

Econometrics as an Academic Discipline in Higher Education: An Exploratory Study of the Need, Relevance and Significance

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Abstract of the Paper

Econometrics is a young science. It developed during the twentieth century in the mid-1930's, primarily after the World War II. Econometrics is the unification of statistical analysis, economic theory and mathematics. The history of econometrics can be traced to the use of statistical and mathematics analysis in economics. The most prominent contributions during the initial period can be seen in the works of Tinbergen and Frisch, and also that of Haavelmo in the 1940's through the mid 1950's. Right from the rudimentary application of statistics to economic data, like the use of laws of error through the development of least squares by Legendre, Laplace, and Gauss, the discipline of econometrics has later on witnessed the applied works done by Edgeworth and Mitchell. A very significant mile stone in its evolution has been the work of Tinbergen, Frisch, and Haavelmo in their development of multiple regression and correlation analysis. They used these techniques to test different economic theories using time series data. In spite of the fact that some predictions based on econometric methodology might have gone wrong, the sound scientific nature of the discipline cannot be ignored by anyone. This is reflected in the economic rationale underlying any econometric model, statistical and mathematical reasoning for the various inferences drawn etc.

The relevance of econometrics as an academic discipline assumes high significance in the above context. Because of the inter-disciplinary nature of econometrics (which is a unification of Economics, Statistics and Mathematics), the subject can be taught at all these broad areas, notwithstanding the fact that most often Economics students alone are offered this subject as those of other disciplines might not have adequate Economics background to understand the subject. In fact, even for technical courses (like Engineering), business management courses (like MBA), professional accountancy courses etc. econometrics is quite relevant. More relevant is the case of research students of various social sciences, commerce and management.

In the ongoing scenario of globalization and economic deregulation, there is the need to give added thrust to the academic discipline of econometrics in higher education, across various social science streams, commerce, management, professional accountancy etc. Accordingly, the analytical ability of the students can be sharpened and their ability to look into the socio-economic problems with a mathematical approach can be improved, and enabling them to derive scientific inferences and solutions to such problems. The utmost significance of hands-own practical training on the use of computer-based econometric packages, especially at the post-graduate and research levels need to be pointed out here. Mere learning of the econometric methodology or the underlying theories alone would not have much practical utility for the students in their future career, whether in academics, industry, or in practice.

This paper seeks to trace the historical development of econometrics and study the current status of econometrics as an academic discipline in higher education. Besides, the paper looks into the problems faced by the teachers in teaching econometrics, and those of students in learning the subject including effective application of the methodology in real life situations. Accordingly, the paper offers some meaningful suggestions for effective teaching of econometrics in higher education.

Key Words: History of Econometrics, Teaching of Econometrics, Practical Training.

1. History of Econometrics

Econometrics literally means 'economic measurement'. It is a combination of mathematical economics, statistics, economic statistics and economic theory. The use of statistical analysis in economics later on culminated into the birth of a new discipline viz. econometrics in the mid-1930. Notable works were made by Tinbergen and Frisch in the initial days, and also by Haavelmo in the 1940's through the mid 1950's. The development of the application of statistics to economic data started with laws of error through the development of least squares by Legendre, Laplace and Gauss, and was followed by the applied work done by Edge worth and Mitchell. The development of correlation and multiple regression analysis and the use of these techniques to test different economic theories using time series data was a landmark achievement.

