

# Detail observation of interaction among foreign exchange markets based on order-book data

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Foreign exchange markets are the markets of currencies which determine the currency exchange rates. The markets are open for 24 hours except weekends and they are playing the role of the backbone of the world economy. It is known that there are strong correlations among currency pairs, such as USD-EUR and USD-JPY, and the corresponding network structure of markets changes with appearance of big events [1].

Here, we analyze interaction among these markets based on order-book data which record all individual orders of buy, sell and cancel with time stamp 1 msec. It is recently found that order-books have layered structure, the inner-layer driving directly the exchange rates and the outer-layer working as resistivity [2]. We pay attention to 3 major markets and observe detail correlations among inner and outer layers of these markets.

## References

[1] Arthur M.Y.R. Sousa, Hideki Takayasu, and Misako Takayasu

“Influence Networks in the Foreign Exchange Market”

Proceedings of the International Conference on Social Modeling and Simulation, plus Econophysics

Colluquium 2014, Springer Proceedings in Complexity (Editors H.Takayasu, N.Ito, I.Noda and

M.Takayasu) , 3-13 (2015).

[2] Yoshihiro Yura, Hideki Takayasu, Didier Sornette, Misako Takayasu

“Financial Brownian particle in the layered order book fluid and fluctuation-dissipation relations”

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