand, because it is closer to his or her ideal point. Accordingly, it can be expected that consumers whose ideal points are above m , which is the bisector of the segment XY , will select X , whereas those whose ideal points are below m will choose Y .

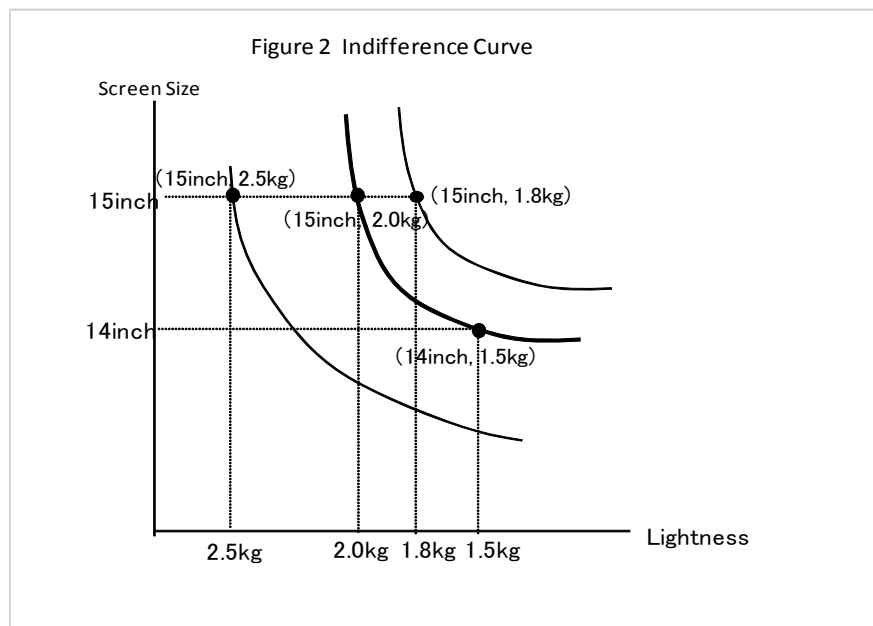


3. Horizontal and Vertical Differentiation within Vertical Attribute Space

Now, let us consider the case where two attributes are both vertical. To better understand the case, it is necessary to understand the indifference curve among attributes for consumers. The indifference curve among attributes represents the group of points where a consumer recognizes the same satisfaction level regarding the combinations of two attribute values. It is the contour of the satisfaction level of the consumer within attribute space.

For example, let us assume a case in which laptop computers are evaluated based on two attributes: the screen size and lightness. When a 14 inch/1.5 kg PC and a 15 inch/2.0 kg PC bring the same level of satisfaction to a consumer, the indifference curve passes the point of 14 inch/1.5 kg and the point of 15 inch/2.0 kg (see Figure 2). This indifference curve is effective enough if it shows virtual possibilities. It is not necessary at all to consider products in between, for example, a laptop computer with a 14.5 inch screen.

