

ASPECTS REGARDING THE MARGINAL RATE IN MATHEMATICAL MODELING

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Abstract: In the case of the practical test, we performed economic applications in which we achieved the marginal rate of substitution, the slope of an isocost line and the slope of a budget line. The algorithm of the indifference curves will be the isoproduction curves, i.e. the totality of the combinations of the two factors of production: W and Q that ensure the same level of production. The indicator of the marginal substitution rate with a content perfectly similar to the one used in the analysis of consumer behavior was also introduced here.

Key words: baskets, chocolate, mathematical analysis

INTRODUCTION

On October 9, Philippe Suchard was born in Boudry, Switzerland. At the age of 17 he starts apprentice confectioner in the Bern chocolate shop of his brother Frederic.

In 1824 Philippe Suchard left for America, where, fortunately for lovers of chocolate, does not settle and returns to the Alps. On November 17, he opens his own chocolate shop in Neuenburg, where he produces and sells fine homemade chocolate. [3]

In 1826 Philippe Suchard rented an abandoned mill, rebuilt it, equiped it with machinery and began producing up to 30 kilograms of chocolate a day, sold in the form of tablets or wafers. [11] Already a year after the opening of the chocolate shop, Philippe Suchard puts into practice his second project. He decides to expand his business, so there will be no need to produce everything manually. [14, 1]

In terms of the range of products, it can be said that Milka is a great success. [15] The ever-growing brand can boast a very diverse range of products related to chocolate. [4,10] From chocolate tablets with all the flavors to crispy biscuits and chocolate pralines, Milka also has chocolate especially for children and last but not least various personalized objects depending on the season or on certain occasions. [9, 14]

Unfortunately, the pioneer Philippe Suchard could not live the important moment, because he died in 1884. But what he left behind for his four children was a first-class chocolate factory, which to this day produces delicious chocolate. [10]

The marginal rate is a parameter of the elasticity factor for a production function. In this case we consider the production function as one of two real variables in which one of the factors remains constant, respectively the variation of sales on the jam market if chocolate maintains its sales coefficient.

MATERIAL AND METHODS

Marginal substitution rate

In the case of the practical test, we rationally chose two baskets, with chocolate and jam, respectively. [6,7] I graphically represented certain curves of indifference, i.e. the totality of the combinations of two products A and B that give me the same satisfaction (therefore the same aggregate unit). [1,3,5]

RESEARCH RESULTS

Marginal rate of substitution

The marginal substitution rate of the three baskets with products is presented in tables 1 and 2.

Table1.

Marginal substitution rate for stack A and B.

| Mark A | Chocolate | Jam | Δq sold goods | Δq obtained goods | Substitution rate |
|---------------|-----------|-----|-----------------------|---------------------------|-------------------|
| | 400 | 150 | 200 | 50 | 4 |
| Mark B | 200 | 200 | | | |

Defining the substitution rate between chocolate and jam as the ratio between the quantity of good sold (chocolate) and the quantity of good obtained (jam). Thus we obtain the substitution rate equal to 4. [2]

We consider a function of two real variables that define the evolution of sales for the two products to be implemented on the market and then make an opinion poll of consumer preferences.

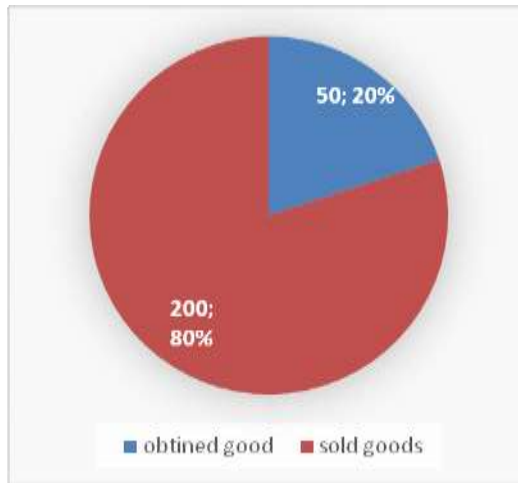


Figure 1. The ratio between sold goods and obtained goods

Table 2.

