MATHEMATICAL ANALYSIS IN STATIC EQUILIBRIUM OF ECONOMICS: AS SUPPORT TO MICROECONOMICS COURSE

Yadav Mani Upadhyaya, PhD*

Abstract

Microeconomics studies the economic behavior of individual decision-makers. To be able to make sound decisions in economics, the economist has designed mathematical models based on the differentiation of simple functions. Economics and mathematics are directly related as changes in quantities and variables affect the relationship and the direction of the consumer behavior to become better –off or worse-off. The main objectives of this study are microeconomic theories that may simplify or easily understandable through the mathematical calculation to illustrate the examples and calculate the equilibrium positions numerically. The study also aims to provide mathematical tools that manage to determine all the information necessary for decision making from a broad vision. The relationship between quantity and price may be better explained through mathematical notations. The supply and demand curve is designed to find the equilibrium point and it is better explained through mathematical equations. To explain, the methodology is used for a simple mathematical function of price with the help of a simple linear and nonlinear model of static analysis of the market equilibrium of Qd=Qs. This study concludes that it will greatly help college students, professionals, entrepreneurs, and in general anyone presents solved exercise and proposes problems, for the student to solve cases create graphs, table, and interpret and analyze results in the market and thus fixing the knowledge.

Keywords: *Microeconomics, mathematical function, market equilibrium, decision making, variable, relation*

JEL: *D00, C30, C62*

Introduction

The proposed topic is important, due to the need of the professionals of the social sciences to possess tools that allow adapting the entire mathematical technical base, to the analysis of productivity and costs to help you adapt to market demands labor within the context of globalization.

It will be very useful to the university student or professional who is interested in exposing the fundamentals and characteristics of economic science, from the concept of microeconomic and its importance in the interpretation of the functioning of market systems.

Taking statistical calculus to a level beyond the elementary will allow us to analyze the trend of a company's costs, thus helping to overcome the difficulties presented by microeconomic theory.

* Assistant Professor of Saraswati Multiple Campus (Humanities Faculty: Economics Department), Tribhuvan University, Nepal.

Developing a teaching and learning concept from the approach theory-practice, it will be possible to understand and predict the structure and behavior of minimum costs, to obtain different levels of production that companies have when they are located in the different market structures, defined and classified by talented economists like Stackelberg (1934), who not only represent the foundations of all conditions for the atomization of supply and demand to subsist but also, they determine a guide to maximizing profits in the short and long term.

Objectives and Problems

Provide future professionals in the field of social sciences with precisely and all the tools that science provides economics, mathematics, for advanced topics, giving it a meaning critic of microeconomic analysis of the market economy. Carry out the mathematical calculation to illustrate the broad and deep economic theory. Establish important innovations for the practice of the subject microeconomics. Calculate the equilibrium conditions numerically considering the current market. Evaluate the state of market demand and market supply, for possible strategies for diffusion and/or expansion of the market segment.

It is a common mistake to interpret mathematical connection with real economic causality. Price does not cause supply or demand any more than slope causes profits. Rather, human action drives all of these variables simultaneously in a way that mathematics cannot completely capture.

Literature Review

Economic growth represents an increase in the level of production of a country and economic development represents economic growth and this is reflected in the quality of life of its inhabitants and is the science a method to know and explain reality it can be determined that economics is a branch of the social sciences that studies the processes of production, distribution and the character of real income.

In the course of history, different approaches have been given to what is must define as economy, using different theories, which can be very useful to identify and analyze the reality of today, somehow many definitions of the greatest economists in history for broadening the vision of what this discipline intends.

- Economics studies the allocation of scarce means (it is a study of the economy as it is, not as it should be, Lionel Robbins, University of London, England, 1932).
- Economics is the study of man and the common problems of his life in pursuit of his material well-being (deals with causes and effects, Alfred Marshall, England, 1890).
- Economics is a static science concerned with preparing a structure based on the maxim of natural rights, utilitarianism and administrative efficiency, being a static theory based on an also static concept of man (Thorstein Veblen, 1898)

It is very unlikely to understand the current reality if it is not understood the past also, currently, in the economy, there are two paradigms. The capitalist, Marxist-socialist and mixed, struggling to be accepted in the third world, a label given to underdeveloped countries.

