Market Microstructure

For other titles in the Wiley Finance series
please see www.wiley.com/finance

Market Microstructure

Confronting Many Viewpoints

Edited by

Frédéric Abergel
Jean-Philippe Bouchaud
Thierry Foucault
Charles-Albert Lehalle
Mathieu Rosenbaum

WILEY
A John Wiley & Sons, Ltd., Publication

This edition first published in 2012

Registered office
John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester,
West Sussex PO19 8SQ, United Kingdom

For details of our global editorial offices, for customer services and for information about how to apply for permission to reuse the copyright material in this book please see our website at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Market microstructure : confronting many viewpoints / edited by Frédéric Abergel . . . [et al.].
p. cm. – (The Wiley finance series)
Includes bibliographical references and index.
ISBN 978-1-119-95277-0 (cloth)
1. Securities. 2. Securities – Prices. 3. Stock exchanges. 4. Microfinance. I. Abergel, Frédéric.
HG4521.M319 2012
332.64′2 – dc23 2012002916

A catalogue record for this book is available from the British Library.

ISBN 978-1-119-95241-1 (hardback) ISBN 978-1-119-95277-0 (ebk)
ISBN 978-1-119-95278-7 (ebk) ISBN 978-1-119-95279-4 (ebk)

Cover images reproduced by permission of Shutterstock.com
Set in 11/13pt Times by Aptara Inc., New Delhi, India
Printed and bound by TJ International Ltd, Padstow, Cornwall, UK

Contents

Introduction

The accumulation of high frequency market data in recent years has revealed many surprising results. These results are interesting both from theoretical and practical standpoints. The mechanism of price formation is at the very heart of economics; it is also of paramount importance to understand the origin of the well-known anomalous 'stylized facts' in financial price series (heavy tails, volatility clustering, etc.). These issues are of obvious importance for practical purposes (organisation of markets, execution costs, price impact, etc.). This activity is also crucial to help the regulators, concerned with the organisation of liquidity in electronic markets and the issues raised by 'high frequency trading'.

Correspondingly, this problem has been vigorously investigated by at least five different communities (economics, financial mathematics, econometrics, computer science and econo-physics), scattered in academic institutions, banks and hedge funds, with at present limited overlap and sometimes lack of visibility. On the other hand, due to the gigantic amount of available data, precise quantitative theories can now be accurately tested.

At the time where this conference series started in 2010, the interest for market microstructure had finally reached a stage where the interest for the theoretical breakthroughs of the pioneers in the field had become comparable to its practical importance for market practitioners. Thanks to the development of high frequency trading, market microstructure is now, not only a subject of theoretical modelling and simulation but, more interestingly maybe, a real practical field where a better model can make a big difference.

The organisers of the conference thought that it would be extremely fruitful to confront the ideas that have blossomed in those different communities in the past decade. In order to foster this confrontation and ease communication, we have gathered researchers from these different communities, including professionals, and ask them to give introductory tutorials, reviewing both their recent activity and the problems that, in their eyes, are most relevant to address in the near future.

Our aim in setting up this friendly, knowledge-oriented confrontation has been to examine and compare possibly very different views on the nature of the mechanisms relevant to describe and understand what one can actually observe when scrutinising the tick-by-tick behaviour of markets. Such important questions as the interplay between liquidity taking and providing, the existence and characterisation of various types of market impact, the statistical tools designed to handle well the ‘tick’ effect, the ‘best-execution’ and other algorithmic trading strategies, or the question of market design and organisation . . . have been studied in-depth by the speakers at the conference, and their contributions to this present volume will help shed a new light, or, rather, new lights, on the market microstructure viewed as an object for scientific study as well as a wealth of information for price discovery and trading.