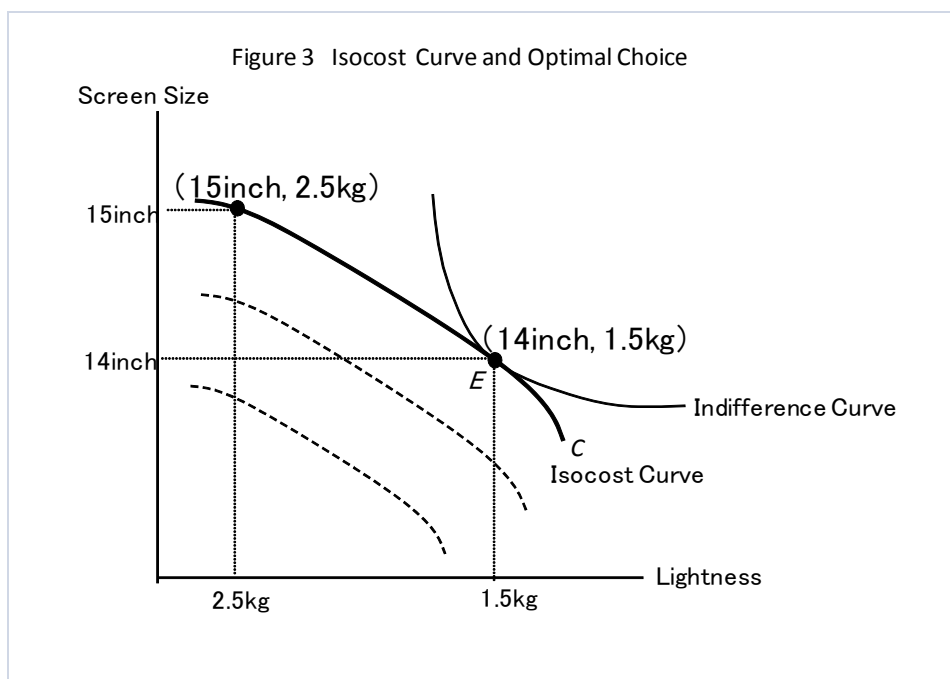
Furthermore, an infinite number of indifference curves can be drawn, just as contours, with indifference curves of higher levels of satisfaction on the upper right of this indifference curve and those of lower levels of satisfaction on the lower left of the curve. For instance, on the upper right can be an indifference curve passing through the point of 15 inch/1.8 kg, which means a higher level of satisfaction to the consumer. Likewise, on the lower left can be an indifference curve passing through the point of 15 inch/2.5 kg. These are virtual cases, so they do not have to be reflected on real products.



Moreover, an isocost curve connecting the combination of the attributes that can be fixed for the same total cost of production and development on the part of a manufacturer can be drawn. The combinations of the attribute values on this curve can be represented as the products sold at the same price. For instance, if the production and development cost of an 1.5 kg laptop computer with a 14 inch monitor and a 2.5 kg laptop computer with a 15 inch monitor is the same, the isocost curve passes through the point of 14 inch/1.5 kg and the point of 15 inch/2.5 kg, and both are sold at the same price. In addition, on the upper right of this curve are curves of higher costs and prices. As the production and development become closer to technical limits, the cost should shoot up. On the lower left, the curves of lower costs and prices can be drawn. These curves do not also have to reflect real products.

Then, from among the numerous points on these numerous indifference curves and isocost curves, one particular contact point is chosen. This contact point signifies the maximum profit for the manufacturer, which is calculated from the demand based on consumers' satisfaction and production cost. The point also signifies that consumers think a particular product is worth the price they pay. When these conditions are met, the product, which is the representation of the attributes of the contact point, is traded.

For example, when the contact point of a personal computer is at point *E* in Figure 3, a consumer selects a 1.5 kg laptop computer with a 14 inch monitor. This is because if he or she chose any point just a little right or left of point *E* on the indifference curve, which would be the outside the isocost curve *C*, he or she would pay a higher price for the product that could give him or her the same satisfaction at a lower price. Therefore, he or she does not select products of any points, right or left, of the contact point on the indifference curve.