In fact, 1939-40 witnessed a debate between John Maynard Keynes and Jan Tinbergen over the logical foundations of econometrics, and Economic Journal (EJ) was the medium for the debate. Though there is a claim that econometrics is an experimental method, the fact that the basic assumptions of the multiple regression and correlation approach are based on the assumption of a normal probability distribution negates the above claim. The logical core of Keynes's critique is page 568 of the Sept.1939 issue of E J. wherein Keynes has stated, "...the most important condition is that the environment in all relevant respects, other than the fluctuations in those factors of which we take particular account, should be uniform and homogeneous over a period of time". Keynes has suggested that the formal procedure required implementing the application of the Lexis Q-test-breaking up the series (time series) into a set of sub-series and then testing to see if each of the subseries' coefficients is generally the same (uniform) as the coefficients of the series. The results would be normal, subnormal, and supernormal (see Keynes's ft.1 on pp.420-421 of the TP). One criticism of Keynes (minor) is that he did not explicitly mention the Lexis Q-test. Keynes probably did not want to preclude other tests for normality, such as the Chi-Square. Nowhere in Tinbergen's two volumes is work there any such test. Keynes, however, could have told Tinbergen the results of such a test in advance. Due to constantly changing expectations of future expected profits and constant new investment in a capital stock changing due to constant technological change, advance and innovation over the long run period of time that would constitute the relevant time series, the necessary uniformity and homogeneity needed to apply a normal probability assumption would fail the test.

The Keynes of the TP also had a suggested solution-use Cheybshev's inequality and other measures of central tendency (law of errors) such as the median, harmonic mean and geometric mean. Morgan discusses the assumption of normality that

underlies the entire edifice of Tinbergen's econometrics without mentioning a single piece of empirical, experimental or historical evidence that would supply some amount of justification for such an assumption. In many respects, Keynes's argument against the misuse and abuse of the assumption of a normal probability distribution to test different theories of the business cycle, using time series data, can be viewed as an earlier underdeveloped version of Benoit Mandelbrot's overwhelming critique of the misuse and abuse of the normal distribution in finance and portfolio theory. It is now obvious, due primarily to Mandelbrot's 50 years of scholarly work, that predictions about future price movements in the stock, money, bond, commodity, and currency exchange markets are all wrong. It should not be surprising that attempts to predict changes in the business cycle over the 65 years since the Tinbergen-Keynes debate have also turned out to be badly off the mark. Econometrics is presently reduced to the short run estimation of coefficients based on the use of cross-sectional data.

1. Nature and Use of Econometrics

The two main purposes of econometrics are to give empirical content to economic theory and also to empirically verify economic theory. For example, econometrics could empirically verify if indeed a given demand curve slopes downward as economic theory would suggest. Empirical content is also given in that a numerical value would be given to this slope, while economic theory alone is usually mute on actual specific values.

Arguably the most important tool of econometrics is regression analysis. Econometric analysis can often be divided into time-series analysis and cross-sectional analysis. Time-series analysis examines variables over time, such as the effect of interest rates on national expenditure. Cross-sectional analysis studies relationship between different variables at a point in time. For instance, the relationship between income, locality, and personal expenditure when time-series analysis and cross-sectional analysis are conducted simultaneously on the same sample, it is called panel analysis. If the sample is different each time, it is called pooled cross section data. Multi-dimensional panel data analysis is conducted on data sets that have more than two dimensions. For example, some forecast data sets provide forecasts for multiple target periods, conducted by multiple forecasters, and made at multiple horizons. The three dimensions provide more information than can be gleaned from two dimensional panel data sets. A simple example of a relationship in econometrics is:

Personal Expenditure = Propensity to Spend * Income + random error

This statement asserts that the amount a person spends is dependent on his or her income and his or her willingness to spend money. If we can observe personal expenditure and income, techniques such as regression analysis can then be applied to find the value of the coefficients, here just the propensity to spend. The estimated coefficient can then be compared across samples (such as different countries or income brackets) and conclusions made.

The above example can also be used to illustrate the many difficulties facing the applied econometrician. For instance, do we really know that the above relationship is correct? Perhaps the true relationship between personal expenditure and income is non-linear (that is, curved). Even if we know the correct theory, it is not certain we can measure personal expenditure and income correctly. For instance, the value of work

by homemakers is not recorded although it contributes to income. There are also a variety of statistical pitfalls that potentially lead to incorrect conclusions. Econometrics has dealt extensively with such issues. Often it turns out to be difficult to fully implement the resulting methods in practice. Most common applications of econometrics are prediction of macroeconomic variables such as interest rate, GDP, inflation, Macroeconomic relationships such as unemployment-inflation and inflation-money, Microeconomic relationships such as wage-education, production-input, Finance such as stock volatility, Forecasting.

