

who will appreciate and use the elegant explanations. The book would also be an excellent choice for students who have had an introductory astronomy course and want to delve a little deeper into this rapidly developing field. And any scientist with some basic knowledge of astronomy and physics would find that the lively writing makes this book very pleasant reading.

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An Introduction to Econophysics: Correlations and Complexity in Finance

▶ Rosario N. Mantegna and
H. Eugene Stanley
Cambridge U. P., New York, 2000.
148 pp. \$34.95 hc
ISBN 0-521-62008-2

In *An Introduction to Econophysics*, Rosario N. Mantegna and H. Eugene Stanley seek to discuss the application to financial markets "of such concepts as power-law distributions, correlations, scaling, unpredictable time series, and random processes." These are concepts that have had considerable impact on the physical sciences. The implicit suggestion is that there is a field called "econophysics," which is the application of mathematical techniques to the modeling and analysis of financial markets and economic systems. The book is an overview and introduction to the field by two respected physicists—Mantegna, of Palermo University in Italy and Stanley, of Boston University—presumably written for physics or mathematics professionals with limited knowledge of finance.

How should we judge *An Introduction to Econophysics* as a book and econophysics as a field? A quick glance at the bibliography reveals a large volume of work devoted to the field, generally culled from physics journals, a few finance journals, and a number of basic books on physics. A single page of the bibliography contains titles as diverse as "Turbulence and Financial Markets" (published by the authors in *Nature*, "Dynamical Optimization Theory of a Diversified Portfolio" published in *Physica A*, and Mandan Mehta's *Random Matrices* (Academic, 1990). The evidence suggests a lot of activity in the field, but the question is: Does this mean the field is impor-

tant? To judge, we have to investigate the aims of modern financial theory and whether econophysics supports these aims.

The aim of modern financial theory (or at least that part of modern finance having to do with financial markets) might be described as an attempt to produce theoretical models describing the behavior of financial markets, with an eye toward causal mechanisms, statistical laws, and even predictive power. Starting with assumptions about the behavior of rational economic agents, one makes restrictions on the set of possible laws describing financial markets. Adding simplifying assumptions such as frictionless markets, an absence of transaction costs, and unlimited short selling, the analysis is brought into the realm of the tractable. By observing the behavior of actual financial markets, through the collection and analysis of time series of financial data, one ultimately eliminates many models that are *a priori* possible but contrary to observed behavior. From these observations theories are refined and advanced, while all along there are opportunities for missteps, debates, and outright bad science. In the process of analysis, tools and methodologies from a number of sciences may be brought to bear on the problem as well.

Unfortunately, *An Introduction to Econophysics* completely ignores questions of financial theory and a great deal of the vast financial literature on capital markets and option pricing produced over the past 30 years. Moreover, it never attempts to establish the contribution of its methods to the field of finance. Rather, it positions itself as a field that can lend insight to the workings of financial markets. Yet many chapters end with conclusions as fuzzy as that of chapter 11: "Indeed no analog of the 2/3 law appears to hold for price dynamics."

As to the field itself, one would hope that the toolchest of analytic techniques developed for studying physical systems would have application to finance. However, such applications must be measured in terms that are useful to finance itself. *An Introduction to Econophysics* fails to deliver a cogent argument as to why this is so. Why it might be so is firmly established, but this is not enough.

The book also fails to discuss some fundamental and important differences between physics and finance, such as the inability to produce financial laws that persist over time, as compared to the constancy of physical

laws (drop a rock off a tower 400 years ago and the rock obeys the same physical laws as it does today). In the end, the reader is left with the impression that the authors, both capable and accomplished in their fields, are in the midst of creating a new field, one that exists alongside traditional finance while, at the same time, is outside of it. The question remains whether this new field will be interesting to an audience broader than physicists, and in particular whether practitioners of mainstream finance will find useful the tools offered by econophysics.

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The Sky Is Not the Limit: Adventures of an Urban Astrophysicist

▶ Neil de Grasse Tyson
Doubleday, New York, 2000. 191
pp. \$23.95 hc ISBN 0-385-48838-6

One Universe: At Home in the Cosmos

▶ Neil de Grasse Tyson, Charles Liu,
and Robert Irion
*Joseph Henry Press, Washington,
DC, 2000.* 217 pp. \$40.00 hc
ISBN 0-309-06488-0

Bold changes have taken place at 81st Street and Central Park West in New York City. The old Hayden Planetarium, where so many awe-struck visitors met the wonders of the cosmos for the first time, is no more. In its place is a glass box containing an enormous suspended sphere reminiscent of a 1930s vision of a madman's Van de Graaff generator—an edifice of glass and steel and high-tech wizardry that is the new, improved Hayden Planetarium, a modern—even post-modern—reconfiguration of a venerable New York landmark.

