

# Modelling Market Crash Events and Big Data

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# About me

Research Interests: Market Microstructure, Asset Pricing, Fintech, Data Science, Climate-Market links, Quantum Mechanics.

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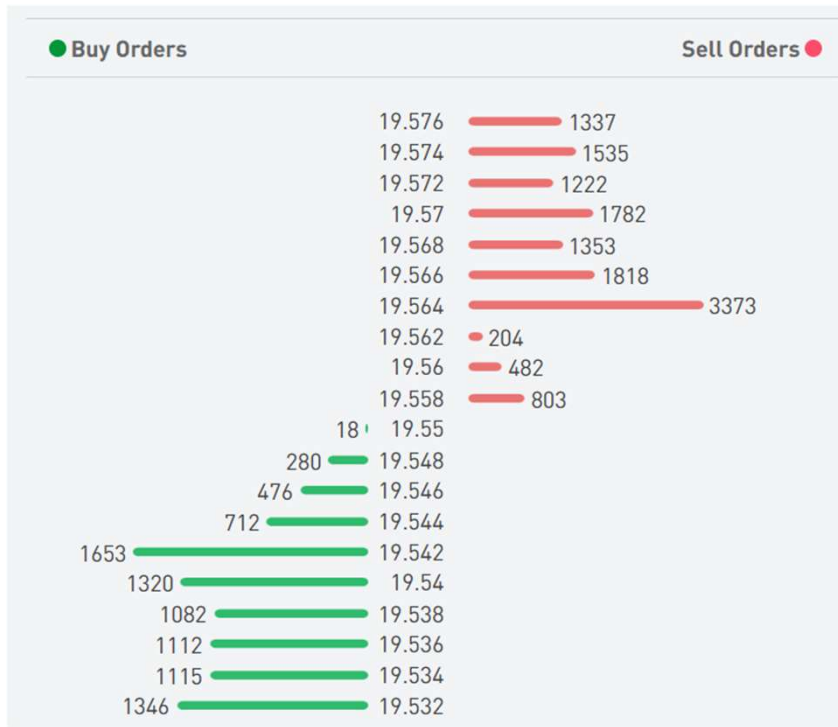
Director of Quantitative Research in Finance and Economics at Durham University Business School.

# This talk is about

Recent work on modelling market crash events (flash crash events) in high-frequency setting, i.e. millisecond trading.

Market Data we use.

Different approaches we take for modelling...



