Mathematics and Economics In Pakistan

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Mathematics, often referred to as the language of nature is arguably the most profound achievement of the human intellect. Why is math so unreasonably effective in explaining the natural world as Eugene Wigner[2] famously argued. For instance, the complex numbers, which were invented to solve equations with no real solutions are crucial for understanding quantum mechanics in modern physics. Some of Srinivasa Ramanujan's work on mock modular forms in number theory has astonishing applications in understanding black holes! Physics is littered with many such examples of the fascinating applications of math which was developed artistically and "merely" for its own sake. On the other hand, the utility of math in the social sciences has been more contested and to many it is less promising. Peter Schonemann[3] even flipped Wigner's famous idea by claiming that math has a reasonable level of ineffectiveness in the social sciences. Unlike in physics, economics is not governed by simple and elegant equations. Often, the pursuit of mathematical elegance in economics is disrupted by the inconvenient interference of human whim, fundamental uncertainty, and the sheer complexity of social and economic interaction.

However, I would argue as do many other economists that math nevertheless has an indispensable role to play in economics. Mathematical formalism imposes a kind of discipline and incisive clarity on economics that remains enviable through mere words. This is because mathematical argumentation necessitates by its very nature explicit assumptions and logically flawless inferences. Math also makes economics portable, compact, and mobile across cultures, languages, and academic disciplines. In addition, math allows us to represent the inherently quantitative nature of claims in economic models. Such quantitative models enable us to achieve isolation of causal forces and draw precise, conditional, causal inferences by creating artificial laboratories, which cannot be otherwise constructed in the social sciences. This centrality of mathematics in economics is not reflected in the curricula, expectations of young students and the vision of economics offered by Pakistan's academic institutions.

There are many facets to the mathematical impoverishment of economics in Pakistan. One problem imposes no culpability on the economists since the quality of mathematical research as well as instruction is generally quite sub-standard. Thus, even when we have joint

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[2]Wigner, E (1959). The Unreasonable Effectiveness of Mathematics in the Natural Sciences. Richard Courant Lecture in Mathematical Sciences delivered at New York University.

[3]Schonemann, P (1994). Measurement: The Reasonable Ineffectiveness of Mathematics in the Social Sciences. Trends and Perspectives in Empirical Social Research.

programs in economics and mathematics, the mathematical foundations of students remain dilapidated. However, one cannot absolve everyone else by simply blaming the mathematicians for being incompetent since the problem is deeper than this.

Moreover, the students who choose economics at university typically do not have the required mathematical background and nor do they have the patience and curiosity to learn it. Often, many O/A level students are under the false impression that if they are mathematically challenged, then economics, accounting, and business studies etc., unfortunately often clubbed together are their natural choices. Our schools and colleges do not effectively communicate to prospective students that an interest in mathematics is not an option but a requirement for pursuing economics at university.

Sadly, the universities happily cater to the large demand for an economics education devoid of mathematics. In fact, often the content of courses is adjusted and watered down to accommodate the mathematical deficiencies of students. While this is a lucrative market strategy to satisfy students as customers, I believe that such an education is a disservice to both the students and the discipline of economics. Such compromised education misleads students, gives them poor preparation for graduate study and occludes a deeper understanding of economics which comes with mathematical thinking.

Furthermore, many economists at our universities do not make the effort to make their courses mathematically rigorous. Some of this reluctance is explained by the attempt to accommodate student incompetence and lack of ability of some professors to deliver such content. Often the professors believe that mathematical content should be utilized only by the mathematicians. They lethargically withdraw their responsibility by believing that the required math can be picked up at graduate level by those who dare to embark upon a PhD in Economics and is hence, redundant at undergraduate level.

Moreover, there is also an ideological dimension. Some of the professors are not fond of a mathematical approach to economics altogether. They believe that mathematics is not crucial to understand economics and it is neither the most interesting nor the most non-trivial component of economics. This view is also shared by some prominent academics such as heterodox economist Ha-Joon Chang[4] who famously argued that 95% of economics can be explained without using any math at all. Hence, professors with this view believe that by excluding mathematical rigor, they are not excluding the essence of economics. A related point is that mathematics in economics is considered useful only for abstruse, pure economic theory or in mathematical economics, a narrow, sub-field of economics. When this thinking weds the general disinterest and aversion to theory, rampant in our intellectual ecosystem,

[4]Chang, H. (2014). Economics: The User's Guide.

mathematical approaches are neglected, leading to an amputated and emaciated version of economics.

I disagree with the view that mathematics is not crucial to understand economics and neither do I think that a mathematical approach is useful only for the theorist and obscure studies in mathematical economics. I think that a deep appreciation of many economic insights including policy relevant ones will remain elusive to many unless mathematics plays its lucid and illuminating role. Contrary to popular perception, mathematics facilitates understanding of concepts rather than obfuscating it. As Harvard economist Dani Rodrik puts it "economists use math not because they are smart but because they are not smart enough". For many of us who perhaps unlike Keynes or Marx or Hayek are "not smart enough", the gateway to deep economic understanding is impossible to cross without the diligent and generous assistance of mathematics.

In addition to helping us overcome human biases and maintain logical consistency, math also extends our capacities by helping us learn facets of the world, otherwise inaccessible. A celebrated illustration of this service of math is the symmetry of the Slutsky matrix in microeconomic theory. Paul Samuelson first cited this as an example of a result, which is both non-trivial and consequential but impossible to arrive at without using the mathematical property of the symmetry of the Hessian matrix. Even when dealing with so called applied/policy applications of economics, mathematical models are indispensable. For instance, any statistically precise and identified, estimate of the impact of any cash transfer program or labor market intervention by policy makers cannot be achieved without a mathematical analysis of the statistical estimators involved. Similarly, if central bankers are trying to estimate a precise, optimal inflation target for Pakistan, a policy question, they need a quantitative model which explicitly incorporates the welfare criterion to be maximized, relevant agents and their incentives involved and stylized facts about prices of commodities to answer that question.

In sum, I urge for a popularization of the inseparable connection between economics and mathematics in our schools and colleges so that young students can make informed choices about their choice of majors at university. I also propose for a more seamless integration between economics and mathematics at our universities so that we can train careful and rigorous thinkers. We do not want economists merely capable of posturing and concocting elaborate word salads but those who can combine empirical evidence with mathematical models to deliver concrete theoretical and policy insights. This transformation requires a change in mindset and attitude through an acceptance of the necessity of mathematical models in not just the natural sciences but also the social sciences, especially in economics.