The normal inverse Gaussian distribution: exposition and applications to modeling asset, index and foreign exchange closing prices

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Abstract

We expose the unique properties of the normal inverse Gaussian distribution (NIG) useful for modeling asset, index and foreign exchange closing prices. We further demonstrate that traditional beliefs in asset, index, and foreign exchange closing prices not being independently identically distributed random variables are fundamentally flawed. Best models are selected using a novel model selection strategy proposed by Käärik and Umbleja (2011). Our results show that closing prices of Baltika and Ekpress Grupp (companies trading on Tallinn stock exchange), FTSE100, GSPC and STI (major world indexes), CHF/JPY, USD/EUR, EUR/GBP, SAR/CHF, QAR/CHF and EGP/CHF (Foreign Exchange rates) can be modeled by NIG distribution. This means their underlying stochastic properties can fully be captured by NIG; very useful for predicting price movements, pricing models, underwriting and trading derivatives etc

References

[1] Barndorff-Nielsen O. E., Processes of normal inverse Gaussian type, Systems & Finance and Stochastics, 2, (1998), 42-68.

[2] Figueroa-López J. E., Jump diffusion models driven by Lévy Processes, Springer Handbooks of Computational Statistics, (2012), 61-88.

[3] Käärik M., Umbleja M., On claim size fitting and rough estimation of risk premiums based on Estonian traffic example, *International Journal of Mathematical Models and Methods in Applied Sciences*, Issue 1, vol. 5, 17-24, (2011).

[4] Lo A. W. and Mackinlay A. C., Stock market prices do not follow random walks: Evidence from a simple specification test, Review of Financial studies, Vol. 1, 41-66, (1998).

[4] Necula C., Modelling heavy-tailed stock index returns using the generalized hyperbolic distribution, Romanian Journal of Economic Forecasting,Vol. 6(2), 610-615, (2009)

[5] Schoutens W., Lévy Processes in Finance, John Wiley & Sons Inc., New York, (2003).

[6] Teneng D., NIG-Levy process in asset price modelling: case of Estonian companies, Proc. 30th International Conference on Mathematical Methods in Economics - MME 2012,Karvina, 1-3 Sept. 2012, to appear.

[7]Rydberg T. H., The Normal Inverse Gaussian Levy Process : Simulation and approximation, Comm. Stat.: Stoch. Models, Vol. 13 (4), 887-910, (1997).