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RELEVANCE OF MATHEMATICS FOR ECONOMICS

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ABSTRACT

The recent experience in the development of economic science however has convinced most of us that there is a need for better understanding of the subject matter. No doubt, this improved understanding can be brought about only through a scientific approach. In the process one must bring the date old verbal economic theories within the framework of technical competence that makes it possible to use the up-to-date mathematical and statistical techniques. In fact, economics is basically a quantitative subject in the sense that most of the economic variables like prices, income, employment etc., are always measured and stated in quantitative terms.

KEY WORDS: economic science , Economic theories , economic principles.

1.1 INTRODUCTION :

Economic theories often deal with the analysis of relationships between some of these variables. When such relationships are stated in a specific format they form economic theories or otherwise called economic principles. For example, the inverse relationship between price charged and the quantity demanded is popularly known as the law of demand. Similarly, the relationship between inputs and outputs, solely determined by the state of technical knowledge of the vintage concerned, is called the production function. In all these relationships, the involved variables are measured and stated in quantitative terms. This way it was proved that, in practice, Mathematics are not a substitute, but a complement for the economic sciences. This paper provides an analysis in terms of the synergy between Mathematics and economics.

1.2 ECONOMICS:

Economics is "the study of how people choose to use resources which can include land, labor, money, equipment, taxes and investments". The broad field of economics has many descriptions each

trying to discover a way to make clear what the field covers. Decisions have to be made in life and people are constantly making decisions about resources at the individual, company and government levels. Economics as "an important branch of the social sciences" that is all about resources. This discussion of resources surrounds the fact that resources are limited and people have needs and wants. Scarcity is a term used to explain these limited resources. Typically, resources have to be distributed to people in the form of goods and services. Thus, Economics is the study of how resources are used as well as an analysis of the decisions made in allocating resources and distributing goods and services.

1.3 MATHEMATICS

Mathematics is "the study of the relationship between size, shape and quantity, using numbers and symbols." These numbers and symbols convey meaning in a clear, concise and consistent way. Mathematics is a way to explain, explore, decipher and analyze complex concepts that otherwise might be resistant to synthesis. Math can also demonstrate whether or not a theory is true. . Mathematics is the language of numbers and symbols that can be used to logically solve problems and precisely describe size, quantity and other concepts. Some complex problems could not be described and complicated problems could not be acted upon without the language of mathematics and its support of logical processes to solve problems. The logical process of problem solving using mathematics can give precise answers to complicated, compound and multi-faced problems.

1.4 MATHEMATICAL ECONOMICS

Now-a-days, the branch of knowledge that uses mathematical techniques especially in Economic Theorizing is popularly known as “Mathematical Economics”. By mathematical economics we transform economic theory into a compact and precise mathematical form by using appropriate Mathematical functional form. For example, the law of demand tells us, when other thing does not change the price and quantity demanded are inversely related. As a first approximation to this demand law, economists often use linear equations of the type $q = a + bp$; $a > 0$, $b < 0$ to make the analysis simple. To depict the needed convexity shape of the indifference curve, we use rectangular hyperbolic functional form. To state the behavior of the total cost, we often use cubic functions. Once such transformations are made, we often derive interesting further properties from the said mathematical functional form. However, it is important to note that mathematical economics is not a separate branch of knowledge by itself. In fact, this approach used both in micro and macro-economic very frequently. Thus, mathematical economics is an approach used in almost all the branches of economics. However, one must remember that mathematical economics is not merely alternative way of representing economic theory. The very purpose of such a transformation is not only to make the theory easy to handle but also to derive certain interesting characteristic results. For example, after transforming both demand and supply functions in its simple linear mathematical form, we can easily calculate both the equilibrium price and the quantity. Similarly, we can calculate the appropriate tax rate that gives maximum tax collection to the government etc. It is important to note that such typical questions can be answered more precisely only by using mathematics. Therefore mathematical economics can always be considered as complementary rather than competitive in economic analysis.

1.5 MATHEMATICS IN ECONOMICS

Mathematics is an important subject and knowledge of it enhances a person's reasoning, problem-solving skills, and in general, the ability to think. Hence it is important for understanding almost every subject whether science and technology, medicine, the economy and business.

