Simulated Reality—A Contradiction in Terms?

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Anyone who has sat through the whole or lengthy portions of televised accounts of space shots knows the meaning of *simulation.* When reality is not producing some live coverage, the telecasters often turn to simulation presentations in order to fill in time until the real thing comes along. But those *simulated shots are guided by reality.* They aim to be as realistic as possible, but *they are obviously not real. We learn, nevertheless, by viewing them carefully.*

So it is with economic model simulations. On some occasions, they are frivolous, but, by and large, they are meant to be realistic simulations of what might happen in the future or of what might have happened in the past.

An economic model simulation is a conditional forecast of an economic system if it is a solution into a future time span. It might be an *ex post* forecast, if it is a simulation beyond an observed sample, but spanning only elapsed historical time.

Econometricians have a bad habit of looking at a dynamic simulation into the unknown future and describing the numerical results as though they were definitely going to take place, instead of representing possible results that might or might not actually take place. The verbal analysis might say, "... in 1982 the inflation rate slows to 3% while the real growth rate remains steady at 3.75% ..." They should be saying, "... in 1982, the *estimated* inflation slows to approximately 3% while the *calculated* path of real GNP shows a steady growth rate of 3.75% ..." All such estimates are subject to significant amounts of statistical error. If simulation results were properly *surrounded by calculated error bands,* there would be an immediate and obvious signal that uncertainty was associated with the results.

Journalists have been known to remark on the high degree of decimal accuracy in tables taken from computer print-outs of economy models. The large number of digits carried in such tabular calculations result from imposition of important checks on arithmetic and from compensation for the loss of accuracy in multiple-step computations. It would be better to recognize that, for formal presentation of econometric simulation results, no more than two or three digits for most numbers have any accuracy at all.

Simulations are uncertain representations of reality when viewed as forecasts, either *ex post* or *ex ante.* They are also frequently made in purely hypothetical situations; i.e. exogenous inputs are chosen just to see *what would happen if...* The *if...* can often mean highly implausible assumptions or, at any rate, assumptions that are chosen without any close attention being paid to their realism. These calculations are, nevertheless, interesting because they show the estimated responsiveness of the economic system. We frequently compare two simulations—one with a standardized set of assumptions and one with an arbitrarily chosen set of assumptions, just to *see what the system reaction to change is.* We might even compare two unrealistic simulations for this same purpose of studying change. Interestingly enough, *the estimates of change might be quite realistic and*

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determined with a higher degree of accuracy than is obtained when studying any single simulation by itself—realistic or not. This is so because there might be some error cancellation when one simulation is subtracted from another; they might both be subject to similar error at a given time point, and this error gets differenced out in the subtraction.

There are other ways of enhancing the degree of realism in simulations. In forecasting from a model simulation, extra information beyond that contained in the formal model itself may be used. This amounts to "*fine tuning*" a model by adding *a priori* information to the simulation model. Such information may consist of statutory changes imposed on an economic system, quantified knowledge of economic disturbances, use of serial properties of errors, or expert (inside) information. It is for these reasons that finely tuned forecasts made from model simulations are generally more accurate than purely mechanical simulations.

The matter of realism of simulations is therefore a more complicated notion than might be thought at first sight. While I can agree that simulations are not realistic in any exact sense, *I do believe that the departures from reality are small enough or manageable enough to make strictly unrealistic simulations quite useful tools for economic analysis.*