Jonh Maynard Keynes (1936) said that the ideas of economists and philosophers Politicians, both when they are right or wrong, are more powerful than that is commonly believed, since it is these who propose or impose the socio-economic systems in which one must live, on the other hand, the social character concerns the phenomena analyzed, production and distribution, rather than the permanent relationships between them".

Natural resources, also called goods, must receive a broad enough interpretation to include the provision of services and thus, achieve all the objectives set.

Therefore, it will be observed that when the procedures are analyzed methodological methods adopted for economic research, is defined as methodology as the essence of science, and the methodology of economics describes and adequately classifies the most important facts of the activity economics to make possible the interpretation of reality.

Theories that apply to the investigative science of economics are divided into three main parts, descriptive economics, economic theory and economic policy, as shown in table no. 1. Therefore, the study of the price system is as important as that of production and consumption.

The two concepts, from which we will start, are goods and agents. Rice, bread, vegetables, electric power, buses, etc., are considered as goods, the quantity of each of them is measured with an appropriate unit; the services, transportation, medical consultations, haircuts, etc., are also goods since they serve to satisfy human needs; work is an of particular importance since it is an essential element in all production.

A good can represent a product or a service, each it must be perfectly homogeneous and we associate a price to each good. Generalizing, agents are individuals, groups of individuals or organisms that constitute the acting elemental units; one can divide them into two categories: producers who transform certain goods into other goods, and consumers who use certain goods for their own needs.

The former is sometimes called companies; the seconds represent: either to individuals themselves or to cells of supportive individuals who constitute a family unit of consumption and also, eventually to the broader social groups pursuing common goals for the direct satisfaction of your needs.

Table no. 1. The Three Main Divisions of the Economy

Concepts and Description of Functions				
Positive Economy			**Normative Economy**	
Descriptive Economy		**Theory Economy**	**Economic policy**	
Describe the action economic and observed the systematically behavior of their various agent.	→	Formulate principles, theories, laws or models based on the description and observations of the descriptive economics.	← →	Apply the development facts by theory economical for the better driving the action economical.

Source: Microeconomic theory basic principles and extensions, Walter N. 9th edition (2007).

Methodology

The analysis proceeds by representing the demand function and supply function with the relation with the price of goods and services. Let Qd is the demand function and Qs is the supply function of price (P). The function represents the relation between price and quantity. Qd is the sum of market demand and Qs is also the sum of market supply. For the market equilibrium, simple mathematical tools have been used with Qd and Qs which should equal to each other. Price and quantity are calculated with the help of a simple mathematical linear and nonlinear model of static analysis of the market equilibrium of Qd=Qs.

The quantities of goods and services which are demand and supply are inversely and positively related to the price. Hence, quantity is the dependent variable and price is the independent variable in this study. Thus, the mathematical function is as follows: Qd = f (P) and Qs= f (P). The independent variable, price is plotted on the vertical axis. The dependent variable, quantity, is plotted on the horizontal axis.

Microeconomics Course

Quantitative methods that determined the area seek the application of the analysis techniques for the quantitative variables that allow the taking of decisions in administration and production.

The content of the microeconomics course that responds to an economics career not only manages to meet this emphasis but goes further, managing to visualize, analyze and evaluate the results of applying mathematical and models to solve problems related to administration in various environments and criteria.

In the last five years the programmatic content of the microeconomics has been modified, emphasizing a large part of the course to the theory of consumer behavior, technology and market among other topics, which are fundamental for the professional performance of social science, since these have frequently to work with economists, because economic strategies, for the price setting, production level, market behavior, etc., are becoming more and more important for all types of institutions.

Which means that consumer and producer must be able to understand and work with economists, as well as their data and reports if want to understand and adequately cope with the financial impact of the job. This means that to some extent they must learn the language of economics, its reasoning and also understand in a way deep the behavior of demand and supply in different scenarios, as is the market structures.

