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Finiteness of variance is irrelevant in the practice of quantitative finance

Nassim Nicholas Taleb

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Abstract

Outside the Platonic world of financial models, assuming the underlying distribution is a scalable "power law," we are unable to find a consequential difference between finite and infinite variance models—a central distinction emphasized in the econophysics literature and the financial economics tradition. Although distributions with power law tail exponents $\alpha > 2$ are held to be amenable to Gaussian tools, owing to their "finite variance," we fail to understand the difference in the application with other power laws ($1 < \alpha < 2$) held to belong to the Pareto-Lévy-Mandelbrot stable regime. The problem invalidates derivatives theory (dynamic hedging arguments) and portfolio construction based on mean-variance. This article discusses methods to deal with the implications of the point in a real world setting. © 2008 Wiley Periodicals, Inc. Complexity, 2009

References

1 Mandelbrot, B. The variation of certain speculative prices. *J Bus* 1963, **36**, 394–419.

Web of Science® | Google Scholar

2 (a) Mandelbrot, B. *Fractals and Scaling in Finance*; Springer-Verlag, 1997;

Google Scholar

3 Plerou, V.;Gopikrishnan, P.;Gabaix, X.;Amaral, L.;Stanley, H.E. Price fluctuations, market activity, and trading volume. *Quant Finance* 2001, **1**, 262–269.

Web of Science® | Google Scholar

4 Stanley, H.E.;Amaral, L.;Gopikrishnan, P.;Plerou, V. Scale invariance and universality of economic fluctuations. *Phys A* 2000, **283**, 31–41.

Web of Science® | Google Scholar

5 Gabaix, X.;Gopikrishnan, P.;Plerou, V.;Stanley, E. A theory of power law distributions in financial market fluctuations. *Nature* 2003, **423**, 267–230.

CAS | PubMed | Web of Science® | Google Scholar

6 Gabaix, X.;Gopikrishnan, P.;Plerou, V.;Stanley, E. *Are Stock Market Crashes Outliers? MIT Mimeo*. Massachusetts Institute of Technology: Cambridge, 2003.

Google Scholar

7 Gopikrishnan, P.;Meyer, M.;Amaral, L.;Stanley, H.E. Inverse cubic law for the distribution of stock price variations. *Eur Phys J B* 1998, **3**, 139–140.

CAS | Web of Science® | Google Scholar

8 Gopikrishnan, P.;Plerou, V.;Amaral, L.;Meyer, M.;Stanley, H.E. Scaling of the distribution of fluctuations of financial market indices. *Phys Rev E* 1999, **60**, 5305–5316.

CAS | PubMed | Web of Science® | Google Scholar

9 Gopikrishnan, P.;Plerou, V.;Gabaix, X.;Stanley, H.E. Statistical properties of share volume traded in financial markets. *Phys Rev E* 2000, **62**, R4493–R4496.

CAS | Web of Science® | Google Scholar

12 The Risk Maverick. *Bloomberg*, May 2008.

Google Scholar

13 Hull, J.;White, A. The pricing of options on assets with stochastic volatilities, *Journal of Finance* 1987, **42**, 281–300.

Web of Science® Google Scholar

14 Heston, S.L. A closed-form solution for options with stochastic volatility, with application to bond and currency options. *Rev Financ Studies* 1993, **6**, 327–343.

Web of Science® Google Scholar

15 Duffie, D.;Pan, J.;Singleton, K. Transform analysis and asset pricing for affine jump diffusions. *Econometrica* 2000, **68**, 1343–1376.

Web of Science® Google Scholar

16 Gatheral, J. *Stochastic Volatility Modeling*; Wiley: 2006.

Web of Science® Google Scholar

17 Goldstein, D.G.;Taleb, N.N. We don't quite know what we are talking about when we talk about volatility. *J Portfolio Manag* 2007.

Web of Science® Google Scholar

18 Bouchaud, J.-P.;Potters, M. Theory of financial risks and derivatives pricing. In: *From Statistical Physics to Risk Management*, 2nd ed.; Cambridge University Press: 2003.

