WHAT IS ECONOMETRICS?

The field of knowledge which helps us to carry out evaluation of economic theories in numerical terms, is Econometrics.

The name 'Econometrics' was introduced in 1926 by a Norwegian economist and statistician, Ragnar Frisch. The term was actually modelled on the expression 'Biometric' which appeared late in the 19th century to denote the field of biological studies employing statistical methods.

Econometrics is the science which combines economic theory with economic statistics and tries by mathematical and statistical methods to investigate the empirical support of the general schematic law established by economic theory. Econometrics, therefore, makes concrete certain theoretical economic laws by utilising economics, mathematics and statistics.

Although measurement is an important role of econometrics, the scope of econometrics is much broader as described by leading econometricians while defining this field of knowledge.

(i) Econometrics may be defined as the social science in which the tools of economic theory, mathematics, and statistical inference are applied to the analysis of economic phenomena. (Arthur S. Goldberger, *Econometric Theory*, 1964, page 1.)

(ii) Econometrics, the result of a certain outlook on the role of economics, consists of the application of mathematical statistics to economic data to lend empirical support to the models constructed by mathematical economics and to obtain numerical results. (Gerhard Tintner, *Methodology of Mathematical Economics and Econometrics*, 1968, page 74.)

(iii) ..... econometrics may be defined as the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference. (Samuelson, Koopmans, and Stone, *Econometrica*, Vol. 22, April 1954, pages 141-146.)

(iv) ..... econometrics is the branch of economics concerned with the empirical estimation of economic relationships. The 'metric' part of the world signifies measurement; and econometrics is basically concerned with measuring economic relationships. (Michael D. Intriligator, *Econometric Models, Techniques and Applications*, 1980,

Econometrics and Statistics

Statistics, as we all know, deals with collection of data, its tabulation in a desired form and then perhaps also the detection of relation between economic variables under investigation. Thus economic statistics is mainly a descriptive aspect of economic theory. Statistics also, as in the case of mathematical economics, does not provide the numerical values of the parameters involved in the economic relationships. Statistics provides numerical data for econometrics but does not itself make concrete the relationships between the economic magnitudes.

Economic statistics also differs from mathematical (or modern or inferential) statistics. The latter which is based upon the theory of probability, deals with the methods of measurement which are developed on the basis of controlled or carefully planned experiments. These statistical methods can be applied in economic relationships because such experiments cannot be designed (except in a very few cases, e.g., agricultural experiments or industrial experimentation) for economic phenomena. Yet fundamental ideas of mathematical statistics are applicable in econometrics; but they are not applied blindly or by analogy. They are used only after adapting them to random or stochastic behaviour occurring in economic problems. These adapted statistical methods are then called econometric methods.

GOALS OF ECONOMETRICS

Mathematical economics and economic statistics, as explained above, are the important aspects of econometrics. Mathematical formulations of theory provide rigour and precision while statistics provides the life-blood or the raw materials to this new field of knowledge, that is, econometrics.

But what is the prime goal(s) of econometrics?

Econometrics helps us to achieve the following three goals:

1. Judge the validity of the economic theories;
2. Supply the numerical estimates of the coefficients of the economic relationships which may be then used for sound economic policies; and
3. Forecast the future values of the economic magnitudes with certain degree of probability.

THE SIMPLE LINEAR REGRESSION MODEL

Relationships suggested by economic theory are usually specified as exact or deterministic relationships between variables; while on the other hand much stress is placed on the need for testing these economic theories. This implies a belief in the existence of stochastic factors. The knowledge of econometrics tries to test these theoretical propositions considering the existence of stochastic variables.

The simplest form of stochastic relation between two variables X and Y is called a linear* regression** model:

$$Y_i = \alpha + \beta X_i + U_i \ (i = 1, ..., n)$$

Y is called the *dependent variable*, X the *explanatory variable*, U the *stochastic disturbance* and α and β are the regression parameters.

For a simple linear regression model, these specifications are grouped in the form of five basic assumptions; usually known as Assumptions of Linear Regression Model.

Assumption 1. U_i is a random real variable and has normal distribution.

Assumption 2. The mean value of U_i is *zero*. $E(U_i) = 0 \ (i = 1, ..., n)$

Assumption 3. The variance of U_i is constant.

$$E(U_i^2) = \sigma^2 \ (\sigma^2 \text{ is a constant})$$

The assumption is known as the assumption of *Homoscedasticity*.

Assumption 4. The disturbance terms of different observations (U_i, U_j) are independent. $E(U_iU_j) = 0 \ (i \neq j)$

The assumption is known as the assumption of *Nonautocorrelation*.

Assumption 5. The explanatory variable(s) is nonstochastic variable and is measured without error; U_i is independent of the explanatory variable(s).

$E(X_i U_j) = X_i E(U_j) = 0$, for all $i, j = 1, ..., n$.

The regression equation: $Y = \alpha + \beta X + U$ along with the given five assumptions represents the *Classical Linear Regression Model*. The five assumptions have important roles to play in the sampling distributions of parameters: α and β. They, therefore, need to be understood very clearly.

The first four assumptions relate to distribution of U while the last one concerns the explanatory variable. The assumptions 1 and 2 state that for each value of X, U is normally distributed with zero mean, that is U is continuous variable symmetrically distributed around zero. The third assumption of homoscedasticity means that every distribution of U has the same variance σ^2 (which is assumed to be some constant value) whose value is not known. In other words this assumption states that for all values of X_i, whether lower or higher, the variance of the distribution of U remains same. Thus first three assumptions fully specify the distribution of U. The interpretation of the fourth assumption is that our observations are independent of each other so that the disturbances of different observations turn out to be non-autoregressive. The final assumption which refers to the explanatory variable states that values of X_i are controllable and predictable and that the covariance between U and X is zero; that is explanatory variable is independent of the disturbance term.

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