At the helm of this startling, reconfigured Hayden Planetarium is Neil de Grasse Tyson, a charismatic astrophysicist who happens to be African American.

Under Tyson's leadership, the Hayden Planetarium Space Theater, now within the Rose Center for Earth and Space, and its associated exhibitry, offer the public new and provocative ways to explore the universe. Its mission is not merely to reveal the wonders of the universe, but to take you

there using real data and near real-time virtual experiences driven by massive in-house computers. Several strands of exhibitry outside the sphere generally reinforce the theme of the planetarium, extending the dramatic virtual tour of the universe that had to be packed into only 18 minutes of sensory delights. The Hayden is no doubt leading the charge now among major planetariums of the world in its commitment to remain an effective and vital part of science education in the 21st century.

In his memoir, *The Sky Is Not the Limit*, Tyson says he wants to be known first as an astrophysicist. But he acknowledges the symbolic power that comes from being a black man who, as director of an internationally renowned popular gateway to the cosmos has become, as it were, a major spokesman for the world of science.

Tyson is blunt enough about the race issue. He reminds us that, "in the perception of society: My athletic talents are genetic; I am a likely mugger-rapist; my academic failures are expected; and my academic successes are attributed to others." Yet, as he provides glimpses of his childhood, upbringing, schooling (at the Bronx High School of Science), and training, he reveals his love of logical thinking and of a life in science.

With its inspirational writing about coming of age, the fascination of mathematics and science, the critical importance of preparedness in life, and the delights and hazards of the astronomical universe, Tyson's memoir makes for a captivating portrait. He manages to weave together his life and his science in a smooth yet episodic fashion, using a calm natural voice. Tyson is a decent story-teller, grabbing you coyly with images of him lugging his first small telescope to the top of his Bronx apartment building, and then he lulls you into familiarity with a geeky technical discussion of the problem of seeing the sky from bright places. He then hits you with the image of a black teenage figure lurking in shadows on a rooftop in a densely packed urban area, and the consequences thereof.

Tyson also loves verbal bullets and one-liners: Relating a childhood memory, he notes: "For years I never knew what to draw with that pink-colored crayon called 'flesh.'" He also speaks out about scientific illiteracy, as both a father and an educator with a passionate scientific soul.

I do wish that Tyson had been more forthcoming about his immediate family and early influences. He pro-

vides only fleeting glimpses of his parents and their circumstances. I learned more about his family from *The New York Times*. His father is a sociologist, who worked in the administration of New York mayor John Lindsay, and his mother is an active professional engaged in federal programs for the elderly.

Tyson lived in a neighborhood where he could earn money for his telescope habit by walking dogs whose owners clothed them in rain gear. He tells about influential teachers and the Hayden Planetarium as youthful inspirations, but he fails to identify a childhood friend who, he admits, had great influence on him.

History may eventually want to know more about this man who, still in his early 40s, has come so far in so short a time. It is too soon to tell. But his memoir is a nice teaser.

The second book, *One Universe: At Home in the Cosmos*, is a coffee table-sized perspective on the nature of the universe and where we are in it. It might be considered a companion volume to the new exhibitry at the Hayden. In this book, which Tyson wrote with colleague Charles Liu and a science writer, Robert Irion, we are reassured that the universe is knowable, that the laws governing the largest known structures in the universe are also active at the smallest levels, and that we live in one universe with a single set of laws. The text is imaginatively illustrated by such renderings as the Empire State Building being torn apart by tidal forces as it is drawn down the gravitational potential well of a black hole. There are occasional lapses or curious juxtapositions, but one expects such things in a popular book that searches for a fresh interpretive view of the knowable universe.

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A Different Approach to Cosmology: From a Static Universe Through the Big Bang Towards Reality

Fred Hoyle, Geoffrey Burbidge, and Jayant V. Narlikar
Cambridge U. P., New York, 2000.
357 pp. \$59.95 hc
ISBN 0-521-66223-0

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