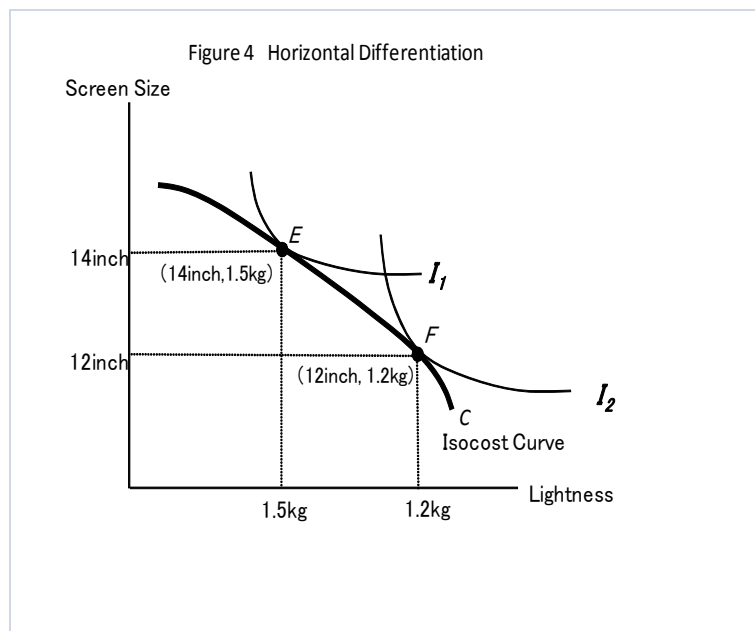


Furthermore, any point to the upper right of point E , even if just a little, means a higher price due to higher production cost. A consumer will decide that the product does not deserve the price. Therefore, there no transaction made will be made. Conversely, any point to the lower left of point E , even if just a little, means a decrease in consumer satisfaction despite a lower price. Therefore, a consumer will decide that the product does not deserve the price and there will be no transaction.

As for this case, where the two attributes are both vertical, not all product differentiations bring vertical differentiations of vertical attributes. Vertical differentiation can be defined as differentiation satisfying almost all consumers to a high degree. However, if only one of the two attributes is highly valued, not all consumers support the product.

Figure 4 shows the isocost curve passing through the point of 14 inch/1.5 kg, representing a 1.5 kg laptop computer with a 14 inch monitor. Then, a manufacturer produces a 1.2 kg computer with a 12 inch monitor to differentiate the product. This is probably because some consumers require a monitor size to be at least 14 inches, while others seek lighter laptop computers even if it means smaller monitor sizes. The indifference curve of the latter group is I_2 , and this curve is tangent to the isocost curve C on point F (12 inch/1.2 kg).

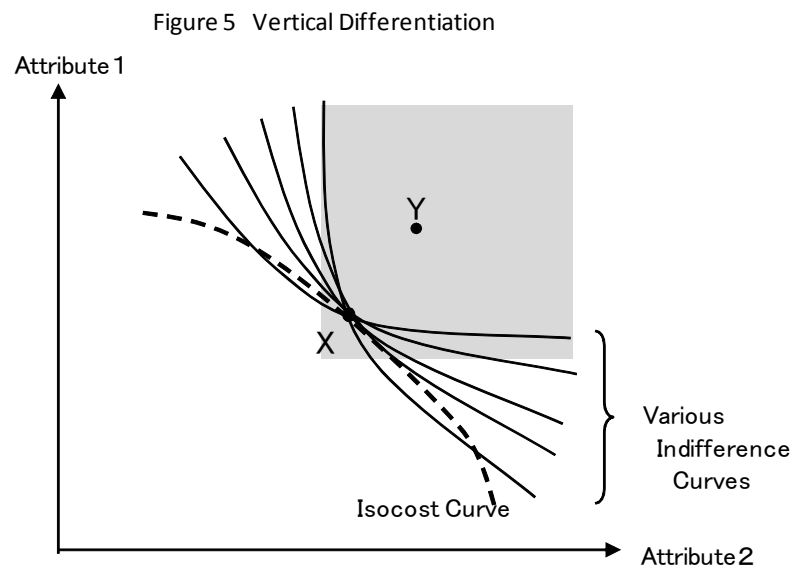
Here, compared with the 1.5 kg personal computer with a 14 inch monitor, the 1.2 kg personal computer with a 12 inch monitor more satisfies consumers who seek lighter PCs due to the improvement in weight. However, it is less satisfying to consumers who value monitor size. In short, the improvement in one of the two attributes does not bring about vertical differentiation. In addition, even though this is supposed to exclusively be the space of vertical attributes, this is the differentiation in which consumers are not in agreement regarding satisfaction, thereby making it horizontal differentiation. Therefore, it is noteworthy that vertical attributes can bring about horizontal differentiation.



