

# Book Reviews\*

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## **Visual Explanations: Images and Quantities, Evidence and Narrative**

By Edward R. Tufte, Cheshire, CT, Graphics Press, 1997, pp. 157, \$45.00.

Presenting information, whether to a large group, to a small group, or even to a single person, now seems to require the creation and delivery of slick computer-generated graphics. The thought of giving a brief talk in this day and age, supplemented only by simple charts passed to participants, and without slide projectors or, in the author's words, "the dreaded overhead projector," is unthinkable. In his third book on data presentation and design, *Visual Explanations: Images and Quantities, Evidence and Narrative*, Professor Tufte of Yale University vividly demonstrates that anyone presenting information should rethink their concepts about how and why information is presented.

*Visual Explanations* departs from Tufte's earlier works in structure and content. Rather than a cookbook or a "how to" (or how not to) guide to the construction of visual displays of information, this book focuses on specific examples of what styles work well to illuminate the topic under examination. The book provides a combination of several case studies of good and bad visual design interspersed with hundreds of examples and illustrations of those designs that work well, those designs that work poorly, and those designs that do not work at all.

Professor Tufte enlightens the reader in the first chapters by demonstrating how presenting data can have lifesaving (or life-threatening) consequences. He uses the analysis performed by one of Queen Victoria's physicians, Dr. John Snow, concerning the London cholera epidemic of 1854. In analyzing the epidemic, Dr. Snow discovered the source of cholera by mapping the area where deaths had occurred and then by finding the common interactions among those who had died. Cholera victims clustered around a central point near a well pump on Broad Street in central London. Dr. Snow's mapping made vividly clear that victims all used the pump and that it was the source of water causing the epidemic. Professor Tufte highlights Dr. Snow's method of placing the data in an appropriate context for assessing cause and effect, thereby en-

abling him to make quantitative comparisons and to consider alternative explanations and contrary cases, and finally to assess possible errors in the numbers reported in the graphs.

The next reminder is the presentation used by Morton-Thiokol as the basis for the disastrous decision to launch the Space Shuttle Challenger in 1986. The Challenger space shuttle disaster demonstrates the effects of poorly designed and thought-through visual explanations. To recount the incident briefly, rubber O-rings in the shuttle's rocket motors did not seal properly at low temperatures. As a result, the motor exploded, killing the shuttle crew shortly after liftoff. In discussions with NASA prior to launch, Morton-Thiokol, the designer and builder of the rocket motors, initially recommended that NASA not launch the shuttle due to the forecast launch time temperature of -290 degrees F. That temperature was nearly 300 degrees colder than any previous launch. The Morton-Thiokol engineers assembled charts and graphs to explain their recommendation. Their poor data presentation included charts that displayed only the flights that suffered O-ring problems; the number was small compared to the total. When viewed in Tufte's way showing all flights, all of coldest launches had been between -530 to -630 degrees F, much colder than the expected -260 to -290 degrees, and all had O-ring problems. Other information presented at launch time was arrayed chronologically rather than by temperature. What was presented failed, in NASA's opinion, to support the no-launch recommendation. After further discussion, Morton-Thiokol reversed its no-launch recommendation, with its now infamous result. How information is displayed matters.

After the cases, Professor Tufte leads the reader through a series of chapters on what constitutes good design. His chapter on Magic, or visual deception, is a fascinating commentary on what not to do when designing explanatory presentations. Another example presents a (primarily) graphical design that consolidates complex patient medical history from reams of written information and thousands of data items into a single, high-resolution page, summarizing the patient's current condition and medical history.

His commentary on how information displays frequently mirror the organization structure of the presenting entity is especially insightful. For example, a news-broadcast method: as users approach an infor-

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\* These book reviews have been obtained and edited by Gerald L. Musgrave, Economics America, Inc., Ann Arbor, MI, who is Book Review Editor of this journal.

mation kiosk, the computer plays a thirty-second video of the Director of the Museum welcoming the visitor, then a series of twenty-second videos of curators of various galleries introducing their territory, and then the Vice President for Facilities Management pointing at the telephones and rest rooms. In addition to resembling bad public television, such an approach commits a common error: the information architecture mimics the hierarchical structure of the bureaucracy producing the design. This also occurs in the design of magazines, as strongly colored frames delineate each subeditor's turf. Those accented borders and running heads, sometimes the strongest visual statement on the page, are not there to help the reader but rather to replicate the organizational form.

The book itself is a magnificent work. The design and execution of the text and the accompanying images are stellar, as befits a book about information design. The author incorporates flaps into particular illustrations to demonstrate before and after techniques and has had redrawn many images to provide greater clarity. The book is a labor of love.

Professor Tufte's book is available at better bookstores. But an infinitely preferable way of obtaining a copy is to attend one of his regular, day-long seminars. During these events, Professor Tufte takes his listeners on a condensed tour of the strategies of information design, highlighting and elaborating on the ideas in his books. As good as his books are, Tufte is even better in person, bringing the same lively style and enthusiasm for his subject, and transmitting it to a roomful of people in a way that cannot be matched in the flatland of paper. He treats attendees to a three-dimensional expansion of the ideas in his books, broadening them and applying them to areas beyond his paper-bound examples. He discusses interface design (especially for computers and Web pages), financial data presentation, and computer modeling, the last using some excellent videos to illustrate his points. Even those who have read and used all of his books can learn a lot by attending one of these seminars and listening to him speak in person. And there are no overheads.