Google Scholar

19 Merton, R.C. Theory of rational option pricing. *Bell J Econ Manag Sci* 1973, **4**, 141–183.

Google Scholar

21 Cox, J.C.;Ross, S.A. The valuation of options for alternative stochastic processes. *J Financ Econ* 1976, **3**, 145–166.

PubMed | Web of Science® | Google Scholar

22 Baz, J.;Chacko, G. *Financial Derivatives: Pricing, Applications, and Mathematics*; Cambridge University Press: 2004.

Google Scholar

23 Sornette. *Critical Phenomena in Natural Sciences: Chaos, Fractals, Self-Organization and Disorder: Concepts and Tools*, 2nd ed.; Springer, 2004.

Google Scholar

24 Lo, A.;MacKinley, A.C. Stock market prices do not follow random walks: Evidence from a simple specification test. *Review of Financial Studies* 1988, **1**, 41–66.

Web of Science® | Google Scholar

25 Taleb, N.N.;Pilpel, A. I problemi epistemologici del risk management In: *Daniele Pace (a cura di) Economia del rischio. Antologia di scritti su rischio e decisione economica*, Giuffre: Milan, 2004.

Google Scholar

26 Taleb, N.N. The Black Swan and the domains of statistics. *Am Stat* 2007, **61**, 3.

Google Scholar

27 Weron, R. Levy-stable distributions revisited: Tail index >2 does not exclude the levy-stable regime. *Int J Modern Phys* 2001, **12**, 209–223.

30 Bodarenko, Why are Put Options So Expensive? SSRN Preprint. 2004.

Google Scholar

31 Gabaix, X.;Ramalho, R.;Reuter, J. *Power Laws and Mutual Fund Dynamics. MIT Mimeo*. Massachusetts Institute of Technology: Cambridge, 2003c.

Google Scholar

32 Plerou, V.;Gopikrishnan, P.;Gabaix, X.;Stanley, H.E. On the origins of power law fluctuations in stock prices. *Quantitative Finance* 2004, **4**, C11–15.

Web of Science® Google Scholar

33 Markowitz, H. Portfolio selection. *J Finance* 1952, **7**, 77–91.

Web of Science® Google Scholar

34 Officer, R.R. *J Am Stat Assoc* 1972, **67**, 807–812.

Web of Science® Google Scholar

35 Haug, E.G.;Taleb, N.N. Why We Never Used the Black Scholes Mertn Option Pricing Formula. *Wilmott Magazine*, in press.

Google Scholar

36 Bachelier, L. Theory of speculation. In: *The Random Character of Stock Market Prices*; P. Cootner, Ed. (edited in 1964); MIT Press: Cambridge, MA, 1900.

Google Scholar

39 Boness, A. Elements of a theory of stock-option value. *J Pol Econ* 1964, **72**, 163–175.

Web of Science® | Google Scholar

40 Thorp, E.O.;Kassouf, S.T. *Beat the Market*; Random House: New York, 1967.

Google Scholar

41 Thorp, E.O. 1969. Optimal gambling systems for favorable games. *Rev Int Stat Inst* 1969, 37.

Google Scholar

42 Bouchaud, J.-P.;Potters, M. Welcome to a non-Black-Scholes world. *Quant Finance* 2001, **1**, 482–483.

Google Scholar

43 (a) Dupire, B. Pricing with a smile. *Risk* 1994, **7**, 18–20;

Google Scholar

(b) Dupire, B. *A new approach for understanding the impact of volatility on option prices. Discussion paper*. Nikko Financial Products, 1998.

Google Scholar

44 Derman, E.;Kani, I. Riding on a smile. *Risk* 1994, **7**, 32–39.

Google Scholar

45 Borland, L. Option pricing formulas based on a non-Gaussian stock price model. *Phys Rev Lett* 2002, **89**, 9.

Web of Science® | Google Scholar

48 Haug, E.G. *Derivatives Models on Models*; Wiley: New York, 2007.

Google Scholar

49 Wilmott, P. *Paul Wilmott on Quantitative Finance*; Wiley: Chichester, 2000.

Google Scholar

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