



Journal of Psychology and Financial Markets >

Volume 3, 2002 - [Issue 2](#)

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Pages 76-86 | Published online: 07 Jun 2010

🗨️ Cite this article https://doi.org/10.1207/S15327760JPFM0302_02

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Bubble, Rubble, Finance in Trouble?

Andrew W. Lo

In this talk, I review the implications of the recent rise and fall of the technology sector for traditional financial theories and their behavioral alternatives. Although critics of the Efficient Markets Hypothesis argue that markets are driven by fear and greed, not fundamentals, recent research in the cognitive neurosciences suggests that these two perspectives are opposite sides of the same coin. I propose a new paradigm for financial economics that focuses more on the evolutionary biology and ecology of markets rather than the more traditional physicists' view. By marrying the principles of evolution to Herbert Simon's notion of "satisficing," I argue that much of what behavioralists cite as counter-examples to economic rationality—loss aversion, overconfidence, overreaction, mental accounting, and other behavioral biases—are, in fact, consistent with an evolutionary model of rational agents learning to adapt to their environment via satisficing heuristics.

I'd like to begin by thanking David Dreman and Arnie Wood for inviting me to speak at this fascinating conference. Although I'm not a psychologist or behavioral finance expert by training, much of my current research interests lies in this area now, and I'll be discussing some of those interests over the next 45 minutes or so. This luncheon talk provides me with a wonderful opportunity to speak somewhat less formally and a bit more expansively about several issues surrounding behavioral finance and how they relate to the apparent bubble in technology stocks that we have experienced over the past few years. Given the occasion, my comments will be less than rigorous, but I've often been reminded by my colleagues that along with rigor usually goes *mortis*, so I trust no one will object in this case!

What I thought I would do instead is to describe part of the personal journey that I've taken in resolving the controversy surrounding behavioral finance and in attempting to reconcile traditional financial asset-pricing models with what's been happening in the stock mar-

ket over the past several years. As part of that journey, I think I've been able to address some of the challenges that David Dreman raised in his opening remarks yesterday, challenges that, at one point, I found enormously difficult to make sense of in the context of modern financial economics. It's only recently that I think I've finally come to a tentative reconciliation, at least in my own mind, of these two apparently disparate lines of inquiry.

The Three P's of Investment Management

Let me start by answering the title of my talk, "Bubble, Rubble, Finance in Trouble?" and state at the outset—with apologies to William Shakespeare—that despite the rubble left by the bursting of the technology bubble, modern finance is not in trouble. To see why, let me first provide a brief overview of what we consider to be the traditional or rational financial paradigm, which is summarized by what I call the "Three P's of Investment Management": prices, probabilities, and preferences. The three P's have their origins in one of the most basic and central ideas of modern economics, the principle of supply and demand. This principle states that the price of any commodity and the quantity traded are determined by the intersection of supply and demand curves, where the demand curve represents the schedule of quantities desired by consumers at various prices and the supply curve represents the schedule of quantities producers are willing to supply at various prices. The intersection of these two curves determines an "equilibrium," a price-quantity pair that satisfies both consumers and producers simultaneously. Any other price-quantity pair may serve one group's interests, but not the other's.

Even in this simple description of a market, all the elements of modern finance are present. The demand curve is the aggregation of many individual consumers' desires, each derived from optimizing an individual's preferences subject to a budget constraint that depends on prices and other factors (e.g., income, savings requirements, and borrowing costs). Similarly, the sup-

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