2. Education in the Reforms Era: Relevance of the Study of Econometrics in Higher Education

In the emerging scenario when economic deregulation measures are sweeping across the globe, education has got added significance to an economy because production of knowledge has become the most decisive economic activity; knowledge being the most important raw-material in the 'knowledge economy' of the 21st century. In the globalised economy, the scope and significance of education in social sciences in general and the one in economics discipline in particular have increased tremendously. Equally important is the need for re-orienting and restructuring the curriculum structure of the courses with a view to adapt them with the changing requirements of the open economy. The International Commission on Education for 21st Century states, "Higher education is at one and at the same time one of the driving forces of economic development and the focal point of learning in a society. It is both repository and creator of knowledge. Moreover, it is the principal instrument for passing on the accumulated experience, cultural and scientific, of humanity" (Delors, 1996. p.130).

Further, the recent UNESCO Report, "Towards Knowledge Societies" states, "Institutions of higher education are destined to play a fundamental role in knowledge societies, based on radical changes in the traditional patterns of knowledge production, diffusion and application." (UNESCO-2005, p.87)

3.1 Restructuring Economics Education in India – Relevance of Econometrics as a Core Course

In view of the foregoing discussions, here an attempt is made to offer some strategies for remolding the higher education in India in economics discipline in the ongoing reforms era. Economics education in India needs to be made more market friendly and hence more rewarding for the learners. The relevance of econometrics lies in its potential to support informed and scientific policy decisions through the use of economic theory coupled with mathematical and statistical approach.

➤ Curriculum Design: Application Orientation – applying the Principles and Theories

Syllabus and the content of the graduate and postgraduate level programmes in economics need to be thoroughly revised, in keeping with the reforms in the economic system and the market structure. The curriculum should primarily focus on providing an in-depth knowledge in the subject matter of economics i.e. a thorough understanding of theories and principles of economics. An equally important but often overlooked, aspect is that of equipping the students to apply the principles and theories of economics in practical situations. As already pointed out, this aspect has got utmost significance in today's globalised economic environment. In this regard,

relevance of courses on Econometrics need not be overemphasized, particularly in sharpening their analytical thinking and adopting scientific approach to economic problems.

➤ Curriculum Design: Industry-Academic interaction:

Similarly, today there is enhanced significance for industry-academic interaction. This can facilitate the much desired practical orientation for the studies. Further, this can also provide better opportunities for the students and faculty members to undertake projects, case studies etc. with or without industry sponsorships. Another important point is that any education to be complete should inculcate in the students the habit of an ongoing, evaluative, critical and strategic ways of thinking in all relevant areas. Accordingly, it should encourage the students to look into education as an ongoing and life-long learning process, whether in the class room or in work environment; either as part of an academic course or otherwise. The curriculum should encourage the students to think like economists and engage enthusiastically the subject learned. Students should be encouraged to use of econometric tools in their analysis of the problems of various industries and hence offer meaningful and pragmatic solutions.

➤ Development of some Specific Skills, particularly Quantitative Analytical Skills

The curriculum should be so designed as to imbibe in the students such skills as (i) Key Skills (Subject knowledge) which involves acquiring advanced knowledge in the subject concerned and also thorough understanding as to the situations wherein the same can be aptly applied, (ii) Transferable Skills, the skills that enable the learner to transfer (i.e. communicate) the knowledge acquired, (iii) Problem Solving Skills, which include the skills that enable the learner to apply the acquired knowledge to specific decision-making situations to arrive at meaningful and logical decisions. Other skills include the skills to work as a Team, Life-long Learning Skills etc.

