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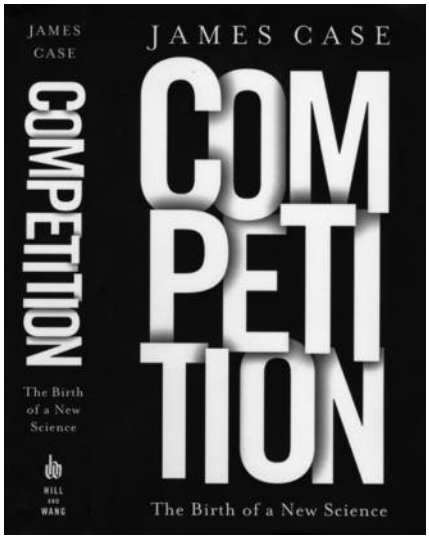
It's the Economy, Stupid!



Competition: The Birth of a New Science. *By James Case, Hill and Wang, New York, 2007, 354 pages, $27.00.*

BOOK REVIEW

By Donald G. Saari

In the midst of a U.S. presidential election, we can expect, in addition to concerns about the Iraq war, a tenacious debate about the nation's economy. A war of words is ensured by the growing economic anxiety: The dollar is reaching uncomfortable lows relative to other currencies, inflation and energy prices are heating up while house prices are freezing, fears of recession, or worse, are growing while confidence in the wisdom of NAFTA is eroding. As these difficulties affect the livelihoods of so many, politicians will put forth competing formulae for what they view as appropriate remedies.

As part and parcel of platforms traditionally adopted by the different political parties, certain proposals are guaranteed. Expect to hear about the need to reduce or eliminate regulations, or to let the markets self-correct. Anticipate the familiar mantra of "lower taxes." How individuals react to proposals, such as an almost guaranteed "no new taxes" promise, is captured by the familiar cartoon character with the devil sitting on one shoulder and an angel on the other, both trying to influence the decision. As the devil argues, lower taxes will mean more money for individuals, while the angel preaches the dangers of "the tragedy of the commons," where a widespread embrace of self-interest can harm the commons—our society. The devil delivers an apparent knockout blow by appealing to lessons from that Econ 101 course describing the powerful advantages and benefits provided by Adam Smith's "Invisible Hand" and the laissez-faire doctrine.

Such neoclassical arguments are often invoked to justify economic policy, but are they correct? To develop insight—maybe to become an informed voter during this election season, but maybe also to acquire a deeper appreciation for the important changes going on in economics—I recommend James Case's fascinating and well-written book *Competition*. Case carefully leads us through many of these standard assumptions, showing how they can and do mislead us—with the very real consequences of lost jobs, pensions, and dreams.

Readers of *SIAM News* will appreciate Case's introduction of his case; while old hat for us because he uses standard methodology developed in applied mathematics, these arguments are not fully appreciated by others. Take, for instance, the self-evident truth of Adam Smith's argument. Well, in fact, Smith's argument is *not* economics; it is a *model* of economics. In an entertaining fashion, Case carefully explains the difference between a model and reality, emphasizing the constant need for evidence if we are to develop trust in any model. I loved his example of Artistotle's self-evident assertion "that men have more teeth in their mouths than women do"; how simple to check, yet, presumably, this claim was not tested for a couple of centuries, or even longer. As Case shows in setting after setting, many "economic truths" have been accepted without careful verification. Economics is not alone: In a recent book, Lee Smolin [3] describes a period in string theory in which "mathematics [without appealing to experiments] now sufficed to explore the laws of nature"; elsewhere, we are told [1] that computer simulations of nuclear models can replace "full-scale testing . . . for certification of the stockpile or for the design of new [nuclear] weapons." As Case argues, models are not the same as reality; to treat them as such can be dangerous for physics, for the safety of society, and for economics. Of this serious concern I say to my economist friends, "Data without theory is merely data: Theory without corroboration by reality is wannabe mathematics."

Some readers might question whether Case overstates what happens. The usual supply-and-demand story of economics, for instance, has the prices of different commodities, represented by the vector $\mathbf{p}$, varying according to the market pressures of demand minus supply, which is called the aggregate excess demand function $\xi(\mathbf{p})$. A dynamic capturing the standard story, in which prices reflect the demand, is the $\mathbf{p}_{n+1} = \mathbf{p}_n + \xi(\mathbf{p}_n)$ tâtonnement process, which Case describes in words. He argues that the underlying assumptions for this dynamic are so specialized that "No one seriously maintains that anything remotely resembling [this] process has ever taken place outside a classroom. . . . Yet the champions of economic orthodoxy insist that free-market capitalism 'works like' [this]."

