Simulations Are Not Real: A Philosophical Speculation on Econometric Models*

ALBERT E. SMIGEL**

Introduction

About a year ago I was speaking with Lawrence R. Klein in his office at Wharton. During the course of our conversation the phone rang and Dr. Klein answered, spoke briefly, hung up and then turned to me and said, "Al, you know there are some people who believe that simulations are real." I've been thinking about that statement and this paper eventuates from it.

From my reading I learned that a lot of attention has been paid to how to build econometric models and how to develop simulations based on them. I thought that there was some responsibility on our part to ask *why* we use simulations and what they *can* and *cannot* do.

This paper can be categorized as a philosophical speculation on econometric models. The nature of the paper does not lend itself to formal structure, with attendant abundant footnotes, references and bibliography. I hope that the informal style will not detract from what I perceive to be an important discussion.

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**Special Assistant for Economic Affairs, Governor's Office, State Planning and Development, Commonwealth of Pennsylvania.

Definitions

For the purpose of formal definitions, we could use the ones stated by Naylor, Balintfy, Burdick and Chu, in "Computer Simulation Techniques," (1966). "*Simulation* is a numerical technique for conducting experiments on a digital computer which involves certain types of mathematical and logical models that describe behavior of a business or economics system (or some component thereof) over extended periods of time."

A *model* involves "the solution of a nonprobabilistic mathematical problem by simulating a stochastic process that has moments or probability distributions satisfying the mathematical relations of the nonprobabilistic problem." With respect, I must say that I don't like those definitions.

It is much handier to consider models and simulations as *simulations.* They are apparent realities, they imitate, as best they can, the real thing. In outline, their proponents say—

1. A model is a representation of something real.
2. It can act as a simulator.
3. The resulting simulations enable us to study the behavior of the model under differing conditions.
4. Properties of the model thereby can be deduced.

5. The simulations can help us look at predictable options.
6. They can help us make sounder decisions.

Discussion

It seems to me that we should examine how people think about other people telling us things. Do we believe indiscriminately or only discriminately, depending on who does the telling? (Many people will believe gossip sooner than their own eyes.)

When the early prognosticators made their pronouncements, people laughed at them. So they got together and invented a gimmick: they examined the entrails of animals and said, "the entrails tell me." As a result, they became believeable.

Another example is to be found in Voodoo. The name comes from a West African word which means god or spirit. The chief magicians are called medicine men or witch doctors. These medicine men tried to tell the tribesmen what to believe. No way! So they came up with a gimmick—a wooden image, a simulation of a real person. They then talked to the wooden image and told the client that the spirit had answered him through the image. Instant belief!

(There may be more here than meets the eye.)

It is interesting to note that in Haiti, a witch doctor will make a wax doll *simulating* the client's enemy (whom we shall call X). Then he sticks pins into that doll in certain places and X gets to feel pain in those places. Now this is a rather primitive religion. If X doesn't know that a doll has been prepared and pins have been stuck into it, will he feel pain? If he is aware that a doll has been prepared and that pins have been stuck into the doll, he probably will feel the pain. This is, in essence, autosuggestion.

I am not suggesting any parallel between entrail examiners or voodoo witch doctors and econometricians. After all, what similarity can there be between entrails, wax dolls and our sophisticated tools?

I'm just trying to explain what makes people believe. Nevertheless, I never cease to marvel that many a perspicacious individual who listens to a story and adjusts what he hears according to the prejudices of the teller, will accept at face value a "story" that evolves from an econometric model. Maybe it's the mumbo jumbo of the equations, but there is something in a computer simulation which persuades some people to abandon their critical faculties.

Aristotle said that Sophocles drew men as they ought to be; Euripides as they were. This difference is most apparent in the statement attributed to Euripides: "Man's most discriminating sense is what *not* to believe."

What should we believe? Consider the mirage that excessive July heat draws from distant surfaces. We observe the mirage. Do we say it is based on an accident of sight or some sort of atmospheric phenomenon having to do with the reflection of light? It depends on how much we know. You and I know it is not something which we actually see, but rather something which we think we see. On the other hand, if we think we see it, perhaps we do see it. I'm not going to lead you into Existentionalism, but a case can be made for the viewpoint that if you see it, it exists *for you.* This is the hallmark of belief, of acceptance.

