Researchers report a link between earthquakes and currency jumps

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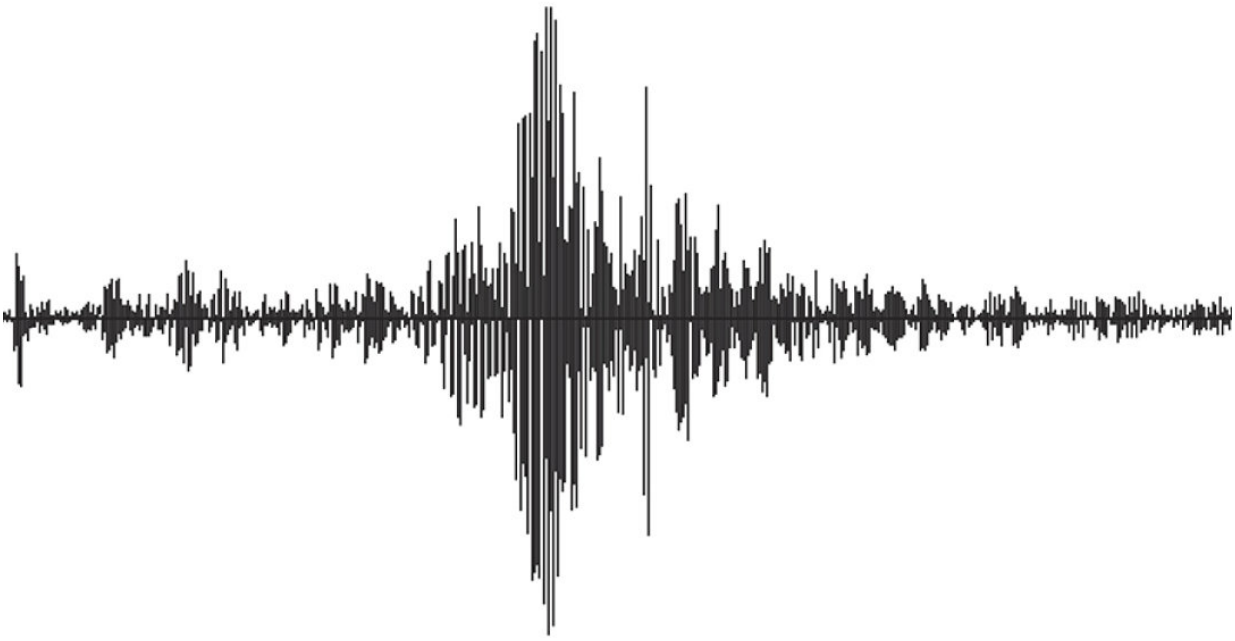

Credit: National Research University Higher School of Economics

Mathematicians at the Higher School of Economics have successfully demonstrated the use of a Japanese model which detects seismic activity in predicting currency risks. The research results have been published in

an article titled "Hawkes Processes for Forecasting Currency Crashes: Evidence from Russia."

The Epidemic-type Aftershock Sequence (ETAS) approach was developed in Japan in 1988 by Ogata. This model is based on Hawkes self-exciting processes and enables scientists to calculate the probability of further seismic activity, based on the first shocks.

This idea of self-excitement shares some similarities with the cause-and-effect relationships of sudden changes on the financial market.

Jumps on the foreign exchange market or on the stock market always stem from external (exogenous) or internal (endogenous) causes. As a rule, external causes are not predictable, but they can have a strong impact on the stock exchange. For example, this happened on the first trading day after the attacks of September 11, 2001, when the Dow Jones index dropped by 7.1%.

An example of instability generated by internal causes is the formation of so-called 'bubbles' due to the herding behavior of investors. "This is when traders, mostly small and medium-sized, who do not have enough insider information to predict further changes, begin to follow their financial 'gurus," thereby creating unfounded excitement on the market. At some point, this bubble grows to critical size, at which point it becomes clear to everyone that prices are unrealistic. An example is the dot-com bubble in the USA in 2000," explains Lyudmila Egorova, Junior Research Fellow at International Laboratory of Decision Choice and Analysis, the Higher School of Economics.

In 2017 Egorova together with Igor Klimyuk, a Master's student at HSE's Faculty of Economics, applied the Hawkes method on the S&P500 stock index and USD/RUB currency pair. They were able to show that the Japanese approach predicts financial risks as successfully as the models

which are traditionally used by analysts for these same purposes.

In their experiment, researchers used the data of the Moscow Stock Exchange on USD/RUB currency pair for the period from January 26, 1999 to April 10, 2017. Lyudmila Egorova noted that the accuracy of the prediction using Hawkes processes is about 40%. Only 112 of the 277 events observed were successfully forecasted. "This is because the Hawkes process predicts subsequent events, but not the first," the researcher added, in her explanation of the inaccuracy.

Furthermore, the foreign exchange market reacted quickly to external events, adjusting to new prices, such that there were no large consecutive shocks, as in the case of an earthquake. The shocks quickly came to an end, and the market 'calmed down."

In general, according to the researcher, the accuracy of prediction using the ETAS model is not inferior to the accuracy of other popular econometric models used for financial risk forecasting. This was shown by comparing the forecasts generated by econometric models using the same S&P 500 data.

More information: Lyudmila Egorova et al, Hawkes processes for forecasting currency crashes: Evidence from Russia, *Procedia Computer Science* (2017). DOI: 10.1016/j.procs.2017.11.490

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