Each science has its language, but all sciences use the same logical system, and the great competence of that has all the knowledge to express all the questions, hypotheses and ideas more concisely, using mathematical models, and It is precisely this that raises the need for this text since the theory deepens and is understood from an adequate practice.

The bibliography used for the conceptual and analytical basis of the course does not have the appropriate mathematical calculation content that will allow the economics student to express the content in a known way programmatic of the microeconomics course. However, within the

context of the accreditation, it is necessary to comply with graduating from the faculty, students with academic excellence.

The mathematical basis of economics students is considerable and more than adequate, which is why it is considered sufficient for an understanding and application of the course topics to the reality, adapt it to economic laws to mathematical knowledge, student statistics. So it is possible to have one more tool accurate for analysis and development of models in companies.

Microeconomics Theory

One way to characterize the evolution of modern economic analysis is growing mathematization, whose main objective is the analysis of the simultaneous determination of prices and quantities produced, exchanged and consumed. The Microeconomic theory uses models that attempt to explain and predict, using simplifying assumptions, the behavior of consumers and producers, and the allocation of resources that arise as a result of their interaction in the market.

In general, microeconomic analysis is associated with price theory and its derivations, being Alfred Marshall, who to solve these problems used optimization techniques.

In microeconomics, there are several branches of development, the most important are: consumer theory, producer theory, general equilibrium theory and the markets. These cannot be considered in the separated form because the results of some aspects influence the others, given the relationship in the circular flow of economic activity, but all propose mathematical models that develop assumptions about behavior economic agents, the conclusions reached, using these models will only be valid, as long as their assumptions are met.

Some economists, especially Milton Friedman, deny that check a model by asking if its assumptions are "real", he argues that all theoretical models are based on assumptions that “are not real “and that the very essence of demands theories that certain abstractions. These economists conclude that the only way to determine the validity of a model is to know if it is capable of explaining and to predict the events of the real world.

The assumptions that in part limit are assumptions of simplification or condition, so that economic models come to be disqualified for static, naive, reductionist, mechanistic and idealistic. Besides, analyzes are constantly linked to the condition of ‘Ceteris Paribus’ , term indicating that all relevant variables except those that are being studied at that time, they remain constant.

Many economic models start from the assumption that agents economic, pursue a rational goal. For example, the model of a company that aims to maximize profits, does not consider the reasons company administrators or personal conflicts that arise between them. They assume that profit is the most important goal of the company and downplay other possible goals, such as gaining power or prestige.

The model also assumes that the company has the complete information on costs and on the natures of the market in which sell your products, such as to discover what true options are for maximize your profits. Of course most companies do not this information is available, however, these model deficiencies are not necessarily serious, and no model describes reality exactly.

On the other hand, an individual demands an article determined by the satisfaction or utility receive from consuming it up to a point, while the more units of an item the individual consumes per unit of time, the total utility will increase, but the extra utility receive from consuming for each additional unit generally decreases, and thus one without number of economic hypotheses.

The fundamental question is whether it can be considered that the simple model is valid or not, so optimization models have arrived to have a privileged place in modern economic theory.

Economic Problem

When resources do not allow all the needs and desires of the people, the problem of scarcity arises and when there is scarcity, it is necessary to answer one of the most important questions of the economics how can existing resources be better used to provide the greatest amount of goods and services? This corresponds to the efficiency question.

Economics is an intellectual discipline that deals with growth and material development, which aims to respond to the economic problem through the questions of what to produce? How to produce it? And for whom to produce it?

To answer these questions, the degree should not be taken into account development of the country or region, since each economic systems adopted must achieve orderly, sustained growth (which is maintained by its forces), and sustainable (justifiable in terms of social welfare, justice, cultural diversity and the ecological).

In the quest to solve the aforementioned questions, economic theory names the frontier of production possibilities curve (PPC), as the technique adequate to explain the underutilization of resources, which shows the different combinations (example: vegetables and computers) that you can produce a country, with the production factors available and obtaining the maximum possible use of the resources you have.

