

Characterizing jumps using MEM and titration for chaotic patterns

K.P. Lam

Department of Systems Engineering & Engineering Management

The Chinese University of Hong Kong, Shatin, N.T., Hong Kong

Email: kplam@se.cuhk.edu.hk

Extended Abstract

Recent research in financial econometrics (Barndorff-Nielsen & Shephard, 2005) has made significant stride in clarifying the intimate relationship between two important latent processes, namely, volatility and jump diffusion. While various issues concerning volatility have been extensively investigated, the characterization of jumps is still in its infancy and can be interpreted under different perspectives. This includes qualitative study of news impact as reported by Barndorff-Nielsen & Shephard, central bank intervention on exchange rate (Beine et al, 2006), and quantitative analysis of jump statistics (Huang, 2004), amongst others.

We consider two new perspectives in characterizing jumps. The first perspective focuses on the idea of *conditional jump QV* (Quadratic Variation) prediction, based on the framework of MEM (Multiplicative Error Model) (Engle & Gallo, 2006) with a non-negative input of *realized jump QV* (which is the difference between realized variance and multi-power variation). A comparison between conditional jump and realized jump is then made, by investigating the nonlinearities embedded in each process. Inspired by the work of titration for chaotic patterns (Poon and Barahona, 2001), our second perspective provides details on the nonlinearities associated with conditional and realized jumps using a litmus test on their respective strength against random noise process. Some empirical studies were performed using a high-frequency data set of S&P 500 from October 3, 2005 to September 29, 2006, covering a period of 247 days regularly-sampled at 10 minutes intervals during each trading day. In particular, the realized and conditional jumps obtained from realized variance, bi-power variation, and quad-power variation were evaluated with respect to the presence of chaotic patterns under the titration metric.

References

- Barndorff-Nielsen, O.E. and Shephard, N. *Variation, jumps, market frictions and high frequency data in financial econometrics*, Invited Symposium on Financial Econometrics, 9th World Congress of the Econometric Society, London, 20th August 2005.
- Beine, M., Lahaye, J., Laurent, S., Neely, C.J., and Palm, F.C. *Central Bank Intervention and Exchange Rate Volatility, Its Continuous and Jump Components*. Working Paper 2006-031B, Federal Reserve Bank of St. Louis.
- Huang, X. *The Behavior of Jump Statistics*. Working Paper, Department of Economics, Duke University, January 30, 2004.
- Engle, R.F. and Gallo, G.M. *A multiple indicators model for volatility using intra-daily data*. J. Econometrics, 131, pp. 3-27, 2006.
- Poon, C-S. and Barahona, M. *Titration of chaos with added noise*. PNAS 2001; 98; pp. 7107-7112.