Emphasis on quantitative analytical skills, particularly in the use of different econometric models, is required in order to ensure that the skill set of the students match with the expectations of the market. More importantly, all courses in the syllabus shall be restructured to have a quantitative bias; because, the market always favours candidates with an analytical and quantitative bend of mind.

➤ Development of Practical Skills – Need for ‘Hands on’ Training (Practical Training)

These skills include, inter alia, (i) skills for planning and scheduling of various works or projects, (ii) skills in making efficient use of computers in data analysis and generation of various reports, making effective presentations, word processing and generation of documents, using statistical packages like SPSS etc.; and also the use of internet to retrieve and manipulate text and data, review of literature etc. (iii) interpersonal skills to relate to, and collaborate effectively with, colleagues. Utmost important is the emphasis required on the practical part of the course. Practical courses (like, Computer Laboratory courses to train the students in the use of econometric packages and other similar packages like SPSS, STATA, E-Views etc.) need to be included at graduate and post-graduate levels of economics education to make the economics graduates and post-graduates readily employable. A ‘Case Study’ approach is very much essential to improve the practical orientation of the economics course, by providing the students better insights into the applications of the economic

theories. It may be noted that ‘Case Study’ approach is followed extensively in business management education.

3.2 Relevance of the Study of Econometrics in Applied and Allied Areas, and Other Courses of Study

Apart from the case of higher education in Economics, study of Econometrics is quite relevant in a number of allied social science disciplines (like Commerce, Sociology etc.) because of the practical orientation of the subject. At post-graduate level, students with adequate background in the relevant fields (viz. Economics, Mathematics, and Statistics) may be offered Econometrics as an elective course.

In professional courses like Management, Engineering etc. too inclusion of as an Elective course as a separate module in some core (compulsory) course is quite relevant, because of the scope for practical applications. Only thing is, adequate background knowledge of Economics, Mathematics and Statistics has to be ensured. At the post graduate level professional courses (like, MBA) the utility of the study in econometrics is quite good. Even better is the practical utility at research level (like, Ph.D, M.Phil etc.) because Econometrics is a handy tool for analyzing quite a large number of research problems in social sciences as well as applied sciences (like, Industrial Engineering and Management Science).

Emphasis on Applied and Allied Areas: Apart from the traditional subjects in economics and quantitative subjects just mentioned above, the learner should be provided opportunities to learn in detail the stock market transactions, operations in foreign exchange market, investment analysis, portfolio management, financial analysis etc as part of the course. Skills acquired in specific areas as above offer high level of employment opportunities to candidates. In this regard, some of the relevant subjects having huge demand in job market that could be included in a typical curriculum include, inter alia, managerial economics; money, banking and finance; capital markets; foreign trade and international finance; computer applications in economic analysis (with practical training on computers and preferably with suitable projects/mini-projects also); market research based on micro-economic tools and statistics; accounting for decision makers (with adequate coverage of financial analysis and modelling); econometric analysis, cost-benefit analysis and project management etc.

4. Teaching Method Relevant for Econometrics Course

Apart from revising the content of the course, equally important is the need to change the methodology of imparting the knowledge to the students. Ideally in the context of higher education, a teacher should turn into a guide by the side rather than a sage on the stage. His role is to arouse the inquisitive instincts of the students and provide them with adequate opportunity to freely express through interaction, both inside and outside the classroom. In this regard, it is the teacher who has to initiate and motivate the learning and application process. The traditional ‘chalk and talk method’ or the lecture method - the most popular one - is of course helpful in providing a starting point for development of the cognitive skills by encouraging them to think about evaluation and application of theories, principles etc. However, this method is often a one-way traffic and the students are bound either by the scholarship of the teacher or are bound by silence when they are unable to follow the teacher. In the new context, it is imperative to go for some modern teaching methodology because

of the paradigm shift in the relevant contextual variables as is depicted in the Table I given below:

Table I: Teaching of Econometrics in Modern Times – the Paradigm Shift.

