**Bookstaber, Richard – The End of Theory**

*Princeton University Press, 2017, [Finance]* Grade ★★★★

This is a text on financial theory and the author advocates a switch from the use of a rigid neoclassical theory based on a number of unrealistic assumptions to a fluent, messy but flexible use of so-called agent based modeling (ABM). Epistemology is the type of philosophy that concerns itself with the theory of knowledge, the nature and rationality of belief. Bookstaber wants to challenge how we understand and think about economics and uses the occurrences of financial crisis as the test environment for his endeavor. The author is the Chief Risk Officer at the pension fund University of California Board of Regents. Earlier he has been both a PM and a risk manager at numerous hedge funds and investment banks. Few have longer experience of financial risk than Bookstaber.

In his 2007 bestselling book *A Demon of Our Own Design* the author reviews his dramatic experiences from the investment bank and hedge fund world and how liquidity, leverage, crowding and tight coupling – the speedy interconnectedness of events – are key parameters in causing cascading that leads to a full blown financial crisis. He also begins to discuss the topic of complexity. *The End of Theory* could be seen as a freestanding appendix to the first book. By now the author has had the time to better develop a theory around what he had experienced first hand and he also offers a practical tool to use. Since the theory is so vastly different from conventional economics the book becomes a crusade against how economic theory address crises currently (if it does at all).

The financial system is described using 4 building blocks: 1) computational irreducibility – a system without mathematical shortcuts to describe it, 2) emergent phenomena – that the overall effect is different from the sum of the individuals actions, 3) non-ergodicity – the concept that actions of one agent depend on and are shaped by history, context and the actions of other agents and 4) radical uncertainty – the fact that the system

cannot be modeled by using historical events. The really important future developments will be unprecedented. All this creates a financial system that I have come to call a complex adaptive system. It is full of self-enforcing loops; developments are non-linear and unpredictable. Then the author goes on and offers the computer modeling technique ABM as a tool to understand and handle the complexity. ABM tries to simulate system effects by the actions and interactions of autonomous agents with separate decision heuristics. Chapters 11 through 13 model the financial system using the method. The exercise is thought provoking and I especially liked the description of the multi-layering within banks.

Nothing of all this is new and Bookstaber never claims that it is. The notion of complex adaptive systems amongst others builds on George Soros' concept of reflexivity as described in his 1987 book *The Alchemy of Finance*, on complexity theory popularized by the Santa Fe Institute and on Andrew Lo's concept of adaptive markets. The merit of this book is rather the compilation of the many parts into a whole and especially the application on special situations – financial crises. The author doesn't really take the knowledge about complex adaptive markets further, but he improves our crises-knowledge.

The writing and language is relatively accessible for a text on financial theory, the boundaries of human knowledge and the intricacies of the plumbing in the financial system. The author takes the time to explain and exemplify. At first this is a positive but during the course of reading the book the notion is reversed. What starts out as illuminating turns into being repetitive. In an attempt to win the reader over to the author's point of view too much is said too many times. The book would benefit greatly from being slimmed down some 40-50 pages.

*The End of Theory* will advance your thinking on financial calamities but it isn't always fun to read.

Mats Larsson, August 16, 2017