MORE ON THE MISUSE OF MATHEMATICS IN ECONOMICS: A REJOINDER

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A YEAR ago and for another audience, my friend David Novick wrote a short piece on the misuse of mathematics in economics, which piece has rather unexpectedly been made the center of controversy.1 Under the circumstances, a rejoinder, and perhaps a more specific restatement of some of Novick's criticisms, is in order. As I share many of his misgivings regarding some "mathematical economics," 2 and because, as colleagues, we could readily confer on this rejoinder, the following comments can be considered a joint expression of our views.

Because some have incorrectly inferred that Novick is opposed to any use of mathematics in economics, the following list of more specific complaints, together with some examples from a recent work of Samuelson, is offered.

1. A few writers make a travesty of mathematics by using its notation, but neglecting its operations. Instead of using the powerful techniques of mathematics to make implicit relations explicit, they merely paraphrase with symbols, and sometimes with their own peculiar and unexplained notation, ideas that could readily be stated also in prose. A very few may use mathematics as a form of "lifemanship" in the best Stephen Potter manner. It is probable, though, that most of these writers have no wish to win arguments through intimidating unintellegibility.3 However, the result is that many able economists, especially the older and more experienced ones, cannot comment on some published ideas because they cannot "read" them. Not only do many competent economists thus become frustrated, but the constructive criticisms they might make are unnecessarily precluded. This is unhealthy and wasteful.4

2. Economic life is so rich in detail that only a few of its features can ever be described in a set of equations. Hence all the rest necessarily becomes lost from any succeeding analysis if it is limited to mathematical operations. Such caricatures of economic behavior can lead to logically correct conclusions — granted the assumptions, the form of the equations, and the input magnitudes if there be any — and yet the results may really be useless. This spinning of theories, with little reference to the real world, can retard progress within economics and bring the profession into disrepute among those who must apply economic theories to problem areas.

3. The widespread use of mathematics has often tended to transfer attention and inquiry from the substance of economic life to the formal properties of some of the mathematical expressions used to describe it. Part of Keynes's contribution was to suggest, from his knowledge of the environment, that aggregate income was somehow related to intended savings and intended investment, and that the equilibrium income would equate them. The repeated enunciation of this idea by others, in the form of graphs and equations, has mesmerized some economists into forgetting that many of the Keynesian functions may not exist precisely.5 What are now really needed are empirical investigations to determine the existence and nature of, say, consumption and investment as functions of income. Somewhat analogously a few economists have become so hypnotized by the delightful fluctuations that can be generated by some dynamic equations, chosen supposedly to simulate business cycles, that they forget that the validity of these models remains unknown, and, in fact, may not even be susceptible to test. For example, do all "firms," if one can sensibly think of so general a class, really adjust their cyclical inventory position in some unique mechanical fashion? Certainly we need models — but surely the cost need not be learning much less about economic behavior.

1 This Review, XXXVI (November 1954).
2 Especially the high deductive and exclusive use of algebraic symbols, in extremely abstract models, without reference to data and with little thought to the real world.
3 The atheist Diderot is supposed to have been routed in confusion from Catherine the Great's court when confronted by an equation that, Euler told him, demonstrated the existence of God.
4 I am indebted, though, to Samuelson for the pains he has taken subsequently to explain his ideas in a language I can better understand.

5 In the sense that observed behavior, among classes, times, and countries, indicate no central tendencies.
4. Some model-builders construct their simulations without any overt thought to the availability of input data (so that equations might be used to provide numerical magnitudes) or of output data (so that the results of the model might be compared with "facts"). This may be due to laziness, ignorance, or caution. Sometimes, of course, there are no relevant data, and an inquiring mind does not wish to wait upon their availability. But more efforts could and should be taken to increase and improve the empirical content of work that purports to lie in the area of econometrics. This may require a division of labor. Unfortunately, deductive and symbolic economics is at present more fashionable than data gathering, even when data are collected to provide inputs for a model.

