ASPECTS OF ECONOMIC APPLICATIONS OF MATHEMATICAL ANALYSIS IN FOOD INDUSTRY

MICULA LIA[1], COZMA ANTOANELA[1], BRAD IOAN[1], DINCU ANA-MARIANA[*1], TONEA ELENA[1]

[1]Banat University of Agricultural Sciences and Veterinary Medicine "King Michale I of Romania" from Timisoara, Faculty of Agricultural Management, Romania

*Corresponding author's e-mail: maridincu2004@yahoo.com

Abstract: *Mathematical analysis deals with the study of derivatives and integrals for functions. Functions of several real variables are most commonly found in phenomena and economic processes. In this article the authors of the paper use derivatives and integral functions for their application in economic processes.*

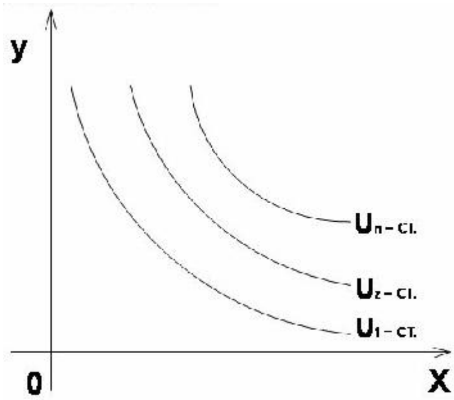
Key words: *functions of two real variables, the substitution rate, increase rate per izocost.*

INTRODUCTION

Thus we identify several functions and try to interpret the use of partial derivatives in the study of economic process described in theory of a consumer and it will be founded on the interpretation of his choices.

MATERIALS AND METHODS

We will represent graphic some indifference curves, all combinations of two products A and B which gives the consumer the same level of satisfaction.



For example, we give below the indifference curve that describes the totality of combinations of two products, equivalent judged by a consumer.

So, we define the rate of substitution between two quantities as, the ratio of the good yielded quantity and the quantity of good obtained.

We will introduce an instant substitution rate called the marginal substitution rate (RMS). [3]

$$\text{RMS} = \lim_{\Delta q_{good\ obtined} \to 0} -\frac{\Delta q_{good\ luck}}{\Delta q_{good\ obtained}}$$

So, on a RMS indifference curve in a given point will be derived at that point of the function: $q_{good\ luck} = \text{f}(q_{good\ obtained})$ taken with the negative sign.

$$\text{RMS} = -\frac{dq_{good\ luck}}{dq_{good\ obtained}}$$

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

$$\mathrm{RMS} = -\frac{dy}{dx}$$

Observation: In the construction of indifference curves, a number of criteria called "axioms of behavior" are taken into account.

If we leave the consumer domain for the producer one, we find in the microeconomic analysis production functions that depend only on two factors of production, functions of two real variables: labor L and capital K. [1, 2]

RESEARCH RESULTS

The production function will be:

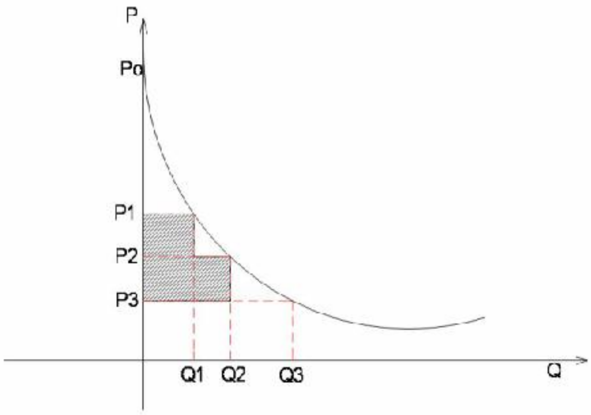
$$Q = f(K,L)$$

The analogy of the indifference curves will be the isoproduction curves, that is all combinations of the two factors of production L and K that provides the same level of production.

Here is also introduced the marginal substitution rate with a perfectly similar content to that used in the analysis of consumer behavior.

We assume, that we have a discontinuous requires function consisting of a series of points:

$$(P_0, Q_0), (P_1, Q_1), (P_2, Q_2), ..., [\ P_0 > P_1 > P_2 > ....\ ]$$



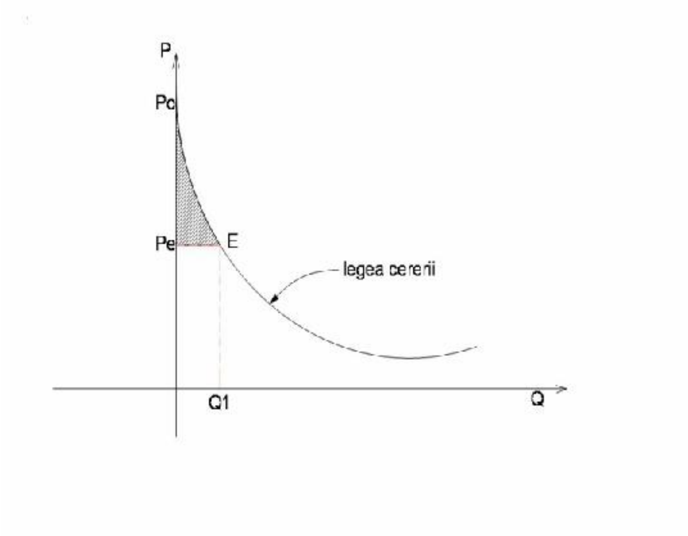
If the price has been set at P_0 no consumer will buy. If the price has been set at P_1 it is demanded and sold in quantity Q_1. If the price was set at P_2 it required and sold in quantity Q_2. In this case, among consumers there are people who would have accepted to pay P_1 but they will pay P_2, because the market price is unique. These consumers benefit from a surplus that we can evaluate by $(P_1 - P_2)\ Q_1$.