How, then, can the vertical differentiation of a 1.5 kg personal computer with a 14 inch monitor be realized? This requires the shift to the upper right of the consumers' indifference curve. Here is how the improvement in vertical attributes that can satisfy most consumers can be realized.

In Figure 5, when a conventional product is on the coordinate X , the common area (the shaded area) inside the area of various indifference curves of consumers (the area representing their greater satisfaction) is the area where vertical differentiation is possible. In Figure 5, for example, Y conducts vertical differentiation on X .

However, in order to realize this vertical differentiation, an isocost curve needs to shift and its contact point with an indifference curve needs to move due to product innovation of the manufacturer. Furthermore, vertical differentiation always places a company into competitive advantage. Therefore, the competitors must follow the company's innovation so that they will not lose market shares.



4. Market Segmentation in Horizontal Attribute Space

In the market segmentation in horizontal attribute space, a large, indefinite number of consumers are divided into groups, each of which is of the same quality in terms of marketing strategies. In each segment, different marketing strategies are developed according to the marketing mix of new products, advertising, channels, pricing, and other factors. In other words, market segmentation is the act of considering the heterogeneity of consumers, while, in one segment, this segmentation is the act of regrouping these consumers as the group that can be

expected to act homogeneously.

Market segmentation can be explained, as follows, by using the model of product differentiation in the attribute space discussed so far.

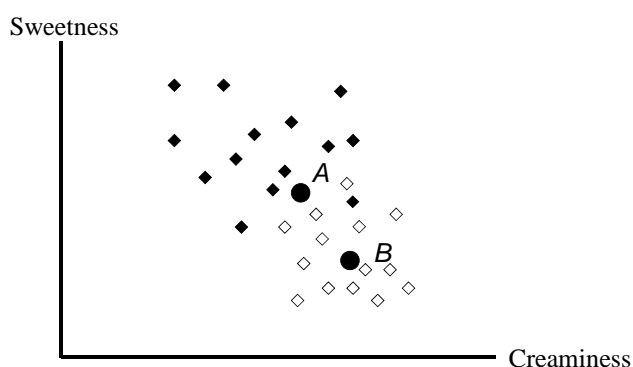
First, let us consider market segmentation in horizontal attribute space. Market is easy to be segmented in case of horizontal attributes, since consumers' preferences about attributes are divided.

Now, let us assume that a product is evaluated in terms of two horizontal attributes. For example, consumers evaluate the taste of ice cream in terms of two attributes: sweetness and creaminess. Since these attributes are horizontal, it can be assumed that the ideal points of consumers regarding these two attributes are dispersed.

There is a point where the total distance from the ideal points of each consumer is the shortest—the point that is the center of the ideal points. If, manufacturer *A*, for example, produces a product that is located at this point, the manufacturer can satisfy most consumers.

Figure 6 represents the ideal points of consumers, with the black marks meaning male consumers and the white marks showing female consumers. Let us imagine that manufacturer *B* is producing ice cream that is creamy and not too sweet, based on the distribution of the ideal points, and advertising it effectively, aiming at female consumers. This is a market segmentation strategy targeted at the female segment. Now, manufacturer *B* can satisfy female consumers more than manufacturer *A*. In addition, even if the ideal point of a female consumer is closer to the products of manufacturer *A* than manufacturer *B*, manufacturer *B* can get her ideal point closer to them, if the marketing activities succeed. In other words, manufacturer *B* can obtain the preference and selection of the group of consumers, including the female consumers.