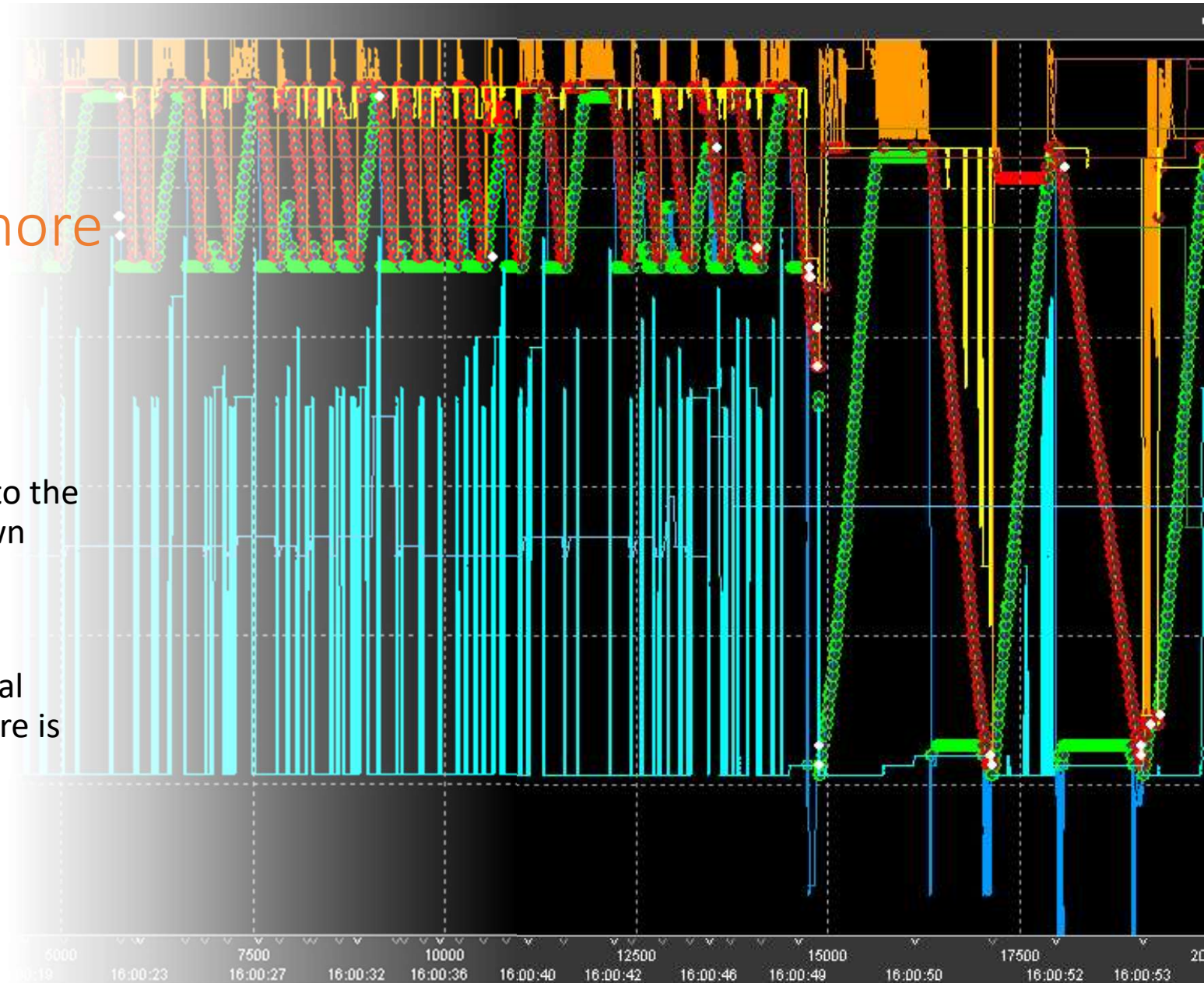
# What sort of Big Data?

Limit Order Books (LOB): a set of bid and ask quotes in millisecond environment in modern markets.

Speed competition (big high frequency trading companies use advanced technology: lights of microwave)

## Modern LOB: This occurs intradaily and more frequently...

- Large Quote Oscillation
- Large Trade Price swings to the point of market breakdown (flash crashes).
- Tighter spreads (traditional measure) don't mean there is liquidity. A case in point...



## Needs for reliable indicators in data-rich and complex environments

- My research suggests two novel liquidity indicators to detect the impact of speed trading on prices.
- Test these measures around Covid-19 selloffs, and several incidents of flash crashes on traditional futures markets and cryptocurrency markets.
- **“Intraday-momentum trading and Liquidity Crises”** paper with Dimitar Bogoev, suggests to implement an Early Warning System using our indicators and non-linear machine learning models to detect market disruptions in the period leading up to crashes.

## Another innovative approach from complex systems

**“A quantum walk model for a flash crash”** with Stuart Adams, Christopher McCarty and Jack Waller from the Physics Department at Durham University.

*One of the lessons of quantum physics is that occasionally extreme events can and do occur, unlike the random walk modelling used in finance and fat-tailed distributions. Particles can ‘tunnel’ through a solid barrier even when they do not have enough energy to get through according to classical physics. Quantum models also allow us to incorporate feedback and collective effects where fast traders tend to follow trends leading to crashes. This suggests that idea borrowed from quantum physics could provide a power framework for financial modelling.*