Edward J. Smith and Gregory Dawson  
Economic Analysis and Forecasting  
US Postal Service

### **The Econometrics of Financial Markets**

*By John Y. Campbell, Andrew W. Lo, and A. Craig MacKinlay, Princeton, NJ, Princeton University Press, 1997, pp.320, \$49.50.*

The remarkable growth of interest in financial markets in the past twenty years has resulted in a large outpouring of books and articles, both theoretical and empirical, analyzing the functioning of these markets.

The development of this literature has been characterized by the introduction of sophisticated statistical techniques now commonly used by finance professionals. *The Econometrics of Financial Markets*, justly called a "landmark" by some reviewers, is the first survey and exposition of the existing empirical literature presented in the form of a textbook. It represents an impressive intellectual achievement of three highly regarded scholars who themselves made a number of significant contributions to the financial literature. It also represents a tremendous amount of work; the authors must have read—and studied—some 830 articles, research papers and books referenced in their text.

The book is presented as a textbook intended for graduate students and industry professionals interested in financial modeling. It is a demanding book because, as the authors themselves declare, "rewards of financial econometrics come at a price." The readers are expected to have a *solid* background in mathematics, probability, statistics, and financial theory. The work covers virtually all topics of the empirical finance literature, with each chapter starting with an outline of the relevant theory, followed by an empirical demonstration, and ending with a set of problems and exercises.

The introductory chapter contains a brief description of the background knowledge expected of the reader, a discussion of notation, basic definitions and conventions, and an eloquent but inconclusive section on market efficiency. The second chapter deals with the question of predictability of asset returns, concentrating on the random walk hypotheses. The authors restrict the discussion to predictions based only on past price changes and come to the not surprising conclusion that predictability, if at all possible, applies to long-term horizons only. Chapter three contains a discussion of nonsynchronous trading, the bid-ask spread, and modeling of transactions data. The research in these areas has been spurred by the newly available transactions data bases. The authors find of particular interest the ordered probit model as the only model "that can capture discreteness, irregular trade intervals, and the effect of economic variables on transaction prices in a relatively parsimonious fashion." There is no discussion of reasons for trading such as differences in expectations, differences in risk aversion, and differences in endowments.

Chapter four deals with the study of events such as mergers, acquisitions, new issues, changes in regulations, and similar occurrences. It is noted that event studies dominate the empirical research in the field of corporate finance. Of some interest is that empirical evidence indicates large positive abnormal returns of the targets but virtually no abnormal returns of the acquirers. The researchers in this area have been encouraged by the acceptance of event study method-

ology by the Supreme Court in 1988. The subject of Chapter five is the well-known and well-researched Capital Asset Pricing Model, which is apparently assured its place as a widely used tool in finance in spite of the statistical evidence against it in the past thirty years of U.S. stock market data. The next chapter on multifactor pricing models deals with purely statistical models of factor analysis and principal components as well as models involving economic and financial variables. The authors' conclusion that "the usefulness of multifactor models will not be fully known until sufficient new data become available to provide a true out-of-sample check on their performance" is somewhat curious, because the plethora of available data should make it possible to save some for out-of-sample testing.

Next, the authors turn their attention to the relation between prices, dividends and returns. After discussing the results of regressions and vector autoregressions involving dividend/price ratios and short-term interest rates, they come to the conclusion that the stock market is too volatile to be consistent with the view that stock prices represent optimal forecasts of future dividends discounted at a constant rate. Chapter eight extends the discussion from purely static pricing models to the real world in which investors consider more than one period at a time. This leads to intertemporal equilibrium models involving stochastic discount factors. The conclusion, drawn from the existing literature, is that while there is no generally accepted model of the stochastic discount factor, its conditional expectation must be relatively stable in order to explain the stability of the riskless real interest rate.

In the next two chapters the authors turn away from the stock market to consider derivative pricing models, justly dominated by the famous option pricing models of Black-Scholes and Merton. The forecasting power in the bond markets of yield spreads for future movements in nominal interest rates is also considered. Chapter eleven deals with models of term structure of interest rates that, according to the authors, can be viewed as "time series models for the stochastic discount factor." The explosion of interest in this topic is apparently due to the practical need to price and hedge fixed-income derivative securities. The final chapter on nonlinearities in financial data represents "a

natural frontier for financial econometrics." Apart from discussing such well-established models as ARCH and GARCH, the authors turn to the real frontier represented by models of chaos and by neural networks. They rightly note that the impact of modern nonlinear dynamic models on economics and finance has been less dramatic than the impact on the hard sciences. The book ends with an appendix containing a complicated technical exposition of certain estimation methods used in the text.

In discussing the theoretical framework for each of the topics, the authors sometimes resort to economic reasoning based on optimization subject to constraint, but more frequently such optimizing behavior is assumed and the emphasis is on the ensuing statistical modeling. The empirical part is sometimes represented by the authors' own calculations (some forty tables in the text present the results) and at other times by a discussion of the authors' own published work or by a mostly brief verbal description of the results from the literature. This is quite unlike the treatment of empirical results in applied econometric texts, where there is typically an extensive discussion of the pivotal research studies pertaining to each topic under discussion.

As for the level of mathematical and statistical sophistication, the authors *really* mean it when they speak of a need for a *solid* background in these subjects. They do not make things any easier by not indulging in simplifications or in trading generality for ease of comprehension. In fact, the book is written more in the tradition of statistical texts, in which mathematical sophistication is taken for granted, than in the tradition of econometric texts, in which mathematics is treated as a scarce resource. Further, the scope of the book and the manner of exposition make it encyclopedic rather than textbookish, not unlike the *Theory and Practice of Econometrics* by Judge *et al.*, the only econometric textbook cited by the authors. However, the preceding caveats notwithstanding, the *Econometrics of Financial Markets* is a classical piece of work that deserves a prominent place in the library of every serious finance professional.

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