Figure 6 Market Segmentation in Horizontal Attribute Space



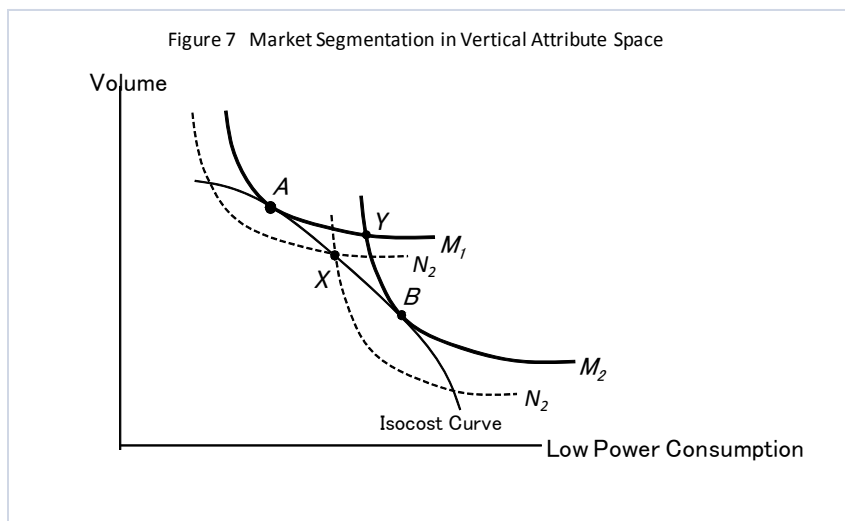
5. Market Segmentation within Vertical Attributes

Next, let us examine market segmentation when there are more than one vertical attributes. When this is the case, consumers present the pattern of a variety of preference and selection in terms of the combination of attributes, making market segmentation possible.

Figure 7, for example, shows consumers' evaluation of the two attributes of refrigerators: power consumption and volume. Most consumers, when comparing refrigerators with the same price, choose the ones with the largest volume and least power consumption. Therefore, these attributes are both vertical. Then, indifference curves among attributes for consumers are drawn, along with isocost curves among attributes for manufacturers. The ideal point for purchase is determined at one of their contact points.

Now, imagine indifference curves on average for consumers, and assume that the combination of attributes on contact point X is desirable for consumers on the whole. However, the actual pattern of preference and selection of consumers is largely divided between the consumers who have large households and those who have small households. Figure 7 exhibits the indifference curve M_1 , which is the curve for the market segment with large households, and the indifference curve M_2 , which is the curve for the market segment with small households. Accordingly, there are two contact points with isocost curves: A and B .

If a manufacturer sells a product based on the combination of the attributes of X , satisfaction cannot be as strong as A or B in either market segment, because point X is on the indifference curve N_1 and N_2 , which represent lower levels of satisfaction than M_1 and M_2 .



Furthermore, if the manufacturer tries to avoid segmenting the market due to its concern about efficiency, they need to produce a product located on Y , which can bring two groups of consumers the same level of satisfaction as A and B . This is, however, vertical differentiation from X , requiring product innovation, including production with lower costs than X . Furthermore, if two types of products that have also introduced innovation and correspond to the two market segments go on sale, the manufacturer of Y cannot be competitive since Y is less satisfying to consumers. Therefore, when different groups of consumers have different patterns of preference and selection, it is effective in competition to produce different products according to different market segments for sale.

6. Market segmentation Based on Vertical Differentiation

When a product has only one vertical attribute used for its evaluation and the attribute is improved, or when a product has more than one vertical attributes and they are improved in the way that is desirable for most consumers, these changes are vertical differentiation.

Under these circumstances, consumers are usually not divided into different market segments since they have the same opinions about the attributes. Still, market segmentation is possible. This is market segmentation according to the differences in price elasticity. It can be regarded as a special case of what is called *price discrimination*.

Product differentiation does not regard low price as an attribute of a product, as it presupposes low price elasticity. This is because the emphasis of consumers on low price means high price elasticity, meaning that product differentiation is not formed. In other words, there is

no such a thing as “product differentiation by price.” If price is a factor of obtaining the preference and selection of consumers, it is not because of product differentiation, but rather is because of price competition. Moreover, in considering product differentiation, it is assumed that consumers as a whole share some low price elasticity.

On the other hand, market segmentation represents the grouping of consumers according to differences in consumer behavior. They can be divided into a consumer group with high price elasticity or a consumer group with low price elasticity. More generally speaking, they can be separated into a low-price-oriented segment or a segment with little inclination for low price. Therefore, market segmentation based on the consumer behavior regarding price can be considered. In addition, this market segmentation is possible where vertical differentiation based on vertical attributes is conducted.

