



BASIC MATHEMATICAL TOOLS TO ANALYSE ECONOMIC PROBLEMS

Arup Das

Assistant Professor, Department of Economics, N.L.College, Lakhimpur, Assam.



ABSTRACT:

Mathematical economics is an approach to economic analysis in which the economist makes use of mathematical symbols in the statement or the problem and also draws upon known mathematical theories to aid in reasoning. Mathematical economics is merely an approach to economic analysis, so it should not differ from non –mathematical approach to economic analysis in fundamental way. Mathematical tools like Equation, Matrix, Differentiation, Integration, Cramer's rule, Linear programming etc. are often used by the economists to analyse and solve economic problems. Simple Market model, National income model, Input-output analysis, Marginal function, Total function and various other economic problems analyzed with the help of mathematical tools by the economists. Being an economic agent one need to keep focus on economic problems rather get into the complexity of mathematical rules. Econometrics and mathematical economics are often used in the same meaning but these two are different term each other. There same issues in public economics, environmental economics, and welfare economics, behavioral economics where the applications of mathematical tools are limited.

KEY WORDS: - *Mathematical economics, Mathematical tools, Market model, Environmental economics, Public economics, Welfare economics.*

INTRODUCTION

Mathematical economics is an approach to economic analysis in which the economist makes use of mathematical symbols in the statement of the problem and also draws upon known mathematical theories to aid in reasoning. Since mathematical economics is merely an approach to economic analysis, it should not and does not differ from the non-mathematical approach to economic analysis in fundamental way. Mathematical economics mainly implies the use of mathematical tools to analyse economic problems. Some of the commonly used mathematical tools to the economic problems are function, matrix, determinants, differentiation, integration, optimization, mathematical programming, etc. Most of the micro and macro economics problems can be analyzed with the application of mathematical tools. In fact, the uses of various mathematical to solve the problems of micro and macro economic problems are very advantageous. One of the important concepts of economics is the analysis of equilibrium. Equilibrium is a mathematical phenomenon which one is drawn from statics and dynamics. In consumer behavior analysis, it is discussed that what amount of a commodity a rational consumer will consume to be in equilibrium with given income. The same way, in producer's equilibrium, the maximum level of output that a producer can produce with least cost combination. The analysis of consumers' equilibrium is based on marginal analysis which can be explained with the application of differentiation.

OBJECTIVES

This paper is an attempt to discuss the following objectives-

1. To know the commonly uses mathematical apparatus to analyse economic problems.
2. To know the problems and limitations associate with the use of mathematical apparatus to analyse economic problems.

ANALYSIS

Function, straight line, differentiation, partial differentiation, integration, maxima, minima, simultaneous equations, model, matrix, etc. are various mathematical tools that extensively used in the analysis of economic problems.

Function is a mathematical tool. In economics, demand is a function of price, output is function of inputs.

Symbolically,

$$D_x=f(P_x) \quad \dots\dots\dots(1)$$

Where, D_x =Demand for commodity X
 P_x =Price of commodity X
 f = functional relationship.

$$Q=f(L,K) \quad \dots\dots\dots(2)$$

Where, Q =Output,
 L,K =Labour and Capital (Inputs),
 F =functional relationship.

The concept of income, cost, supply savings, investment, utility etc are the function of some related variables.

Linear function is a mathematical concept which is commonly used in economics. In economics, in the analysis of demand and supply linear function is often used. An example of simple market model is –

$$\begin{aligned} Q_d &= Q_s, \\ Q_d &= 22 - 2p, \\ Q_s &= -5 + 7p \end{aligned}$$

The above linear function of simple model can be solved to get the equilibrium price and quantity.

One of the prime concepts of economic analysis is marginal analysis. Marginal analyses of economics are based on the differentiation. For instance, $C=f(Q)$ is total cost function, then the marginal cost would be first order derivative of total cost function i.e. $\frac{dc}{dq}=MC$.

Let,
 Total cost function $C=1000+60q-12q^2+\frac{1}{3}q^3$
 Therefore, $MC=\frac{dc}{dq}=0+60-12q+q^2$
 $=60-12q+q^2$

The slope of MC will be the derivative of MC function, i.e., $\frac{d}{dq}(MC)=-12+2q$.