A final brief note on this subject is in order. The Solipsist believes he can be aware of *only* what he experiences. An extension of that philosophy persuades many solipsists that if it is not experienced by them, it does not exist.

Let us turn from people to simulations. What can they do for us? Ideally, they enable us to examine a complex system and understand it better; they enable us to build and test some hypotheses; furthermore, we shall be able to anticipate problems of the future, or what we think is the probable future.

I encounter many conceptual problems in dealing with simulations. Having been raised on

Baconian Scientific philosophy, I believe that the inductive method must be included along with deductive logic; otherwise, meaningful projections or predictions cannot be made.

I addressed this subject in 1972 in a paper prepared for the National Action Conference on Intergovernmental Science and Technology Policy.

"Were it not for the human and social variable we could construct a mathematical model which would describe all the components of our situation. Economic and policy inputs we can handle, but when it comes to psychological variables we are at a loss.
How do we make an assessment? There are qualitative and quantitative methods. Both methods start with Bacon's postulates:
1. The universe is subject to rational laws.
2. The laws become comprehensible to man, if he reasons with an open mind, and, if he will experiment."

Some wise men have been addressing these issues for a long time. One problem is that of proper selection. In a different context, but still relevant, Charles Darwin in 1857 wrote:

"*Selection* acts only by the accumulation of slight or greater variations, caused by external conditions, or by the mere fact that in generation the child is not absolutely similar to its parent. Man, by this power of accumulation variations, adapts living beings to his wants—may be said to make the wool of one sheep good for carpets, of another for cloth, etc."

Another problem is that of proper definition. Charles Dodgson, whom we know as Lewis Carroll, solved the problem quite simply:

"'When I use a word,' Humpty-Dumpty said in a rather scornful tone, 'it means just what I choose it to mean, neither more nor less.' 'The question is,' said Alice, 'whether you can make words mean so many different things.' 'The question is,' said Humpty-Dumpty, 'which is to be Master—that's all.'"

Lewis Carroll, *Alice Through the Looking Glass* (1872)

I am not suggesting that Humpty-Dumpty is a prototype for our present-day model builders.

Still another problem is that of the need to simplify complexities in order to be able to set up the model. Enormous simplifications may be necessary to cull a deeper truth that may lie on the surface of a mass of unsorted detail. After all, that is what happens when history is written. Many, if not most, of the true facts are distorted, or even discarded. The tendency is, a priori, to set up a hypothesis and look for a pattern which fits your hypothesis. This may entail disregarding any facts which do not fit into the pattern.

It is not apparent to eclecticists, as it was to John Muir (in 1912), that: "when we try to pick out one thing by itself, we find it hitched to everything else in the universe." If we consider only first-order criteria, our results will be relatively simplistic, ignoring important complicating factors. D'arcy Thompson, in 1942, expressed it this way:

"As we analyze a thing into its parts on into its properties, we tend to magnify these, to exaggerate their apparent independence and to hide from ourselves (at least for a time) the essential integrity and individuality of the composite whole . . .
. . . . We may study them apart, but it is a concession to our weakness and to the narrow outlook of our minds."

We are faced with hard choices when we design a model. Gregory Bateson (in 1956) coined the phrase "double bind" to describe sets of antithetical directions. e.g. "chop down that tree, but be careful—the axe is very sharp, and you know how clumsy you are."

In effect, the recipient of these directions is faced with the corollary of Plato's Law of Irreversible Gain:

"You may break even, but you can't win."

The model builder is faced with difficult options: He may:

1. Include all the data, much of which is contradictory.

2. Exclude those data which prove troublesome, e.g. give opposite signs, or don't fit into the pattern.

3. Adjust. (Massaging the data).

Bateson theorizes that "double bind" victims adjust by becoming schizophrenic. I am not implying, nor should anyone infer, that model builders resort to schizophrenic strategies. The relationship between econometrics and psychiatry is not that evident. On second thought—I think I'll stop right there.

Bateson also theorizes that most of us think and act in a linear fashion, despite the fact that nature is made up of circular, steady-state systems. A good model is a means of breaking out of the linear mold, of incorporating feedback mechanisms into the system. (A line *may* be a good approximation of a curve, but only over a short period of time).