If they occur at the points on the frontier of possibilities, produced efficiently and that when it occurs below it, produces inefficiently, it is not impossible to produce at points outside the PPC, but it is important to determine that the invention and innovation cause this the border is extended allowing a higher level of well-being in an economy. The question of interest is: What drives economic progress? Answer this question, it should be understood that every company must be efficient, which is a criterion for minimizing the use of resources, and it must also be effective, to the degree of being competitive before the other rival companies.

Analysis of Static Equilibrium in Microeconomics

Like any economic term, equilibrium can be defined in several ways. According to Roger, M. (1996) in his book microeconomics, equilibrium is "a set of variables selected and interrelated, so close to each other, that no inherent tendency to change prevails in the model that constitutes it". Several words of this definition deserve special attention.

a) First, the words "selected" emphasize the fact that there are variables that, by choice of the analyst, have not been included in the model. Since the equilibrium understudy may have relevance only in the particular context of the set of variables chosen, if the model is extended to include more variables, then the state of equilibrium belonging to the smallest model.

b) Second, the word "interrelated" suggests that, for the equilibrium, the model variables must be at the same time in a state of rest, in addition to the state of rest of each variable must be compatible with all other variables, otherwise if any exchange variable also changes those that are directly related to it, causing a chain reaction. That is there would be no balance.

c) Third, the word "inherent" means that, in defining equilibrium, the state of rest in question is based only on the balance of forces internal factors of the model, while external factors are assumed to be fixed. From an operational point of view, this means that the parameters and exogenous variables are treated as constants. When in fact, yes external factors change there will be a new equilibrium.

In essence, equilibrium is a specific pattern in a situation characterized by the lack of a tendency to change; it is for this reason that the Equilibrium analysis is called static. And the only guaranteed interpretation is that equilibrium is a situation that, if achieved, tends to perpetuate itself, unless external forces change.

Linear Model of Market Equilibrium

The equilibrium of linear model markets can be partial, given that only a single item will be considered, therefore it is necessary to include only three variables in the model: the quantity demanded of the item (Q_d), the quantity offered of the item (Q_s) and its price (P). Equilibrium will occur in the market if and only if the excess demand is zero (Q_d - Q_s = 0), where:

a) Q_d is a decreasing linear function of P (when P increases, Q_d decreases).

b) Qs is assumed as an increasing linear function of P (if P increases Qs also increases).

In a mathematical expression, the model can be written as:

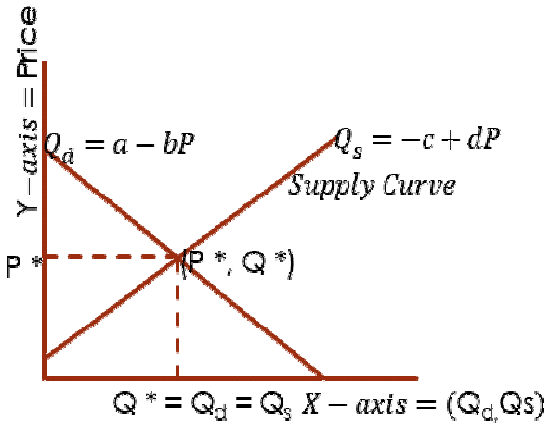
$$Q_d = Q_s \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

$$Q_d = a - bP \ (a, b > 0) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

$$Q_s = -c + dP \ (c, d > 0) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

Whose restrictions indicate that the four parameters, a, b, c, d, must be positive. It is now to solve the mathematical model and obtain the solution values of the three endogenous variables described with anteriority (Q_d, Q_s, P). The solution values are those that satisfy simultaneously the three equations, in the context of the model, can be called equilibrium values (P *, Q *).