Frédéric Abergel
Jean-Philippe Bouchaud
Thierry Foucault
Charles-Albert Lehalle and
Mathieu Rosenbaum

About the Editors

Frédéric Abergel

After graduating from École Normale Supérieure in 1985 and completing a PhD in Mathematics in 1986, Frédéric Abergel started an academic career as a researcher with the CNRS. He spent ten years in the Mathematics Department of the University of Orsay Paris XI, where he obtained his habilitation degree in 1992. He then switched to the capital markets industry and became a ‘quant’ (quantitative analyst). During the second part of his career, Frédéric Abergel has worked for trading floors in various financial institutions, mainly in the derivatives sector, developing pricing and hedging models. In July 2007, he decided to return to Academia, where he now holds the BNP Paribas Chair of Quantitative Finance at École Centrale Paris. His research focuses on the study of empirical properties and mathematical model of market microstructure, high frequency data and algorithmic trading.

Jean-Philippe Bouchaud

Jean-Philippe Bouchaud graduated from the École Normale Supérieure in Paris, where he also obtained his PhD in physics. He was then appointed by the CNRS until 1992. After a year spent in the Cavendish Laboratory (Cambridge), he joined the Service de Physique de l’État Condensé (CEA-Saclay), where he worked on the dynamics of glassy systems and on granular media. He became interested in economics and theoretical finance in 1991. His work in finance includes extreme risk models, agent based simulations, market microstructure and price formation. He has been very critical about the standard concepts and models used in economics and in the financial industry (market efficiency, Black-Scholes models, etc.) He founded the company Science &

Finance in 1994 that merged with Capital Fund Management (CFM) in 2000. He is now the President and Head of Research at CFM and professor at Ecole Polytechnique since 2008. He was awarded the IBM young scientist prize in 1990 and the C.N.R.S. Silver Medal in 1996. He has published over 250 scientific papers and several books in physics and in finance.

Thierry Foucault

Thierry Foucault is Professor of Finance at HEC, Paris, where he received his PhD in Finance in 1994. He is a research fellow of the Centre for Economic Policy (CEPR). He has taught in various institutions such as Carnegie Mellon University, the École Polytechnique Fédérale de Lausanne, Oxford (Said Business School), Pompeu Fabra University (Spain), the Tinbergen Institute and the School of Banking and Finance at UNSW. His research focuses on the determinants of financial markets liquidity and the industrial organisation of the securities industry. His work has been published in top-tier scientific journals, including *The Journal of Finance*, *The Journal of Financial Economics* and *The Review of Financial Studies*. He serves on the scientific committees of the Autorité des Marchés Financiers, the Research Foundation of the Banque de France, the Group of Economic Advisors of the Committee of Economic and Markets Analysis of the European Securities and Markets Authority (ESMA) and on the executive committee of the European Finance Association (EFA). He acts as co-editor of the Review of Finance since 2009 and is an Associate Editor of *The Review of Asset Pricing Studies*. For his research, he received awards from the Europlace Institute of Finance in 2005 and 2009, the annual research prize of the HEC Foundation in 2006 and 2009, and the Analysis Group award for the best paper on Financial Markets and Institutions presented at the 2009 Western Finance Association meetings.

Charles-Albert Lehalle

Currently Head of Quantitative Research at CA Cheuvreux, Charles-Albert Lehalle is an international expert in optimal trading. He published papers in international journals about the use of stochastic control and stochastic algorithms to optimise a trading flow with respect to flexible contraints. He also authored papers on post-trade analysis, market impact estimates and modelling the dynamics of limit order books. Charles-Albert Lehalle lectures at 'Paris 6 (El Karoui) Master of Finance' (École Polytechnique, ESSEC, École Normale Supérieure) and

MASEF/ENSAE, and gives master classes in the Certificate in Quantitative Finance in London. With a PhD in applied mathematics, his core fields are stochastic processes, information theory and nonlinear control.

Mathieu Rosenbaum

Mathieu Rosenbaum obtained his PhD from Université Paris-Est in 2007. He is now Professor at Université Pierre et Marie Curie (Paris 6) and École Polytechnique and is a member of the CREST (Center of Research in Economics and Statistics). His research mainly focuses on statistical finance problems, such as market microstructure modeling or designing statistical procedures for high frequency data. Also, he has research collaborations with several financial institutions, in particular BNP-Paribas since 2004.