Mathematics is helpful in economics because it can help quantify or provide measurement and meaning to economic concepts. Mathematics also plays a large role in the area of economic analysis. Economics uses modeling to describe certain states of being and to analyze economic scenarios. Modeling suggests what will happen if certain actions are taken. Simulation of real world situations is possible with economic analysis and modeling and would not be possible without mathematics. Moreover, Mathematics can help in visualizing and quantifying economic concepts. Formulas and graphs can be used to describe and display such concepts. Mathematics is also a way to deal with uncertainty in a problem. Many economic terms can be represented mathematically. The terms are used to describe values and behaviors concerning supply and demand, the U.S. economy, producer and consumer theory, imperfections in the market and strategic behavior. The national economy is very complex so it is impossible for one single number or measure to accurately represent it whether as snapshot in time or over a period of time.

1.6 ADVANTAGES OF USING MATHEMATICS IN ECONOMICS

1.The mathematical language by nature is concise and precise. Hence by using mathematics, We can restate the economics theory in a more compact form like the one stated above to represent the demand law. In it the involved relationship is simple and self-explanatory in its mathematical form.

2.The mathematical simplicity enhances the precision of analysis like the calculation of Equilibrium price, equilibrium quantity, price elasticity of demand etc.

3.The mathematical economists can have always the added advantage of using the ever-growing unlimited amount of tools and theorems in pure mathematics for their advantage. The use of Euler's mathematical theorem in economics in explaining the distribution of income among the
factors of production is the classical example for such an advantage. Once a certain specific mathematical relationship is obtained, the mathematical economists Can deduce interesting and more useful new propositions and theories by applying Suitable mathematical methods.

4.The biggest advantage of mathematical economics is its ability to handle large number of variables at a given point of time. For example, in the theory of consumption Especially in indifference curve analysis, at the most we can handle only two commodities, one along the x-axis and one along y-axis. But in reality our consumption basket contains a large number of commodities. Mathematical economists can handle this situation by increasing the commodity space to accommodate any number of commodities in getting the extended equi-marginal principle.

1.7 USE OF STATISTICAL METHODS IN ECONOMICS

Statistics is another important branch of knowledge having the wider applicability in economics. Since very often-economic theories are constructed on the basis of real world observations, statistical analysis plays a crucial role in the development of economic theories. To quote Marshall "Statistics is the straw out of which I, like every other economists, have to make my bricks". In fact the quantity theories of money have undergone drastic revisions after having tested for its reliability or otherwise now and then by using the real world data. Thus statistics plays a unique role in testing economic theories empirically. Statistics are everything to economists. Without statistics, the economic field wouldn't even exist. Economists need statistics to represent data, to track and store information, to identify trends, to attribute value-in short, every aspect of economics relies on statistics.

Why is statistics so important to economics? The way to look at the relationship between statistics and economics is that economics is essentially the study of human decisions and trends, and

how these have a financial impact. Economists rely on information to form analyses, understanding and opinion on the human activity that they are scrutinizing. This information comes in the form of statistical data. Statistics is the core around which economic deductions are built. It highlights the relationship between figures that would otherwise be meaningless, and is key to economic analysis.

1.8 IMPORTANCE OF ECONOMETRICS

In recent times another quantitative approach, called econometrics, has emerged as an important tool in economic theorizing. The empirical content and policy significance are the two important faces of this new approach. Osker Lange defines econometrics as "The science, which deals with the determination quantitative laws occurring in economic life." Econometrics is the name given to the set of statistical techniques employed to test economic theories, or, increasingly, as a means of presenting 'the facts'.

Mathematical economics plays an important role in translating the verbal economic theories into its mathematical form. Econometrics, on the other hand, provides the necessary tools in testing the so-obtained mathematical statements of the concerned theory. Thus it is a branch of knowledge that deals with the empirical measurement of the economic relationships listed out in economic theories. For example, the linear demand equation given in the previous section (1.4) is only a restatement of the date old demand law in its mathematical form. Econometrics proceeds further in this direction by measuring the tightness of this inverse relationship using the statistical tools like correlation, regression etc. It is also used to test the reliability of the inverse demand law by using statistical tools. Once the reliability of the relationship is established the so-obtained relationship is used to forecast the likely changes in the quantity demanded for an expected price change on a future date. This is the practical utility of Econometrics.

One must remember that before testing a theory for its reliability, it must be first translated into a suitable mathematical form. It is also true that the statistical tools are commonly used in econometrics. Thus the basic relationships, which are analyzed in econometrics, are economic relationships expressed in mathematical form. Hence, for a good understanding of the subject "econometrics" one must be good enough in economic theory, in addition to mathematical and statistical tools. In other words, we would say that econometrics is a combination of economics, mathematics and statistics.

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