Figure1: Partial Market Equilibrium



Source: Alpha C. Chiang. Fundamental Methods of Mathematical Economics

Solution by Eliminating Variables

One way to find the solution for a system of equations is by successive elimination of variables or by substitution. In the model of linear static equilibrium for an item, there are three equations with three variables. However, because of the equality of Q_d and Q_s, it can be rewritten the model as follows:

$$Q_d = Q_s$$

$$a - bP = -c + dP \text{ (from equation no. (ii) and (iii))}$$

Reducing to a single equation with one variable, and after subtracting $(a + dP)$ from both sides of the equation and multiply by -1, then:

$$(b + d)P = a + c$$

Since b + d ≠ 0, it is valid to divide both sides by (b + d). The result is the solution value of P *.

$$P * = \frac{a + c}{b + d}$$

Note that P* is expressed, like all solution values, in terms of the model parameters. Thus, P* is a definite value. Note also that P* is positive because the four parameters are positive by the specification of the model, which agrees with the economic term of price. To find the equilibrium quantity ($Q^* = Q_d = Q_s$), which corresponds to P * value, it is substituted in any equation (supply or demand), and then solve the resulting equation.

Substitute in the demand function, we get:

$$Q* = a - b\left(\frac{a+c}{b+d}\right)$$

$$Q* = \frac{a(b+d) - b(a+c)}{(b+d)}$$

$$Q* = \frac{ad+bc}{b+d}$$

$$Q* = \left(\frac{ad+bc}{b+d}\right)$$

Which again is an expression only in terms of parameters and it is greater than zero, since the denominator (b + d) is positive. With this more general formulation, questions can be raised regarding the changes in the equilibrium price, if the supply curve or the demand varies. This is obtained under the differentiation of the equation of P *.

$$\frac{\partial P^*}{\partial a} = \frac{1}{d-b} > 0$$

$$\frac{\partial P^*}{\partial c} = \frac{-1}{d-b} > 0$$

That is, an increase in demand (an increase in "a") increases the equilibrium price, while an increase in supply (an increase in from "c") decreases the price.

This is precisely what the graphical analysis of the curves of supply and demand, by the way, the intersection of the supply curves and the demand, is not different in the concept of the interaction of sets, the only The difference is that instead of the points being inside two circles they are on two lines. If the set of points on the supply curves is denoted and demand with sets D and S, respectively. The intersection of sets is described as:

$$D = \{(P, Q) \mid Q = a - bP\}$$

$$S = \{(P, Q) \mid Q = -c + dP\}$$

$$D \cap S = (P *, Q *)$$

Nonlinear Model of Market Equilibrium

Assuming that the demand is expressed in a second polynomial degree, and assuming that the supply remains linear (hypothesis may vary since demand can be linear and supply quadratic or even both can be a second-degree polynomial). A model such as the next:

$$Q_d = Q_s$$

$$Q_d = a - bP^2$$

$$Q_s = d + cP$$

Under the equality of quantities, for supply and demand the model is you can rewrite as:

$$a - bP^2 = d + cP$$

By reducing the previous expression to the form,

$$bP^2 + cP - (a + d) = 0$$

A quadratic equation is obtained because the expression on the left is a quadratic function of the variable "P". An important difference between a quadratic and a linear equation is that, in general, the former produces two solution values. Since we can write an infinite number of pairs ordered, one for each value of P, there is an infinite number of solutions.

When f (P) = $bP^2 + cP - (a + d)$ is graphed as a curve, the pairs ordered that belong to his domain and counter-domain, produces a Parabola similar to figure no. 2. By setting the function off (P) equal to zero, the situation changes in a fundamental way, since now a variable disappears (for having been assigned the value zero), the result is a quadratic equation with a single variable P.

