
What is Computable Economics? I have heard such a question many times. Indeed, the computable approach to Economics is still alien to the majority of trained economists. It is true that the term computable sounds familiar as in the collocation “computable general equilibrium” and is often used as a synonym for “computational.” However, few economists will think of Turing Machines and of the Classical Theory of Recursive Functions when hearing the term computable.

As clearly stated in the first chapter of the book, computable economics has several pioneers and precursors, but this book is the first attempt at systematizing such an approach and methodology through an organic presentation of fundamental results in various branches of economics.

Each chapter tackles a different issue and is self-contained. The reader interested in game theory will gravitate towards chapter seven where Rabin’s results on the playability of games are reconsidered. Chapter 3 deals with rationality and microeconomics; while chapters 5 and 6 are devoted to learning, as induction. Rationality re-emerges in chapter 4 where it is linked to adaptive behaviour; chapter 9 proposes a series of research topics in growth and development, indivisibilities and economic dynamics in general.

However, no matter what the primary interest of the reader is, she/he should start reading chapter one where Velupillai’s ability in weaving the historical threads of economic thought is at its best.

Computable economics is the path not yet taken in the modern mathematization of economics. The unavailability of the relevant tools of analysis may explain why the process followed a set-theoretical approach rather than a recursive-theoretical one. But why bother now? What is to be gained by this reconsideration of the foundations of mathematical economics?

I can see at least two strictly related reasons for this endeavour. On the one hand, the advent of the computer is slowly but steadily changing the way economists “think” about economics. Models for which a closed form solution cannot be determined are more and more often coded and simulated on a computer. Very often, the reference model is uncomputable, that is, it transcends the...
computational power of an idealized computer not constrained by memory or time limitations. These computer implementations, however, are necessarily computable because of the choice of specific functional forms to be explicitly coded and the abandonment of certain axioms (like the axiom of choice) which are completely extraneous to the nature of the computer. Hence, the relation of such exercises with the theoretical model whose behaviour they are supposed to study is not easily justifiable, neither to confirm nor to reject it.

On the other hand, and in close connection with the previous point, it may not be true that, as Frank Hahn (1991) sadly states in his forecast for the next hundred years of the Economic Journal, the theoretical drive in economics has exhausted its energy, and that “[i]nstead of theorems we shall need simulations” (Hahn, 1991, p. 47). Rather, what might happen is that simulations will be employed for the discovery and in the proof of theorems. Computable economics is precisely such a different theoretical approach. By concentrating on what is computable in principle, “simulations” can be justified from a theoretical point of view as a tool for the identification of regularities and the synthesis of theorems.

It is essential to stress that, typically, computability tries to make explicit which mathematical objects are inherently uncomputable or, equivalently, which mathematical statements are undecidable. In a similar vein, initial results in computable economics were “negative,” pointing at the uncomputability/undecidability of well-known economic-theory propositions. By contrast, Computable Economics goes beyond such an iconoclastic attitude and offers constructive results showing how that approach can positively contribute to our understanding of economic phenomena.

In the process of building such a conceptual edifice, Velupillai introduces various provocative ideas. In chapters 3 and 4 the reader will find the controversial proposal to equate “rationality” — in the sense in which economists use that term — to universal computation. Perfect rationality is often criticized as depicting an unlikely scenario where highly sophisticated beings are confronted with simple problems, and is opposed to the “more realistic” one where simple beings face a complex environment. By giving rational agents the power of universal computation, Velupillai is proposing a new “benchmark”. Perfect rationality is simply the extreme of a spectrum of a rigorously characterized cognitive and computational power which encompasses all notions of bounded procedural rationality with no discontinuity, but rather, as shades of the original concept.

Chapter 6 presents another somewhat disturbing idea. It restates the Occam razor principle linking it to Solomonov–Kolmogorov’s notion of universal prior. Following Rissanen’s minimum description length argument, the simplicity of a model is equated to the length of the string which encodes the model and its description of the data. A shorter description makes the model more probable, therefore better. From this starting point, Velupillai proceeds to show how
a rational-expectation equilibrium can be identified, i.e. learned, since it will be selected among the (possibly countable infinity of) candidates as the simplest hence most probable outcome. The justification lies in the explicit hypothesis that rational agents (according to the notions of rationality given above) will choose precisely that line of action as the simplest available one.

This seems, in my opinion, the most unintuitive result of the book to accept. Especially “institutional” economists would not agree. However, it should be stressed that, in principle, the probability (hence description length) of a RE equilibrium could be calculated with respect to a probability distribution conditional on the relevant institutional setting. Still, following a similar reasoning, the institutional arrangement itself should be chosen rationally, hence it should be the most likely outcome. Does this mean we are modelling the best of the possible worlds? Clearly, the answer is undecidable, as it is not possible to determine whether the model which has so far best explained the data will keep doing so in the future. This result, a consequence of the halting problem of computability theory, is far from frustrating. It points both at an endless quest for comprehension and at its fundamentally creative nature.

As the author stresses in the book, the Church–Turing thesis is a working hypothesis. This book should be read in that mental disposition. In this way the reader will appreciate the richness and aesthetic appeal of the computable approach besides its rigour and relevance for the modern economic discourse. Perhaps, computability theory will be challenged by the ongoing research on quantum computers which may redefine what is effectively calculable. Such a conquest will enlarge the boundaries of what can be computed, but the approach delineated in this book will remain valid.

The Ryde Memorial Lectures on computable economics were delivered in 1994 and the preface to the book was penned in 1998. It is a pity that we had to wait so long for such an exhaustive answer to the original question “what is Computable Economics?”

F. Luna

Department of Economics, Oberlin College Ohio,
University of Venice Ca’Foscari,
IMF 700 19th St.
N.W. Washington DC 20431, USA
E-mail address: fluna@imf.org

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