SPRINGER NATURE Link

Log in

Option Pricing Using Variance Gamma Markov Chains

Published: January 2002

Volume 5, pages 81–115 (2002) Cite this article



Review of Derivatives Research

Mikhail Konikov[1] & Dilip B. Madan[2]

617 Accesses 82 Citations 3 Altmetric Explore all metrics

Abstract

This paper proposes a Markov Chain between homogeneous Lévy processesas a candidate class of processes for the statistical and risk neutral dynamicsof financial asset prices. The method is illustrated using the variance gammaprocess. Closed forms for the characteristic function are developed and thisrenders feasible, series and option prices respectively. It is observed inthe statistical and risk neutral process is fit to data on time period of4 to 6 months in a state while this reduces to month for indices. Risk neutrallythere is generally a low probability of a move to a state with higher moments.In some cases this is reversed.

This is a preview of subscription content, log in via an institution to check access.

Access this article

Log in via an institution

Subscribe and save

Springer+ from €37.37 /Month

- Starting from 10 chapters or articles per month
- Access and download chapters and articles from more than 300k books and 2,500 journals
- Cancel anytime

View plans →

Buy Now

Buy article PDF 39,95 €

Price includes VAT (Poland)

Instant access to the full article PDF.

Institutional subscriptions →

Explore related subjects

Discover the latest articles, books and news in related subjects, suggested using machine learning.

Brownian Motion | Markov Process | Statistical Finance | Stochastic Calculus | Stochastic Analysis | Stochastic Processes

References

Andersen, T. G. (1994). “Stochastic Autoregressive Volatility: A Framework for Volatility Modeling,” *Mathematical Finance* 4, 75–102.

Andé, T., and H. Geman. (2000). “Order Flow, Transaction Clock and Normality of Asset Returns,” *Journal of Finance* 55, 2259–2284.

Bakshi, G., C. Cao, and Z. Chen. (1997). “Empirical Performance of Altrernative Option Pricing Models,” *Journal of Finance* 52, 2003–2049.

Barndorff-Nielsen, O. (1998). “Processes of Normal Inverse Gaussian Type,” *Finance and Stochastics* 2, 41–68.

Barndorff-Nielsen, O., and N. Shephard. (1999). “Non-Gaussian OU Based Models and Some of Their Uses in Financial Economics,” Working Paper No. 37, Center for Analytical Finance, University of Aarhus.

Bates, D. (1996). “Jumps and Stochastic Volatility: Exchange Rate Processes Implicit in Deutschemark Options,” *Review of Financial Studies* 9, 69–108.

Black, F., and M. Scholes. (1973). “The Pricing of Options and Corporate Liabilities,” *Journal of Political Economy* 81, 637–654.

Carr, P., H. Geman, D. Madan, and M. Yor. (2000). “The Fine Structure of Asset Returns: An Empirical Investigation,” forthcoming in the *Journal of Business*.

Carr, P., H. Geman, D. Madan, and M. Yor. (2001). “Stochastic Volatility for Lévy Processes,” Working Paper, University of Maryland.

Carr, P., and D. B. Madan. (1999). “Option Valuation Using the Fast Fourier Transform,” *Journal of Computational Finance* 1, 61–73.

Clark, P. K. (1973). “A Subordinated Stochastic Process Model with Finite Variance for Speculative Prices,” *Econometrica* 41, 135–156.

Derman, E., and I. Kani. (1998). “Stochastic Implied Trees: Arbitrage Pricing with Stochastic Term and Strike Structure of Volatility,” *International Journal of*

Theoretical and Applied Finance 3, 7–22.

Dupire, B. (1994). “Pricing With a Smile,” *Risk* 7,1, 18–20.

Duan, J, I. Popova, and P. Ritchken. (1999). “Option Pricing under Regime Switching,” Working Paper, Case Western Reserve University.

Eberlein, E., U. Keller, and K. Prause. (1998). “New Insights into Smile, Mispricing and Value at Risk: The Hyperbolic Model,” *Journal of Business* 71, 371–406.

Elliott, Robert J., Lakhdar Aggoun, and John B. Moore. (1995). *Hidden Markov Models: Estimation and Control (Applications of Mathematics, Vol. 29)*. Berlin: Springer-Verlag.

Engle, R. F. (1982). “Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation,” *Econometrica*, 61, 929–952.

Geman, H., D. Madan, and M. Yor. (2001). “Time Changes for Lévy Processes,” *Mathematical Finance* 11, 79–96.

Heston, S. L. (1993). “A Closed Form Solution for Options with Stochastic Volatility with Applications to Bond and Currency Options,” *Review of Financial Studies* 6, 327–343.

Madan, D. B., and E. Seneta. (1990). “The Variance Gamma (VG) Model for Share Market Returns,” *Journal of Business* 63,4, 511–524.

Madan, D. B., P. P. Carr, and E. C. Chang. (1998). “The Variance Gamma Process

and Option Pricing," *European Finance Review* 2, 79–105.

Merton, R. C. (1973). "Theory of Rational Option Pricing," *Bell Journal of Economics and Management* 4, 141–183.

Merton, R. C. (1976). "Option Pricing when Underlying Stock Returns are Discontinuous," *Journal of Financial Economics* 3, 125–144

Nelson, D. (1991). "Conditional Heteroskedasticity in Asset Returns: A NewApproach," *Econometrica* 59, 347–370.

Author information

Authors and Affiliations

Department of Mathematics, University of Maryland, College Park, MD, 20742

Mikhail Konikov

Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742

Dilip B. Madan

Rights and permissions

Reprints and permissions

About this article

Cite this article

Konikov, M., Madan, D.B. Option Pricing Using Variance Gamma Markov Chains. *Review of Derivatives Research* **5**, 81–115 (2002). https://doi.org/10.1023/A:1013816400834

Issue date
January 2002
DOI
https://doi.org/10.1023/A:1013816400834

Keywords

Markov Chain | Characteristic Function | Closed Form | Asset Price | Option Price

Search

Search by keyword or author

Navigation

Find a journal

Publish with us

Track your research