Integration is used in economics to derive total function from marginal function. For example, total consumption function can be derived from marginal consumption function.

Symbolically, $TU = \int MU \, dx$.

By using definite integral consumer's surplus and producer's surplus can be determined.

Let, demand function is $P = 35 - 2X - X^2$ and the demand is 3.

We can determine consumer's Surplus from the given demand function,

$$P = 35 - 2x - x^2 \text{ where } x = 3$$

$$\text{Then, } p = 35 - 2 \cdot 3 - 3^2$$

$$= 35 - 6 - 9$$

$$= 20$$

$$\text{Therefore, } Px = 20 \cdot 3 = 60$$

$$\text{Now, consumer's surplus} = \int_0^3 (35 - 2x - x^2) dx - px$$

$$= \left[35x - x^2 - \frac{x^3}{3} \right] - 60$$

$$= 105 - 9 - 9 - 60$$

$$= 27 \text{ units.}$$

In economics, to determine value of a variable number of equations or simultaneous equations is solved together. From a pair of equations of simple market model equilibrium price of a commodity can be determined. Equilibrium price is that price where the quantity of supply and demand is equal.

For instance,

$$Q_d = -5p + 20, \quad Q_s = 7p - 16$$

In equilibrium,

$$Q_d = Q_s$$

$$\text{Or, } -5p + 20 = 7p - 16$$

$$\text{Or, } 2p = -16 - 20$$

$$\text{Or, } p = \frac{36}{12}$$

$$\text{Or, } p = 3$$

DISCUSSION

In recent times, mathematical tools are becoming indispensable part of economic analysis. Due to the complexity of economic theories descriptive analysis has become less interesting these days. Mathematics has provided so many tools to the economists which application makes economic analysis interesting and stronger than descriptive analysis.

Mathematical tools are extensively used in economics to solve various economic problems. Various problems of micro and macro economics are analyzed with the use of mathematical tools. The marginal analysis, equilibrium analysis, elasticity, optimization, consumers' surplus, producers' surplus and many other concepts of economics are systematically analyzed with the use of mathematical tools. As like micro economics, mathematical tools are used in the analysis of macro economics problem, too. Multiplier, accelerator, national income model etc are macro economics concept where mathematics is used. The commonly used mathematical tools are Differentiation, Integration, Set theory, Matrices and determinants, differential and difference equation, Linear programming and etc.

Mathematics has definite language and operational rules. It offers suitable method to analyze complex economic problems in an easy way. It helps to understand the structure of economic model. In economics Micro and Macro models are formed. For an easy and better understanding of a subject models are formed. A model is a set of equations where each equation establishes relationship within the variables associated with the model. A simple market model is formed for the determination of price of a commodity and a national income model formed for the determination of national income. These models are the set of equations which are to be solved by the application of mathematical tools.

CONCLUSION

Mathematical tools are the indispensable part of economics. In the existing trend, without the knowledge of basic mathematical rules the study of economics almost impossible. These days every simple problem of economics is analyzed with mathematics. Whether it is a problem of elasticity or a problem of marginal utility mathematics are extensively used.

Although the use of mathematical apparatus is helpful for understanding of economic problems but also we need to be careful while using them otherwise has to be faced with awkward situation. Mathematics is an art. After acquiring the knowledge of this art then only someone can use it effectively to the analysis of economics.

According to Samuelson 'mathematics is neither necessary nor a sufficient condition for a fruitful career in economic theory. The use of mathematics can make the economics better and clear understanding but it cannot compensate bad economy. Mathematical economics related theoretical expression but it is not related with practical problems of economics.

Mathematical economics only concerned with quantitative elements but not with qualitative elements which are very important in economics. We can cite the example of utility. Utility is a physiological phenomenon and it cannot be explained with the use of mathematics. The mathematical tools are unable to solve the problem of negative externalities, positive externalities and social goods of environmental economics. The welfare concept of micro economics also can be analyzed with the use of mathematical tools.

Finally can be concluded that being economic agent our prime concern should be on the problems of economics but not how we can solve them by using mathematics. Excessive use of mathematics in economics may take away the key philosophy of the subject. So, keeping intake the very much philosophy of the subject of economics we can use mathematics in it.

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