# Information Flow in International Foreign Exchange Rates

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## Abstract

In this paper, we investigate the asymmetry effect of information flow for the 31 daily international foreign exchange rates and also observes the relationship between the difference in the degree of market efficiency and the degree of asymmetry in the information flow. We utilize the symbolic transfer entropy (STE), widely acknowledged in econophysics literature, to estimate the information flows between foreign exchange rates and use the Approximate entropy (ApEn) method which can measure the randomness in the time series. We have find that the information for the 31 daily international foreign exchange rates streams from European to Asian continents, In other words, there is the asymmetry behavior of information flow. We then consider the difference in the degree of market efficiency as driving force of information flow and calculate the ApEn value in all foreign exchange rates used in this paper. We find that the degree of asymmetry in information flows between foreign exchange rates shows the strong positive correlation with the difference in the degree of market efficiency. Our finding suggest that for the international foreign exchange markets the difference in the degree of market efficiency plays an important role as driving force that can determine the direction of information flow.

## Keywords

information flow, symbolic transfer entropy, foreign exchange rate

## References

# References

[Aydi(1998)] O.F. Aydi, U.B. Dufrene, A. Chatterjee, Int. Rev. Finan. Analy. 7 (1998) 83.

[Bouchaud(2003)] J.P. Bouchaud, M. Potters, Theory of financial risks: From statistical physics to risk managements, Cambridge university press, Cambridge, 2000.

[Engel(1987)] R. Engel, C.W. Granger, Econometrica 55 (1987) 25-2.

[Eun(1989)] C. Eun, S. Shim, J. Financ. Quant. Anal. 24 (1989) 241.

[Eom(2008)] C. eom, W.-S. Jung, S. Choi, G. Oh, S. Kim, Physica A, 387 (2008) 5219.

[Fama(1970)] E.F. Fama, J. Finance 25, (1970) 383.

[Granger(1969)] C.W. Granger, Econometrica 37 (1969) 424.

[Halváćková-Schindler(2007)] K. Halváćková-Schindler, M. Paluś, M. Vejmelka, and J. Bhattacharya, Causality detenction based on information-theoretic approaches in time series analysis, Physics Reports, Vol 441, pp 1-46 2007.

[Hamao(1998)] Y. Hamao, R. Masulis, V. Ng, Rev. Financial Studies 3 (1990) 281.

[Jung(2004)] W.-S. Jung, S. Chae, J.-S. Yang, H.-T. Moon, Physica A 361 (2004) 263.

[Jung(1990)] W.-S. Jung, O. Kwon, F. Wang, T. Kaizoji, H.-T. Moon, H.E. Stanley, Physica A 387 (2008) 537.

[Kingo(1990)] M. King, S. Sadhwani, Rev. Financial Studies 3 (1990) 5.

[Kwon(2008)] O. Kwon, and J.-S. Yang, EPL, 82 (2008) 68003.

[Kaiser(2002)] A. Kaiser and T. Schreiber, physica D 166, (2002) 43.

[Lungarella(2007)] M. Lungarella, A. Pitti, and Y. Kuniyoshi, Phys. Rev. E 76, (2007) 056117.

[Mantegna(1999)] R.N. Mantegna, H.E. Stanley, An introduction to econophysics: correlations and complexity in finance, Cambridge university press, Cambridge, 1999.

[Oh(2008)] G. Oh, S. Kim, C. Eom, Physica A 382 (2007) 209.

[Palus(2001)] M. Paluś, V. Komárek, Z. Hrncir, K. Sterbova, Phys. Rev. E 63 (2001) 046211.

[Pincus(1991)] S.M. Pincus, Proc. Natl. Acad, Sci. 88 (1991) 2297.

[Pincus(1996)] S.M. Pincus, B.H. Singer, Proc. Natl. Acad, Sci. 93 (1996) 2083.

[Pincus(2004)] S.M. Pincus, R.E. Kalman, Proc. Natl. Acad, Sci. 101 (2004) 13709.

[Schreiber(2000)] T. Schreiber, Phys. Rev. Lett. 85, (2000) 461.

[Staniek(2008)] M. Staniek and K. Lehnertz, PRL, 100 (2008) 158101

[Verdes(2005)] P.F. Verdes, Phys. Rev. E 72, (2005) 026222.