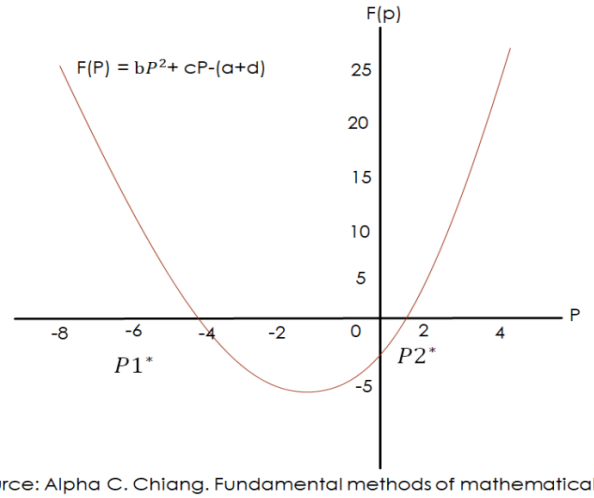
Now that f (P) is constrained to the value zero, only a select amount of P values can satisfy and qualify as solution values; to know, those values of P in which the parabola crosses the horizontal axis (the roots of the quadratic equation) f (P) = 0, obtain two solutions that are expressed how:

$$P_1^* = -X_1$$

$$P_2^* = X_2$$

But we must rule out that negative prices are not conceivable, therefore $P_2^* = X_2$ is the only admissible from the economic point of view.

Figure 2: Partial Market Equilibrium
(Nonlinear model)



Source: Alpha C. Chiang. Fundamental methods of mathematical economics.

Quadratic Formula for the Solution of Second Degree Polynomials

The previous model was solved graphically, but you can also solve it by an algebraic method. In general, given an equation quadratic of the form, $aX^2 + bX + c = 0$ where ($a \neq 0$). There are two roots that are you can get from the quadratic formula:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$X_1^* = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$X_2^* = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

Also note that while $b^2 - 4ac > 0$, the values of x_1^* and x_2^*, so that we get two different real numbers as roots; but in the special case where $b^2 - 4ac = 0$, the roots would be $x_1^* = x_2^* = \frac{-b}{2a}$.

In this case, the two roots share the same value; these are known as repeated roots, in another special case, where $b^2 - 4ac < 0$ would have the task of taking the square root of a negative number, which is not possible in the system of real numbers, in the latter case, there are no roots of values real. This widely used formula is derived by means of a process known as "completing the square."

First: dividing each term, ax^2, bx and c, within "a" you get:

$$X^2 + \frac{b}{a}X + \frac{c}{a} = 0$$

Solving for c / a and completing the square gives:

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$

$$ax^2 + \frac{b}{a}x + (\frac{b}{2a})^2 = -\frac{c}{a} + \frac{b}{2a}$$

The left side is now a "perfect square", so the equation can be expressed as:

$$(x + \frac{b}{2a})^2 = \frac{b^2 - 4ac}{4a^2}$$

After taking the square root of both sides, the expression is as follows:

$$(x + \frac{b}{2a}) = \frac{\sqrt{b^2 - 4ac}}{2a}$$

Finally, we solve for "x", we obtain the two possible solutions:

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Summary

This article focused on the topics with the mathematical calculation of a balance between static equilibrium in microeconomics. This topic will allow the reader to understand the behavior of consumers and producers of the latter are will expose the logic of price determination through the intersection between demand and supply. This allows a special emphasis on responsibilities and price totals incurred by the company to produce or sell an additional unit; thus allowing a maximization of profits, which is the main objective of any organizer.

This text aims to provide mathematical tools that manage to determine all the information necessary for decision making from a broad vision, leading the reader to the planning of predictions market and competition under the criterion of marginal values created to be a practical guide, it also provides the theoretical support necessary to understand hypothetical deductions from the laws of demand, supply, and marginal theory becoming excellent support to the practical part of the course of microeconomics.

Taking advantage of the skills and knowledge of the students of the school of social sciences, with which they have been trained and needs of these future professionals, who will have to solve the business requirements consisting of installed capacities, minimizing costs, increasing productivity, evaluating returns, among others.

It is essential to equip them with tools like this one, which increase their decision-making capacity and interpretation of the factors that determine the behavior of the market for goods and services, the establishment of pricing and planning of available resources in the short and long term.

This article is technically prepared and developed based on microeconomics, with unlimited access to the applicant, it will be of great help to college students, professionals, entrepreneurs and in general anyone looking for the best techniques to determine the price and production levels that maximize their economic investments, regardless of their business role.

Recommendations

For this text to fulfill its objectives, it should be used by the teaching assistants of the microeconomics course, such as practices for the realization of worksheets.

