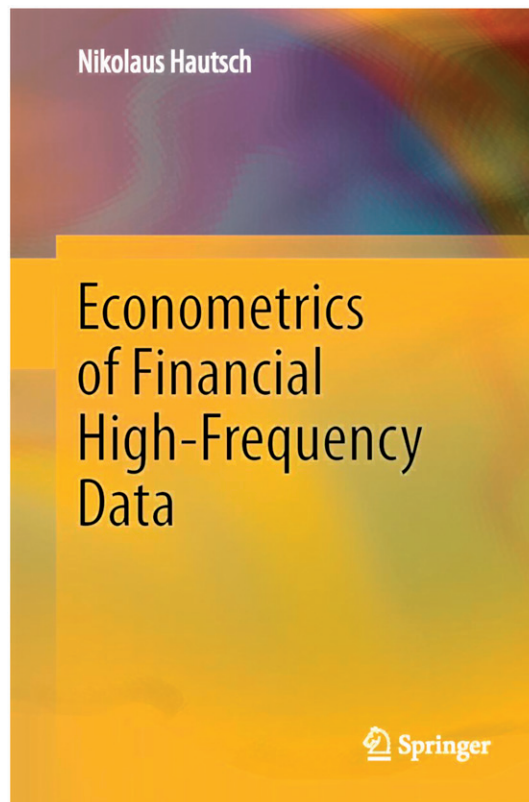# Book review

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Econometrics of Financial High-Frequency Data, by Nikolaus Hautsch, Springer (2011). ISBN 978-3642219245.

Nikolaus Hautsch extends and updates his earlier book on econometric models for financial trading data for scholars and practitioners. The new book is timely and highly recommended because the past decade has witnessed the radical technological transformation of stock exchanges and other financial markets through technology. Recent events highlight the importance of these market structure changes to all investors, even those who trade infrequently. On May 6, 2010 the so-called Flash Crash occurred with the stock market losing and recovering nine percent of its value in less than half an hour. This was followed by Knight Capital losing $440 million in 45 minutes due to a technology error and Nasdaq's technological struggles with Facebook's initial public offering. This book provides tools to help understand and model current financial market data.

The automation of financial markets increases trading capacity and the amount of information disseminated about market conditions. This enables investors to expand their use of technology and quantitative methods. Up to date information on the trading process and the ability to immediately execute trades makes sophisticated modelling more valuable. Shorter lags between getting information and being able to act on it expands the benefits of precisely modelling the dynamics of the trading process, especially at crucial times when volatility and trading activity are highest.

Older slower trading technologies that often gave some market participants special privileges, e.g., the old New York Stock Exchange trading floor, have given way to modern fully automated markets. This led to human-oriented manual trading giving way to algorithms generating order submissions and trading. These algorithms require detailed instructions and rules based on quantitative analysis. The *Econometrics of Financial High-Frequency Data* provides a series of models characterizing

the importance of events and non-events in the trading process. The individual chapters include empirical illustrations of the frameworks and models. The models present many possible efficient estimators and predictors for volatility, time-varying correlation structures, trading volume, bid-ask spreads, depth, trading costs, and liquidity risks. The estimates from these models provide valuable inputs into trading algorithms and academic research.

Modelling and understanding the interaction between liquidity supply and demand is fundamental to characterizing various aspects of the trading process and investors' behavior. The book's different models focus on important aspects of markets to illustrate the insights to be gained from more sophisticated econometrics. The development and application of numerous econometric models tailor-made for specific data and research tasks is the book's greatest strength and major weakness. The techniques and models are each well suited to answer specific questions, but a larger unifying framework is missing.

The approaches and techniques are organized around modelling key frictions in markets and features of high-frequency data. For example, transaction data are irregularly spaced in time. The time between market events carries information, measures trading activity, and affects price and trading volume behavior. The book uses point processes to characterize events' occurrences dependent on observable characteristics and the process history. The techniques can also quantify dynamic interdependencies between order flow, volatility and liquidity within and across markets and assets. Furthermore, the book takes seriously an important property of financial high-frequency data: the discreteness of transactions, prices, quotes, and bid-ask spreads. In addition, the models can be modified to capture nonlinearities in dynamics, long-range dependence, and intraday seasonalities as well as additional explanatory variables.

For practitioners sophisticated econometrics are only as valuable as their useful outputs. Important tasks in practice are high-frequency predictions of trading volume, volatility, market depth, and bid-ask spreads to optimize order placement and order execution with minimal price impact and transaction costs. The book's models can also be used to construct high-frequency trading strategies by providing price prediction and risk measurement. While the book provides many valuable tools, how to best apply them in practice is often left to the reader. In addition, practitioners often focus on simple robust techniques. Discussion of the potential pitfalls of more sophisticated techniques would be valuable.

For more academically inclined readers, modelling limit order books provides insights into the interplay between liquidity supply and demand, execution risks, traders' order submission strategies, and the market impact of order placements. However, a significant challenge is that the theoretical models for limit order books are so stylized and incomplete that a deeper economic understanding of what is generating the empirical properties of the data is elusive. This is beyond the scope of book and hinders most related research.

As mentioned above, the book's numerous models illustrate a variety of techniques for examining interrelated questions about financial market data. By choosing different classes of models for analysing different situations, properties, and metrics the book exposes the reader to many approaches. The downside is that at times the book reads more like a collection of papers. As the author notes, it is not necessary to read all chapters in a strict order. This contrasts with another book in the area: *Empirical Market Microstructure* by Joel Hasbrouck. Hasbrouck's book develops a framework which is methodically developed throughout. The *Econometrics of Financial High-Frequency Data* chooses different models to answer different questions. Because of this the book provides more limited economic understanding. However, Hautsch's book offers a greater variety approaches, techniques, and models. For readers with a deep interest in methodological possibilities it offers a broad toolkit for studying many important issues.

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