Marginal substitution rate for stack B and C

| Mark B | chocolate | jam | Δq sold goods | Δq obtained goods | Substitution rate |
|---------------|-----------|-----|-----------------------|---------------------------|-------------------|
| | 200 | 200 | 20 | 100 | 0,2 |
| Mark C | 180 | 300 | | | |

Defining the substitution rate between chocolate and jam as the ratio between the quantity of good sold (chocolate) and the quantity of good obtained (jam). Thus we obtain the substitution rate equal to 0,2.

It is known that the first product (chocolate) is an already established brand and we analyze how much the sale of the second product influences the sale with it and we find that there is a correlation so that consumers offer confidence in products of the same quality.

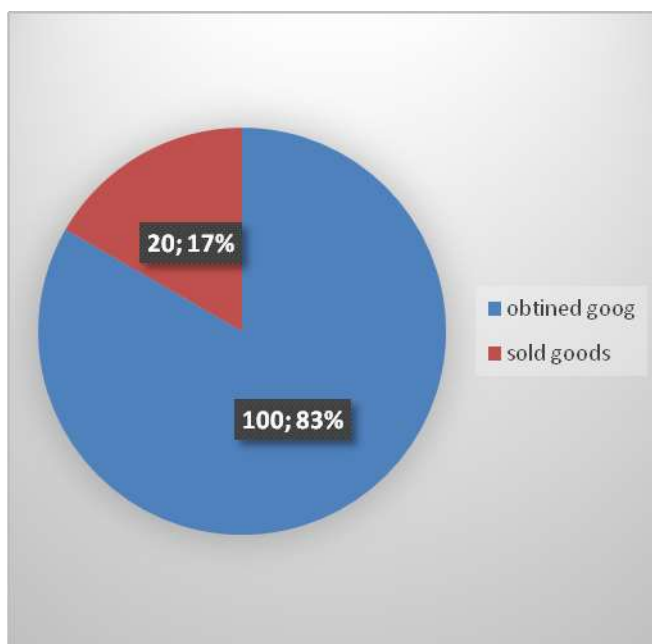


Figure 2. The ratio between sold goods and obtained goods

We introduced an instantaneous substitution rate called the marginal substitution rate.

$$\text{MARGINAL SUBSTITUTION RATE} = \lim_{\Delta q \text{ obtained goods} \rightarrow 0} - \frac{\Delta q \text{ sold goods}}{\Delta q \text{ obtained goods}}$$

$$\text{MARGINAL SUBSTITUTION RATE} = \lim_{\Delta q \text{ obtained goods} \rightarrow 0} - \frac{20}{100} [11]$$

Thus on a curve of indifference RMS at a given point there will be derived at that point the function $q_{\text{sold good}} = f(q \text{ obtained goods})$ taken with the minus sign. [8,9]

$$\text{MARGINAL SUBSTITUTION RATE} = - \frac{\Delta q \text{ sold goods}}{\Delta q \text{ obtained goods}}$$

$$\text{MARGINAL SUBSTITUTION RATE} = - \frac{20}{100}$$

Thus, in the case of products A and B in quantities x, y the marginal rate of substitution will be:

$$\text{MARGINAL SUBSTITUTION RATE} = - \frac{dy}{dx} [12]$$

To test the opinion of people who preferred to purchase the promotional package consisting of Milka chocolate and jam in the promotion was used Microsoft Forms application available at [https // forms.office.com](https://forms.office.com). The questionnaire was anonymous and continues only affirmative or negative answers in order to get a very real opinion. The evaluation was done using Microsoft Forms and statistical calculations and graphs were made in Microsoft Excel.

CONCLUSIONS

Starting from the analysis of a company promoting Milka chocolate on the market, we considered to be a case study the way in which the product is implemented both in terms of quality and in terms of marketing.

Questionnaires were made and then the information was disseminated from a statistical point of view. Concluding that most consumers were very satisfied with the product, we considered another appropriate approach by analyzing by comparison with another product, the jam, with the help of mathematical analysis, an infinitesimal model of the isocost line and using the calculation for the marginal substitution rate.

The mathematically analyzed limits were interpreted as the minimum and maximum satisfaction level with a possible substituted produs.

We recommend as a result of this analysis that any two competitive and high quality food products be promoted together in the same campaign in order to achieve success and maximum profit.

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