Sl. No.	Distinction between a Traditional and Modern Teaching Methodology	
	Traditional Methodology	Modern Methodology
01.	‘Chalk and Talk’ method	Participative and Interactive method
02.	Teacher-Centric approach	Learner-Centric approach
03.	Conditioned environment	Flexibility in the setting
04.	Passive and less interactive learner	Active and more interactive learner
05.	More Theoretical oriented	More of Application oriented
06.	Spoon feeding	Self paced learning
07.	Feed back over a period of time	Immediate Feed back

4.1 Use of Modern Teaching Aids

Many of the traditional teaching aids are being fast replaced by modern ones because of the paradigm shift in the environment. The modern teaching typically includes the following:

- (i) Use of overhead and slide projectors. Quite often, these are also getting replaced by the ever latest techniques like the use of LCD projectors and such other ICT enabled teaching aids. Extensive use of audio-visual aids can make learning easier and more interesting to the learners and further more convenient to the teachers.
- (ii) Computer aided learning is making rapid strides in the field of education and is redefining the way education is delivered by enabling the learner to virtually interact with far off experts. Using the Internet, plenty of the ever latest and relevant information can be accessed easily; apart from enabling people at far off locations to instantaneously interact each other.

4.2 Seminars, Tutorials, Case Studies, Mini Projects, Fieldwork etc.

With a view to actively involve the students in the learning process, it is imperative that alternative teaching-learning strategies are introduced. These include innovative methods like small-group seminars which would encourage the students to prepare a paper by themselves and communicate their ideas by presenting the same before the audience. Tutorials also perform the similar functions, but the written form of communication is employed here. Other methods quite commonly employed, like case-studies, field-works; mini projects etc. can also ensure very meaningful and innovative learning process.

The benefit of the above methods is that they provide the students with opportunities to interact freely with faculty members, peers, practitioners,

professionals from industry etc. thus widening their spectrum of knowledge particularly the application part of whatever theories they learn. These sorts of field-based and practice-oriented studies would greatly enhance creativity of thought of the learners and would instill the necessary skills in them for application of economic theories to solve real-life problems.

5. Major Problems Faced by the Teachers and Students of Econometrics and Remedial Strategies

Lastly, let us look into the problems and challenges faced by the teachers and students of econometrics, and other allied problems like infrastructural inadequacies. Students of economics generally do not have adequate background in quantitative techniques (Mathematics, Statistics etc.) and as such they are scared of Econometrics or similar subjects that require quantitative analysis. Often, there are no takers for elective courses in Econometrics. Moreover, colleges that offer Econometrics stream for post-graduate or graduate courses in economics are avoided by many students because of the above reason, and naturally colleges do not pay much attention to Econometrics while offering courses. Besides, for delivering the course meaningfully with adequate practical training too, there is the need for better infrastructure facilities (like, computer laboratory and trained teachers) which are also lacking in most cases. Getting good teachers (or, more aptly ‘trainers’) for Econometrics to groom the students properly as per the market requirements seems to be a formidable task indeed, especially when we notice that vast majority of the teaches have not studied this course as part of their studies nor have they attended suitable training courses to enrich their background in this area.

Thus, suitable training needs to be given to economics teachers in this area. Also, adequate background in quantitative techniques needs to be given to the student’s right from higher secondary level so that ‘econometrics phobia’ could be reduced at higher classes. Needless to mention, better infrastructure is essential to offer the course meaningfully, that is, with ‘hands on’ practical training through the use of popular econometric packages like e-Views.

6. Concluding Remarks

Given the very young status of the discipline of econometrics but the vast potential of econometric tools for practical applications, there is immense scope for development of Econometrics. Besides graduate and post-graduate economic courses wherein Econometrics may be offered as a core course, it may be offered in various applied and allied disciplines (including Engineering and Management) either as core course or as elective. In an increasingly opened up economy like ours the market prefers the right skills and talents. The value addition that Econometrics offers need not be over-emphasized.

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