

Introduction of Econometrics

Econometrics deals with the measurement of economic relationships. Econometrics can be defined as that branch of economics concerned with the empirical estimation of economic relationships. Prof. Ragnar Frisch, a Norwegian economist and statistician, first of all named this science "Econometrics" in 1926. He defined econometrics as 'the mutual penetration of quantitative economic theory and statistical observation is the essence of econometrics.'

Econometrics is a combination of economic theory, mathematical economics and statistics. But it is completely distinct from each one of these three branches of science. So far as providing numerical values for the parameters of economic relationships, say elasticity, propensities, marginal values and verifying economic theories, Econometrics may be considered as the integration of economics, mathematics and statistics. It is a special type of economic analysis and research in which the general economic theory, formulated in mathematical terms, is combined with empirical measurement of economic phenomena.

"Econometrics is the science which deals with the determination of statistical methods of concrete quantitative law occurring in economic life" defines Prof. Oscar Lange. It shows that econometrics tries to picture economic phenomena statistically with the aid of quantitative economic relations. Though it is true that econometrics is a scientific method of study, which uses statistical methods, mathematical tools are also indispensable.

Prof. G Tintner has defined it as: "It (econometrics) consists of the application of mathematical economic theory and statistical procedures to economic data in order to establish numerical results in the field of economics and to verify economic theorems" Prof. Goldberger too has defined econometrics as, "A social science in which the tools of economic theory, mathematics and statistical inference are applied to the analysis of economic phenomena." Prof. Tinbergen wrote, "Econometrics is the name for a field of science in which mathematical economics and mathematical-statistical research are applied in combination."

From these definitions, one can be sure that econometrics is a separate branch of knowledge. Thus, Econometrics could be defined as statistical observations of theoretically founded concepts or alternatively mathematical economics working with measured data. In short

Economics + Mathematics = Mathematical Economics
Mathematical Economics + Statistics = Econometrics

Let us take an example for clarity. Economic theory postulates that the demand for a commodity depends on its price, on prices of other commodities, on consumer's income and on tastes. This is an exact relationship because it implies that demand is completely determined by the above four factors. No other factor, except those explicitly mentioned, influences the demand. In mathematical economics, we express the above abstract economic relationship of demand in mathematical terms.

Thus, we may write the following demand equation

$$Q = b_0 + b_1P + b_2P_0 + b_3Y + b_4t$$

where

Q = quantity demanded of a particular commodity

P = price of the commodity

P₀ = prices of other commodities

Y = consumer's income

t = tastes

b₀, b₁, b₂, b₃, b₄ = coefficients of the demand equation.

The above demand equation is exact, because it implies that the only determinants of the quantity demanded are four factors, which appear in the right-hand side of the equation. Quantity will change only if some of these factors change. No other factor may have any effect on demand.

Yet it is common knowledge that in economic life many more factors may affect demand. The invention of a new product, a war, professional changes, institutions changes, changes in law, changes in income distribution, massive population movements (migration) etc., are examples of such factors. Furthermore, human behaviour is inherently erratic. We are influenced by rumors, dreams, prejudices, traditions and other psychological and sociological factors, which make us to behave differently even though the conditions in the market (prices) and our incomes remain the same. In econometrics the influence of the above mentioned factors is taken into account by the introduction into the economic relationships of a random variable.

In our example, the demand function studied with the tools of econometrics would be of the (stochastic) form.

$$Q = b_0 + b_1P + b_2P_0 + b_3Y + b_4t + u$$

where u stands for the random factors which effect the quantity demanded.

It is essential to stress that econometrics presupposes the existence of a body of economic theory. Economic theory should come first, because it sets the hypothesis about economic behaviour which should be tested with the application of econometric techniques. In testing a theory we start from its mathematical formulation, which constitutes the model or the maintained hypothesis. In our example of the demand function the maintained hypothesis is

$$Q = b_0 + b_1P + b_2P_0 + b_3Y + b_4t + u$$

The next step is to confront the model with observational data referring to the actual behaviour of the economic units-consumers or producers. The aim of this stage is to establish whether the theory can explain the actual behaviour of the economic units, i.e., whether the theory is compatible with the facts. If the theory is compatible with the

actual data, we accept the theory as valid. If the theory is incompatible with the observed behaviors, we either reject the theory or, in the light of the empirical evidence of the data, we may modify it. In the latter case one needs additional new observations in order to test the revised version of the theory.

The procedure outlined above is not intended to imply that when testing a theory the researcher should restrict himself only to factors suggested by economic theory.

If these factors do not provide a satisfactory explanation of theory, the researcher should look for other variables. Alternative formulations, each of including various explanatory factors, should be done to revise the hypothesis of economic theory.

Many writers have argued that there is no need for pre-existing body theory. One may start with set of observed data and from this derive a behavioural theory. But such an approach seems absurd given that economics in present state does provide a large number of hypotheses that can be tested empirically. A pre-existing theory saves a lot of time by showing which of the mass of data available are of interest in any particular case.
