

COMPLEXITY, RISK, AND FINANCIAL MARKETS.  
BY EDGAR E. PETERS. NEW YORK: JOHN WILEY  
AND SONS, 1999.

**C**omplexity, Risk, and Financial Markets completes a trilogy of books on chaos and fractal analysis. Fractal analysis examines self-similarity or scale invariance, a structure that is often present in seemingly random and otherwise complex processes. Time series, for example, exhibit self-similarity if subsamples resemble compressed versions of longer samples. Pioneered by engineers, mathematicians, and natural scientists, fractal analysis is now routinely applied to financial markets. Author Edgar E. Peters is a leading practitioner and also chief investment officer at PanAgora Asset Management, a distinguished quant firm managing over \$13 billion. Peters published *Chaos and Order in the Capital Markets* in 1991 (expanded and corrected second edition 1996), a conceptual application of fractals and chaos theory in economics and finance, followed by the more technical *Fractal Market Analysis* in 1994, which remains an excellent introduction to fractal methodology, though recent advances have rendered it technically obsolete in some respects. *Chaos and Order in the Capital Markets* includes a sophisticated and devastating critique of the efficient market hypothesis.

*Complexity, Risk, and Financial Markets* completes Peters's trilogy by presenting the underlying philosophical case for chaos theory, which turns out to be grounded on distinctively Austrian views of information and market process. This book should be read by Austrians interested in, or already familiar with, fractal analysis or chaos theory, a statistical methodology developed extensively by Benoit Mandelbrot.<sup>1</sup> In addition, this book should also be read by practitioners of fractal analysis and related statistical techniques, in order to receive an introduction to the Austrian School and deepen their understanding of their methodological paradigm's justification, implications, and limitations.

Although it can be read profitably on its own, *Complexity, Risk, and Financial Markets* calls for some discussion of the context it occupies in the larger trilogy. In particular, this book serves as a philosophical background and introduction to Peters's two earlier books, to which readers should go for more detailed critiques of

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<sup>1</sup>See particularly Mandelbrot (1963a, 1963b, 1972); Mandelbrot and van Ness (1968); and Mandelbrot and Wallis (1969) for the original applications to income distributions and the distribution of financial returns. Fractal analysis of asset returns is of special interest because it can provide conclusions about the market processes which generate asset prices.

market efficiency and conventional quantitative economics, as well as a range of empirical applications of fractal analysis. Peters's applications use financial or macro-economic data, and give readers a good feel for how these statistical methods can be used in research. Though many applications are common to both earlier books, some of the techniques described in *Fractal Market Analysis* have been superseded. Anyone interested in conducting a fractal research program should refer in addition to more advanced techniques.<sup>2</sup> In addition, fractal analysis can be applied in many situations where conventional econometrics and statistical inference are invalid. *Chaos and Order in the Capital Markets* and *Fractal Market Analysis* remain outstanding guides to interpreting fractal analysis as applied to finance, and constitute the best introduction to the literature.

*Complexity, Risk, and Financial Markets* is an engaging book, abounding in the kind of memorable and succinct examples that can inject more life and relevance into anybody's classroom teaching. Simultaneously, it offers a broad, philosophical look at how market economies self-organize into complex and sometimes chaotic systems. Peters introduces uncertainty as a necessary precondition for the market order, which arises spontaneously through the interaction of self-interested individuals. Very specific conditions are required for such an order to be stable, and Peters notes economic markets are unstable in societies like Sudan and Bosnia, where uncertainty may be high but where little complexity is present (p. 191).

Central planning aims at removing this uncertainty, but makes it impossible for markets to function. Planned economies attempt to insulate their citizens from risk, but can succeed only to a limited extent. A free market operates beyond the control of any one individual. Investment in a planned economy should offer a guaranteed return, but clearly things do not always go according to plan. Often, planned economies suffer greater impact from uncertainty precisely because they lack the flexibility and freedom of a market economy. Peters notes that uncertainty goes along with freedom of choice, forming a necessary precondition for competition and innovation, two things a planned economy attempts to do without.

Although he sees many problems with government intervention, he is frequently critical of monopoly pricing (contrast particularly with Mises 1998, pp. 357-62), and concludes government regulation is the best hope for solutions to market failure and the business cycle. Deterministic markets, the ideal of central planning, cannot survive, as the first person to solve the riddle of deterministically chaotic market structure would eventually accumulate all wealth. In addition, however, Peters feels markets must be regulated to ensure competition and equal access. Peters criticizes the Austrian School for its rejection of antitrust regulation (pp. 181-83), and develops a rationale for the Microsoft antitrust case (p. 113). He makes the argument that antitrust regulation is necessary to ensure competitive markets. In his view, spontaneously evolved market order may be suboptimal, and then must be improved by government intervention.

