Light-bulb moment for stock market behaviour

July 21 2016

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University of Adelaide physicists have discovered that the timing of electronic orders on the stock market can be mathematically described in the same way as the lifetime of a light bulb.

The surprising finding is a "crucial first step" towards predicting dramatic movements on stock exchanges that could lead to stock market

crashes.

The two University of Adelaide physicists, in collaboration with colleagues in the German finance sector, analysed the arrival and cancellation times of many millions of buy and sell 'limit orders' from seven different stocks on the electronic orderbook of the London Stock Exchange over a period of four months.

The seven stocks were chosen to represent the full gamut of stocks from those traded rapidly in large volumes such as Rio Tinto through to Yellow Pages which are traded much less frequently.

The results, published in the journal *Physics Letters A*, showed remarkable and unexpected behaviour.

"We found that when we looked at orders that came in extremely close together, less than 10 milliseconds apart, there were a huge number of orders placed and withdrawn that don't satisfy any rational formula that we could see at all," says Professor Anthony Thomas, Australian Laureate Fellow and Elder Professor of Physics at the University of Adelaide.

"It appears that in these cases, what's going on is some attempted market manipulation through fake orders to try and suggest that the market is moving when it's not.

"However, when we excluded all the orders of less than 10 millisecond intervals, we found the market actually shows amazingly rational behaviour. In fact the pattern of placement and removal of orders then follows a well-known probability distribution, the Weibull distribution.

"And even more surprisingly the shape of the distribution is the same for all the stocks we studied – a shape that corresponds to 'maximum

entropy' or, in other words, maximum disorder.

"This is a major discovery, telling us about the dynamics of the electronic orderbook."

Research Associate Dr Ayse Kizilersü says one example of Weibull distribution is the life-time of a light bulb. "The finding that the stock market activity can be described in this same way may lead us to being able to determine how likely dramatic events such as stock market crashes are," says Dr Kizilersü.

"Perhaps then the information can be used to properly manage the risks associated with investing. For example, stock market regulators could detect irregularities in movements which would leave the small investors at a disadvantage, such as market abuse."

The researchers plan to continue their research looking at price movements.

More information: Ayşe Kızılersü et al. Universal behaviour in the stock market: Time dynamics of the electronic orderbook, *Physics Letters A* (2016). DOI: 10.1016/j.physleta.2016.05.035

Provided by University of Adelaide