Dependence of Research Methodology on Laboratory Tools in Economics

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The fact that the nature of research is higly dependent on tools is not well-known and has not attracted enough attention among scientists. By the word "tool", I mean any laboratory instrument that helps the researcher in examining the various properties of models which have been built for simplifying real world phenomenon. Let us start with the point that as sophisticated laboratory tools enhance the development of scientific theory, they also prevent its structural promotion. One who reads this sentence may be surprised as to how the improvement of tools could restrain the growth of science. I hope to clarify this point in my discussion.

Consider mathematics which is an abstract science; its laboratory tools include computing machines and equipment. The principal development of this science does not belong to this century but a time when computational equipment were not able to handle actual problems. Works of mathematicians i.e. Euler, Lagrange, Fourier, Laplace, Gauss and others are theoretical contributions to mathematics. Their endeavors were in a way to solve existing unsolved problems theoretically, not numerically. In their time .computational equipment were primitive. When computers grew, incentives to find closed form solutions and general solution formulas declined whereas computational methods as numerical analysis grew.

This example may be interesting to note. General solution of a polynomial of a higher degree has not been attained yet and there is no closed form for the roots of such polynomial. In special cases of these polynomials, finding the corresponding roots is mathematically very cumbersome and laborious, but by using an appropriate software and spending a little time the roots can be approximately found with the desired degree of approximation. Perhaps in 20th century, owing to the invention of fast computing hardware and software, the incentive to find the algebraic solution of polynomial has been discarded. Nowadays, researchers are doing their best to innovate good algorithms but not good formulas. This conclusion is overstated but not really exaggerated. Recent progress in mathematics just consolidates the predecessor's findings.

Now consider statistics, the same story is repeated. Evolution of statistics is categorized (by Huber 1972) into three waves, namely, distribution theory, nonparametric statistics and robust statistics. In my view, the first wave (distribution theory) includes the main contribution to the theory of statistics that is the theoretical analysis of random variables behavior. The works of Laplace, Pareto, Edgeworth, Gauss, Poisson and others are good examples. When the way of progress in this field hardened, and the required tools (abstract mathematics) had not gained enough necessary developments, this area became more or less stagnant and the second wave of statistics started to grow. Nonparametric statistics (as the second wave) changed the way of thinking by disregarding parametric distribution theory. The reason was the complexity of distribution theory and its need to benefit from the unexplored formulas of pure mathematics. Therefore the tools of statistics which were actually mathematical instruments by nature, indeed distorted the research path in this field. When computing machines and methods had grown enough, and mathematicians turned their attention to numerical analysis of the problems, another trajectory opened to statisticians. In accordance with the newly developed field of mathematics, the third wave of statistics – robust statistics – began to have some bases. Statisticians of this wave started to develop an important disagreement with their predecessors. this new wave of thought assumes that in statistical analysis we are not always confronted with the known distribution of random variables (see Huber 1988); so they search for the best model fitting to the observed data. In this course of events they feel rwlatively more free to experiment with all the situations they like and make any computation they need. In this wave theoretical discussions lost their importance and computational experiments took over.

Thus, generally it was the computing methods and machines as tools of mathematics and mathematics as tools for statistics that distorted statistical analysis.

Now let us turn to economics and its tool-econometrics. Econometrics itself uses different tools of statistics, mathematics and computer hardware and software. Econometrics works as a tool for evaluation of economic hypothesis. True economic research methodology dictates to take exactly defined steps. Accordingly, economic variables should be analyzed, their behavioral model recognized and derived, and the phase of model specification ended with a well defined system of functional forms and variables. The specified model should be able to define the logic of the researcher about his real world observation exactly. At this stage the model is convenient to be checked with real data. Experimentation and empirical investigations start according to the assumptions that the model has been built on them. Owing to the relative advancement of tools compared to economic theory (see, Morishima 1984), actually the above-mentioned steps do not always take place. The researcher uses real data to find any kind of correlation and tries to justify it and then builds a convenient model to explain the cause of occurrence of this observation. In fact this way of research uses the reasons just to justify the observed phenomenon, not to identify the global and general aspects of the phenomenon behavior. On the other hand, what really occurs is the inference of various experiments of different specified models which all of them may not be theoretically compatible with the observed phenomenon. In this process, tools have the main role and logical analysis becomes less important. Assumptions are then defined and "theory" is designed. Thus, the process of hypothesis making is actually neglected. This research procedure is prevailing among young researchers whose access to advanced tools help them to do it this way.

There are many examples related to this discussion, but I just refer to specification error in econometrics which is one of the most important types of errors in model building theory and completely ignored in empirical research. Specification error occurs whenever the formulation of the model or one of the underlying assumptions is incorrect. In this context when any assumption of the underlying theory or the formulation of the model does not hold, a relevant variable is omitted or an irrelevant one is included, qualitative change of a variable is disregarded, incorrect mathematical form of the model is adopted, or incorrect specification of the way in which the disturbance enters the regression equation is used and so on, specification error exists. If we neglect the underlying economic theory and build an empirical model, serious specification error will occur.

To sum up, as Allais (1990) emphasizes, "*mathematics is not and cannot be anything more than a tool*" and "*mathematics is, and can only be, a means of expression and reasoning*". Using econometrics (tool) but disregarding economics (tool) but disregarding economic theory brings us into the pitfall of invisible errors and accordingly incorrect conclusions.

References

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