Does Case overstate the problem? Actually, the situation is far more bothersome than he suggests: Even in classroom exercises where everything strictly adheres to standard economic assumptions, the tâtonnement dynamic need not work. This suggests an adjustment to the theory, which can be represented as:

$$\mathbf{p}_{n+1} = \mathbf{p}_n + M(\xi(\mathbf{p}_n)), \tag{1}$$

where M is an appropriate continuous function. Or, to be more adventurous, include differential changes in the economy for prediction purposes with a $\mathbf{p}_{n+1} = \mathbf{p}_n + M(\xi(\mathbf{p}_n), D\xi(\mathbf{p}_n))$ representation. For any theory—that is, for any M—the story still need not work even for strictly classroom-level examples; a regular homework assignment for my students, for example, is to prove that, with any such M, it is possible to create a simple economy of the kind we show freshmen, with a "period three implies chaos" dynamic for (1) frustrating the price-adjustment process. Current economic assumptions do not suffice to support the common "market pressure" path to an equilibrium (see, for example, [2]); this is true even for simple classroom examples.

For the positive side of the story, Case describes recent developments in economics in which "competition" is analyzed with game theory and the results are then verified by examining actual practice involving real people and by using the new area of experimental economics. I enjoyed

the way he was able to introduce central game theoretic concepts in a non-mathematical manner, providing understanding and intuition for neophytes, yet, I expect, keeping the experts interested. He achieves this with a wealth of stories.

By first hooking us on the competitive strategic interactions between Ford and General Motors during the early years of the auto industry, for instance, or the design of chess strategies for Big Blue to compete with Garry Kasparov, Case introduces in a natural fashion the tree structure of game theory. Elsewhere, he uses his expertise as a former pitcher in the Los Angeles Dodgers organization to take us through the game theoretic thought processes of a pitcher–batter duel and the value of competitive, strategic planning during the annual draft of players. His analysis of a pistol duel, in which a crucial part of the strategy is to determine when to shoot your only shot, brought back fond memories of the time a student and I, each armed with a water pistol, enacted this analysis in front of a class. (I got wet.) Thirsty? You will find satisfying Case's description of the competitive strategy adopted by Budweiser to become dominant.

Economics was long hampered by its inability to conduct experiments. That changed during the 1950s with the pioneering work of Vernon Smith and Charles Plott in creating experimental economics. What makes this area so important is that, by using cash incentives to govern the subjects' preferences, it is now possible to determine actual economic behavior—at least in small groups. In other words, as Case points out, it is becoming possible for economics to move into a more scientific mode. Results are interesting; a recent example is a description by Plott and his collaborators of an experiment in which the price dynamic entered into a cycle, which means that the prices will never converge to the equilibrium.

My take is that economics, viewed in the context of the history of physics, is still at a pre-Newtonian stage. Thus, several of the theories should be treated as only first approximations that, as Case makes clear, still involve a level of philosophical art form or ad hoc favor. But progress is being made, and it is crucial that more mathematicians become involved.

In any book with such ambitions, one finds points of disagreement. When describing the Arrow and Debreu result concerning market-clearing prices, for example, Case asserts, "They seemed to think that some variant of Walras's tâtonnement (or groping) process would suffice." Actually, the cleverness of their work was to separate the price dynamics from the determination of whether a market-clearing price existed. As to the second issue, they used fixed-point theorems to prove that at least one price $\mathbf{p}^*$ exists where $\xi(\mathbf{p}^*) = \mathbf{0}$, so supply equals demand: This goal clearly required emphasizing $\xi(\mathbf{p})$, but not the dynamic.

These minor quibbles and disagreements, however, do not detract from Case's theme. Indeed, I found the book valuable, fun to read, full of captivating stories, controversial at points, and always informative; I recommend it to you.

References

[1] M. Riley, R. Buss, et al., *Verification and validation plan for the codes LSP and ICARUS*, Sandia Report SAND2002–0422, February 2002.

[2] D. Saari, *Mathematical complexity of simple economics*, Notices Amer. Math. Soc., 42:2 (1995), 222–230.

[3] L. Smolin, *The Trouble with Physics*, First Mariner Books, Boston, 2007.

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