Peters's critique of the Austrian positions on antitrust, though well-reasoned and thought-provoking, would likely be better received if he made more explicit what

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<sup>2</sup>See particularly those described by Calvet, Fisher, and Mandelbrot (1997), Cheung (1993), Lo (1991), and Mandelbrot, Fisher, and Calvet (1997).

kinds of intervention he felt could be justified. Like all complex systems, free markets must be stable but must also be free to grow and adapt. The structure must be decentralized to be capable of incorporating many individuals' subjective goals. Free markets need rules that do not constrain uncertainty, but also encourage cooperation and trust, promote coordination, protect property rights, and ensure competition. Implicitly, Peters seems to require very strict limitations on the kinds of market regulations he would accept, and it is a weakness of his argument that these limitations are not made more explicit. It is not entirely clear that Peters's position on antitrust regulation is really different from Mises's.

Self-organizing systems like the market order, patterns which emerge spontaneously from the actions of independent and (externally) uncoordinated individuals, result when individuals respond to one another, a broad class of behavioral responses conventionally categorized as feedback. Adam Smith recognized this principle when he described the coordination of productive activity in a free market as the working of an invisible hand.

Peters contrasts the approaches to uncertainty taken by mainstream or Keynesian economics and subjectivist or Austrian economics. Mainstream economics assumes uncertainty can always be modeled mathematically, and that everyone should arrive at the same assessment of an uncertain event's probability, at least given the same information. The Austrian School notes every individual always perceives a unique information set, and that each individual values every item of information in a unique manner. Even if participants had identical information, their assessment of its importance would be subjective. One person's behavior may be quite different from another's, even facing identical choices.

Peters invokes the Austrian theory of subjectivism to criticize mainstream theoreticians' frequent recourse to representative agents. Peters motivates his presentation by providing examples of how market participants attempt to project a spurious order on their understanding of the world (pp. 11–14). Chaotic behavior, which can display seemingly nonrandom structure, but is generated by random, uncoordinated influences, can thus inspire conspiracy theories, convenient assumptions which explain observed regularities.

Peters praises the Austrian School for its recognition of the diversity and uniqueness of market participants, supporting a more realistic economics. Investors, for example, are not all alike—each has a unique and subjective combination of time horizon and risk tolerance. In contrast, mainstream and Keynesian economics ignore differences among individual agents by assuming, for simplicity and analytical convenience, that everyone is identical, or that differences among market participants do not matter and can be ignored. The diversity of individual goals and actions enables entrepreneurs to create profit opportunities by better satisfying individual wants. The Austrian School views knowledge as subjective, and unique to the individual who acts on that knowledge. Far from consisting of identical agents, the real economy consists of perfectly unique agents who react differently in response to the same information.

A market process is a complex process because it works toward individuals' goals of moving goods and services to those who value them the most, and because the market works for its own survival. The market is not a living being, but in some ways acts as if it were. In Peters's view, mathematics has finally caught up with the Austrian School's intuitive models (p. 63), and he believes that quantitative, though possibly nondeterministic, models will emerge based on Austrian insights.

Though developed extensively in *Chaos and Order in the Capital Markets*, Peters extends his critique of the efficient market hypothesis, which he views as being fallaciously based on homogeneous expectations and valuation. In the Austrian view, these are subjective factors, and thus heterogeneous. It would be impossible for one price to reflect everyone's information even if everyone has the same information, because our evaluation of the facts is subjective and unique (p. 91). Peters emphasizes differences in investment horizons as the principal source of heterogeneity in the investment market, rather than differences in risk tolerance. He suggests the stability of financial markets is directly proportional to the diversity of participants' knowledge bases and investment horizons. When long-term investment funds dry up, short-term assets experience bubbles, and volatility increases. When no particular criterion dominates the market, valuation is less likely to be distorted, and volatility declines.

Peters suggests the business cycle results from the complexity necessary for financial markets to provide liquidity without systematically favoring one investor over another. His treatment of business cycles is particularly weak from an Austrian perspective; his discussion owes more to Schumpeter than Hayek or Mises. Peters's view of business cycles is that they are a natural and inevitable part of the market process, rather than externally imposed by credit manipulation. Adoption of the Schumpeterian business cycle seems more due to the author's admiration for Schumpeter's theory of the entrepreneur than conscious rejection of Austrian capital theory.

In financial markets, investors compete to employ capital in the most productive manner, and to provide liquidity to whoever is willing and able to pay the most. The market has no mind of its own, but rewards investors who succeed in this competition, and this steady process of creative destruction drives the business cycle. In Peters's view, the Great Depression and the Asian financial crisis led to market reforms which laid the foundation for future prosperity. It is somewhat disappointing that there is little reference to Mises's and Hayek's theories of the business cycle. Austrian capital theory's emphasis on the discoordination caused by credit inflation as the driver of the business cycle may have been more relevant to Peters's thesis. The Austrian conception of the government and/or the central bank's attempt to manipulate and control investment spending leading to malinvestment seems highly complementary with Peters's critique of central planning.

*Complexity, Risk, and Financial Markets* presents a coherent overview of how local randomness, existing at the level of diverse and independent individuals, interacts to form the global structure of a market economy, which is stable and yet continuously in flux. It can be read profitably on its own, or as the philosophical introduction to the trilogy it forms in conjunction with Peters's (1994, 1996) two other books on fractal analysis. Although Austrians will occasionally take exception to minor conclusions, Peters's trilogy remains the best introduction to fractal market analysis, and the final volume demonstrates the largely Austrian foundation on which the economic interpretation of fractal analysis is based.

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