A simulation can provide a relatively sophisticated means of examining criteria for decision-making. In simplest terms, it can provide an answer to a "what-if" question. The answer, however, may be wrong. Does this negate the value of the exercise?

Before discussing this further, I'd like to quote John Kenneth Galbraith (Economics, Peace and Laughter—1973):

"The accepted economic models, in the past, have not necessarily been the ones that illuminate reality."

Some econometricians maintain that even if a simulation turns out to be far off the mark, this does not detract from the validity of the analysis of the subject. I suppose that means that the proof of the pudding is *NOT* in the eating. I suggest that an argument can be made that the validity of the simulation *as an analytical instrument* is not impaired. (A cliché comes to mind: it's what you do with what you've got that counts).

It seems appropriate, at this point, to introduce an argument which can be labeled as religious, philosophical or, perhaps, metaphysical. Let us postulate that the assumptions we have made in building our model are unreal, even though our aim was to have them reflect reality. Nevertheless, the model gives good answers as to the behavior of the output (endogenous) variables that the model treats. Simply put, we are right for the wrong reasons. (In Goethe's Faust, to paraphrase Mephistopheles, even though he acts immorally, he is the most moral of creatures).

Milton Friedman speaks to this point in his article "Methodology of Positive Economics" (U. of Chicago, 1953). I understand him to say that it doesn't matter whether or not the assumptions you make in your simulation are valid or not. What is important is how well the model works. (I hasten to disclaim any implied connection or similarity between Mephistopheles and Milton Friedman).

A weighty question, quite analagous to model building, is the following. Assume a man accomplishes good by being stupid, or even bad. Is that man more valuable to society than one who does all the right things but whose results turn out badly?

Isn't the proof of the pudding, after all, in the eating? If so, doesn't it follow that the so-called "bad assumptions" are really "good assumptions," because the model worked?

(A few years ago I had a mental lapse during a lecture and instead of "the road to hell is paved with good intentions," I blurted out "the road to hell is paved with bad assumptions." Given the above reasoning, the statement appears to be invalid).

A point of controversy between admirers and detractors of models is how well a model can simulate reality. The following conversation may illuminate this murky issue:

"What are you drawing there, son?," a father asked his little boy.

"A picture of God."

"Well, how can you do that? Nobody knows what God looks like."

"They will," replied the child, "when I get this picture done."

If I have appeared to be entirely negative, such was not my intent. There are many applications of simulation which contribute importantly to our understanding of complex systems. Furthermore, they are valuable tools in planning and decision-making.

A simulation is a most valuable tool to allow for feed-back. Because of lag, however, the feed-back is of a predictable nature. The problem of feed-back unpredictability has been stated (in a different context) by Harry G. Johnson (Technology and Economic Interdependence—St. Martin's Press, 1975):

"In a technologically advancing society, however, the pollutant by-products of new types or methods of productive activity are unpredictable in advance, either in nature or in quantity or in both, *and man has to learn by trial and error.*" (Emphasis mine).

Econometric models are non-destructive (except for time and capital) instruments which allow us to experiment, to learn from simulated trial and error. This statement is true *only* if our model is not a simulacrum—a sham.

Can the model builder make the proper assumptions? In discussing "Economic Growth and Man's Environment" Johnson speaks of:

"... the fallacies of applying arithmetic, whether crude or sophisticated, to an economic system in which the available factual information is itself generated by the economic processes of competition and growth, and hence represents no inevitability in the relationship between man and his environment." (*Ibid*)

The apparent reality which we call a simulation can be a valuable tool. If, however, a simulation is distorted and a new simulation is built on it, the distortion in the new simulation is increased exponentially.

Conclusion

I conclude with the story of two old friends who were enjoying fixed-income, low-level retirement. They met one morning and the conversation went like this:

PAT: "I had a great dream last night. I dreamt I was in the bleachers at Yankee Stadium when Mickey Mantle hit a home run ball right at me. I caught it and later Mickey autographed it for me."

MIKE: "I had a better dream. I dreamt I was lying in bed last night when Marilyn Monroe and Gina Lolabriggida came in the room."

PAT: "Some friend you are! Why didn't you call me. You had an extra girl."

MIKE: "I did, but they told me you had gone to the ball game."