The mathematical and statistical methods should be expanded, with the use of programs like excel, mathematics and other free access and easy application for the student; through which can put specific topics into practice, such as multiple correlations, regression and trend.

After the necessary theoretical foundations, it is recommended that guide students to market research, the purpose of which is to obtaining information that allows modeling explanations of economic phenomena, through the numerical method exposed in this text.

Every three to four years it will be required to evaluate the update and extension of topics in the practice of the course of microeconomics.

Conclusion

Mathematical analysis to support the course of microeconomics is a document designed to comply with the theoretical and practical requirements necessary for understanding and exercise of the topics developed in the course. This is aimed at economics students who have not had the opportunity to participate in economics courses, but possess skills sufficient numbers to understand mathematical models of the introductory, intermediate and advanced topics of the microeconomic theory.

This article is intended to strengthen and reinforce in the student microeconomic analysis of consumer behavior and productive economic unit, through the interpretation of the theory through exercises and practical problems, designed for understanding the operation of the market, supported by the theories of demand and supply.

It fosters the capacities to identify, analyze, forecast and offer viable solutions, the decision-making possibilities of economic entities and their consequences, in the different structures of the market. Adapting the content of the course to the profile of the student, in a way that enhances their inherent abilities and improves understanding of the issues presented.

Develops the conceptual themes, presents solved exercise and proposes problems, in order for the student to solve cases create graphs, table, and interpret and analyze results in the market and thus fixing the knowledge.

References

Ahuja, H. L. (1998). Advance Economic Theory, S. Chand and Co., New Delhi.

Allen,W. L. (2000). Statistics Applied to Business and Economics. 3a edition, UK: McGraw-Hill, 512 p. ISBN: 978-958-410-072-6.

Alpha, C. (2006). Fundamental Methods of Mathematical Economics. Sanchez, Francisco 4th edition. San Francisco: McGraw-Hill, 708 p.

Andrew, S. R. (1996). Microeconomics a modern approach. UK: CECSA, 430 p.

Dewett, K. K. (1999). Modern Eeconomic Theory. Shyamlal Charitable Trust, Delhi.

Dominick, S. (2008). Microeconomics. Cue, Agustin (ed. Lit.); Choir, Julio (trad.). 3rd edition. Mexico: Mc Graw-Hill, 436 p. ISBN: 0-07- 054515-4

Ellen, M. (1993). Microeconomics. Cue, Agustin (ed. Lit.); Coro, Julio. San Francisco: Mc Graw-Hill, 649 p.

Hal, V. (2010). Intermediate microeconomics. 8th edition. California: Norton, 600 p. ISBN: 0-393-97370-0

Keynes, J.M. (1936). The General Theory of Employment, Interest and Money. London: Macmillan

Koutsoyiannis, A. (1975). Modern Microeconomics. Printed in Hong Kong.

Paschoal, R. Jose (1982). Introduction to Economics. Rojas, Mario 3rd edition. UK D.F.: Harla, 1982. 585 p. 332

Robert, P. (2002). Microeconomics. 4th edition. UK: Prentice Hall, 701 p. ISBN: 013-240-672-1

Roger, M. (1996). Microeconomics. Arango, Carlos 3rd edition. San Francisco: McGraw-Hill, 703 p.

Roger, L. M. (1982). Microeconomics. De Calvo, Stella. Bogota Colombia: McGraw-Hill, 610 p.

Salvadore, D. (1992). Microeconomic Theory, International Editions Schaum's Outline Service, McGraw Hill, INC.

Stackelberg, H. F. (1934). Market structure and equilibrium, Marktform and Gleichgewicht, German

Thorstein, V. (1898). Why is Economics not an Evolutionary Science?, The quarterly journal of economics. Vol. 12, No. 4, pp. 373-397 (25 pages) Published by: Oxford University Press.

Walter, N. (2007). Microeconomic theory basic principles and extensions. 9th edition, San Francisco: Thomson, 671 p. ISBN-13: 978- 970-686-548-9