5. A few people, who have stumbled into economics equipped primarily with mathematics, act as though this skill is sufficient for worthwhile economic inquiry. They do not always appreciate their lack of training in economic principles or their ignorance of economic thought. Having occasionally worked with some competent mathematicians on economic problems, I know that mathematics alone is always insufficient. But I have also learned that its use is often a practical necessity because it saves time and effort. The important thing is to ensure that the mathematical skills remain at the service of economic experience. Even that "practical budgeteer" David Novick has hired mathematical economists during his long career.

In case anyone should feel that, in passing these strictures, I am tilting at a straw man, I would like to consider Samuelson's "The Pure Theory of Public Expenditures," which rather ironically follows hard upon some of the wise precepts suggested in reply to Novick. Samuelson himself cites this work as an example of the uses of mathematical economics. The following comments on this article are without malice and are designed to indicate some of the ways in which I think the value of such an essay could be further increased.

First, it is unnecessarily unintelligible to most people. Many economists, interested in public finance and welfare, will want to understand what anyone of Samuelson's reputation has to contribute. Frustration will be their lot. Moreover, this refusal to communicate to more than a few is willful. The use of mathematics is here limited, in my opinion, to notation, although all but one of the equations do together express optimal conditions. The mathematics is not used to demonstrate consistencies or reveal hidden truths. Nor is it used as a step toward empirical verification. Mathematical shorthand may permit a three-page article, but a few more words would have added many readers, some of them capable of subsequent contributions to the theory.

Second, the abstractions are so refined as to be unduly unrealistic, and the reader is never told whether or how some obvious aspects of the real world, omitted from the article, might be included or treated. Thus, only two kinds of goods are postulated—private and collective consumption goods. The collective consumption goods are supposedly enjoyed by all "in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good . . .". Now a great many government-provided goods, perhaps most, do not fit this definition, if consumption means enjoyment. Examples are highways, public hospitals and libraries, police and fire protection, and defense against air attack; in each case, for a given public expenditure, I can have better service or more consumption enjoyment if other people will not exercise their rights to these benefits or compete with me for their favorable deployment. Samuelson's collective consumption goods comprise a small class at the opposite extreme from his more numerous private consumption goods. If his theory can handle intermediate categories of goods, which I believe it can, he should explain how. A minor point, but one which could prevent us being sure that $u_i > 0$, is that everyone does not want to maximize the same outputs and minimize the same inputs: some simple examples are juke-box music that one cannot stop in public places, alcohol and tobacco that may endanger or discommodate some people, and government programs like aid to undeveloped countries. Also,
there is a complex interaction between collective and private goods, and as these will occur to every reflective reader, the author has some obligation to discuss them. Further, there are a few thousand governments in any large nation, and one is not told whether the interactions of their public expenditures modify the theory. How can these considerations be omitted from an article advertised as "the" pure theory of public expenditure?

Third, one might expect that an article on public expenditure (however "pure") might throw out a few hints to responsible government officials (or at least to the economists on their staffs) on how policy implications (if any) might conceivably be derived. Not to do so is to imply that there will be none. And if there can be none, then . . .

Reverting now to the general question of the use and misuse of mathematics in economics, and I have really in mind deductive economists who use mathematics only for notation and eschew all magnitudes, there is a moral aspect that might be mentioned. Most economists were surely drawn to their profession, at least initially, by a desire so to understand economic affairs that, through public measures and other means, economic welfare might be advanced. People like Marshall did not choose economics for the intellectual enjoyment to be derived from the elegant manipulation of highly abstract models. A few economists of today should similarly foreswear these selfish pleasures if they have a more worthy alternative capability. While we all want economics to provide some fun, and not too little income, we should not forget all higher objectives. During recent years, hastened along by a few exclusively deductive and symbolic economists, some sectors of the profession and its journals have come to seem rather asocial.