This product is nothing more than the area of a rectangle. Similarly if the price would be set at P_3 every consumer benefits from a total surplus:

$$(\ P_1 - P_3\ )\ Q_1 + (P_2 - P_3)\ (Q_2 - Q_1)$$

From a discontinuous request function, we can easily switch to a continuous reques function. The surplus will be calculated using the integral concept.

So if we note with P_E şi Q_E the price and quantity values on equilibrium balance and with P_C the price demand law according to quantity we will have:

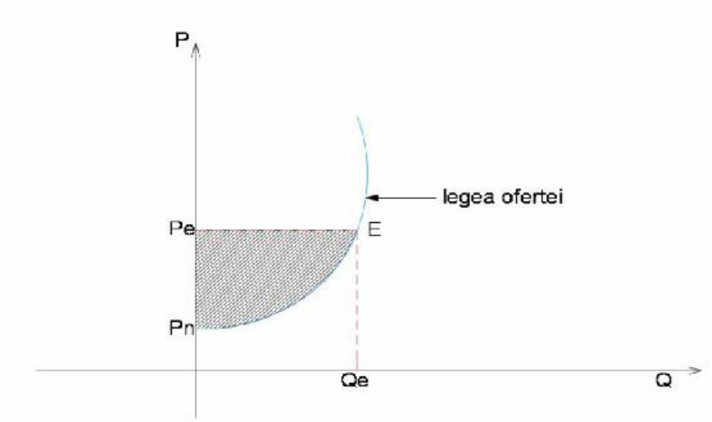


The surplus of consumers is:

$$SC = \int_0^{Q_E} P_C(Q)dQ - P_E \times Q_E$$

which represents no other than the curved triangle area: P_0EP_E.

By analogy, we can establish the notion of producers surplus, SP. So if we mark with P_E the price that is formed on the market and with Q_E the corresponding quantity also will note with P_0 the offer price law according to the quantity, producers who are willing to yield their products at a P_E lower price realize a surplus of SP represented by the area of a P_EEP_N curve triangle, which can be calculated by:



The function $\frac{f'}{f}$ is called the logarithmic derivative of function f. (because $(\ln f)' = \frac{f'}{f}$). The number $\frac{f'(x_0)}{f(x_0)}$ is the value of the logarithmic derivate in x_0 and is called the rate of increase of the function f în x_0.

Sentence. $\frac{f'(x)}{f(x)} = a \Leftrightarrow f(x) = ke^{ax}$ (k, a real constant).

$$\frac{f'(x)}{f(x)} = a \Leftrightarrow (\ln f)' = a \Leftrightarrow \ln f = \int adx = ax + C$$
$$\Leftrightarrow f(x) = e^{ax+C} \Rightarrow f(x) = e^{C} \cdot e^{ax} \Leftrightarrow f(x) = ke^{ax}$$

Observation. The logarithmic derivative allows us to calculate a number of economic growth rates.For example, if P (t) is a production function then its logarithmic derivatives

$$p(t) = \frac{P'(t)}{P(t)}$$

We deliver growth rate of production at time t.

CONCLUSIONS

In the evolution study of the amount q(t) in a time interval $[t_0, t_1]$ we can consider:

1. Instant growth rate $a(t) = \frac{q'(t)}{q(t)}$

2. Average growth rate in the period $[t_0, t_1]$:

$$\bar{a} = \frac{1}{t_1 - t_0} \int_{t_0}^{t_1} a(u)du.$$

We note that : $q(t_1) = q(t_0)e^{\bar{a}(t_1 - t_0)}$.

Indeed

$$\bar{a}(t_1 - t_0) = \int_{t_0}^{t_1} a(u)du = \int_{t_0}^{t_1} \frac{q'(u)}{q(u)}du = [\ln q(u)]_{t_0}^{t_1} = \ln q(t_1) - \ln q(t_0) = \ln \frac{q(t_1)}{q(t_0)}$$

And so ,

$$e^{\bar{a}(t_1 - t_0)} = \frac{q(t_1)}{q(t_0)}$$

reaching the desired relation.

REFERENCES

[1]. OTIMAN P. I., 2012, Elemente de matematici aplicate in economia agroalimentara Elements of applied mathematics in the agro-food economy, Ed. Agroprint, Timisoara

[2]. OTIMAN P. I.,1981, Planning function, Editura Ceres, Timisoara

[3]. RUJESCU CIPRIAN, CRET FLORIAN, MICULA LIA, 2011, Mathematical Analysis Course, Editura Artpress, Timisoara