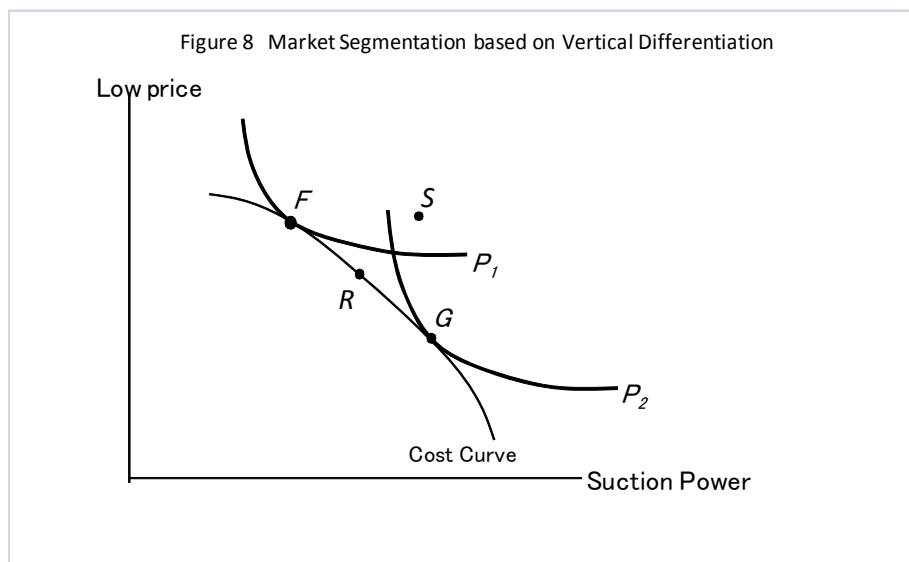
Let us use the example of vacuum cleaners. Suppose that consumers evaluate a product according to the vertical attribute of its suction power and price, and that, as previously discussed, a numerous amount of indifference curves for consumers can be drawn, which connect the values of suction power and prices that brings the same degree of satisfaction to each consumer. Meanwhile, the curve showing the combination of suction power and price that have the same economic meaning for a manufacturer represents the cost curve for the manufacturer, since the curve shows the price reflecting the cost to achieve certain suction power. This cost curve, unlike the isocost curves discussed so far, cannot be virtual and multiple because it reflects the manufacturer’s actual cost of development and production. Therefore, the manufacturer’s technology decides on a single cost curve and the contact points of the indifference curves are the ideal points of purchase for consumers. Incidentally, in Figure 8, the farther away a point is from the origin, the greater satisfaction, and the higher it goes, the lower the price, just as in the previous figures.

As for the price of the vacuum cleaner, when consumers are divided into two groups, the low-price-oriented segment and the segment with little inclination for low price, the contact points of the indifference curve P_1 of the low-price oriented segment and the indifference curve P_2 of the other segment, and the cost curve C of the manufacturer are positioned on F and G . In other words, the segment that emphasizes low price chooses low-price and low-suction power vacuum cleaners, and the segment that values suction power selects high-price and high-suction power vacuum cleaners.

Here, the manufacturer may think that it would be more advantageous to produce, not two kinds of products on F and G , but product R , whose price and suction power are between those of F and G , because the product could attract both segments. However, the position of R is

outside the indifference curve P_1 of the low-price oriented segment and the indifference curve P_2 of the segment with little inclination for low price, meaning the position of R is less satisfactory. Therefore, both segments select either low-price products or high-price products, not the ones in between.

However, if the manufacturer, instead of producing F and G , focuses on the production of a single product and can achieve economies of scale, and therefore is able to shift the position of the product to the position S in the upper right of the cost curve going through F and G , consumers might select S instead of F and G . This is because S is located inside P_1 and P_2 , the area representing greater consumer satisfaction. This is vertical differentiation, which integrates market segments.



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