In memoriam: Mark H. A. Davis and his contributions to mathematical finance

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Mark H. A. Davis was one of the most inspirational and influential scientific leaders in both fields of stochastic optimization and mathematical finance. This volume honors Mark's leadership and contributions to mathematical finance.

Mark read Electrical Engineering at the University of Cambridge and moved to UC Berkeley for his Ph.D. The Bay area was an exciting place for researchers working in stochastic analysis and control theory. People whom Mark had met there and ideas they had discussed remained influential throughout his career. Mark's own Ph.D. thesis, under the supervision of Pravin Varaiya, initiated the martingale theory of stochastic control and had an impact which is hard to overstate. After defending his Ph.D. [189] in 1971, Mark moved back to the UK, joining the Control Group at Imperial College London. He remained at the forefront of the stochastic control community, making key contributions and undertaking scholarly visits to leading institutions, including the Polish Academy of Sciences, Harvard, Stanford, the University of Oslo, MIT and the University of Vienna. Giving justice to Mark's heritage in stochastic control is beyond the scope of this editorial. We focus instead on Mark's contributions to mathematical finance.

In the 1980s mathematical finance was an emerging field, a cauldron of finance, engineering, stochastic analysis and control. Mark was uniquely positioned to join this multidisciplinary wizardry. He took a keen interest, ultimately becoming a founding father and forever a towering figure in the field. His first paper, with A. Norman [71], considered the portfolio selection problem with transaction costs and offered a computable solution. It remains a seminal reference which had a rich and lasting influence. Mark then looked at option pricing with transaction costs, working with V.G. Panas and T. Zariphopoulou [80, 84, 88]. His works were introducing some of the most challenging problems of singular control in diffusion markets [85], as well as being among the first works in indifference valuation, which later became a major area on its own. Few years later, Mark introduced a more systematic approach to value unhedgeable risks [93], now known as the *Davis price*, which has since been extensively studied and further developed by others.

In 1995 Mark made a bold move and left academia for the industry, joining Mitsubishi Finance (later Tokyo-Mitsubishi International) as the Director and Head of Research & Product Development, leading a research team on valuation models and risk analysis across fixed income, equity, and credit desks. This new role gave him first-hand experience with how his research field was being applied in practice, but it also allowed him to identify novel research questions

which were of practical importance. Among other themes, this time saw him developing, with V. Lo, a first *infectious defaults* model in the credit space [106]. A decade later, in the wake of the 2008 financial crisis, this work and theme were in the spotlight.

Mark returned to academia in 2000, re-joining Imperial College to lead its Mathematical Finance Group. He launched the acclaimed MSc program in mathematical finance and curated a strong liaison with the quant groups in the City. His research group quickly became one of the focal points for mathematical finance worldwide and Mark supervised a string of Ph.D. students who went to make careers in both industry and academia. Among others, Mark worked on interest rates models with V. Mataix-Pastor [123, 127], on sensitivities and Malliavin calculus with M. Johansson [120] and on risk-sensitive investment with S. Lleo [124, 134, 138, 137]. From the late 2000s, Mark became increasingly interested in model uncertainty and model-independent methods which led to a string of works, from the paper with D. Hobson [122], through the work with J. Obłój and V. Raval [145], to his last work with S. Badikov and A. Jacquier [159], found in this volume. These topics also led him to consider pathwise stochastic calculus [157], drawing a bridge with his much earlier contributions on pathwise non-linear filtering. More broadly, Mark became involved with foundational questions on "risk and uncertainty". He proposed "The Beaufort Scale of Predictability" [150] to summarise this landscape. He was also looking at risk measures and issues around estimation and elicitability [195, 152], drawing bridges to much older notions in statistics, including 'prequential statistics'.

It is difficult to give a proper account of the quality and impact of Mark's research, given its multifaceted nature, substantial depth and prolific breadth. Mark had endless curiosity and, time and again, showed the capacity to distill the important questions and offer novel and insightful answers. In his own words, "the trick is to identify problems which are big enough to be important but not so big that you can't solve them."[1] He always went to the core of things, and his enthusiasm when he properly understood and grasped the issue at hand was contagious. His ideas and works inspired many researchers and started new lines of scientific development. He had formative influence on many young researchers, his students and his mentees, and a large impact across the field.

In 2020, Mark published 'Mathematical Finance: A Very Short Introduction' [11] in the renowned OUP series. The book truly conveys his grasp of the whole field combined with his capacity to communicate research to a wider public. Mark was awarded the Naylor Prize by the London Mathematical Society in 2002 for his "contributions to stochastic analysis, stochastic control theory and mathematical finance". He was a Fellow of the Royal Statistical Society, a Fellow of the Institute of Mathematical Statistics, and an Honorary Fellow of the Institute of Actuaries.

Besides the inspirational research output that Mark leaves behind, his role and impact in the early development and later life of the mathematical finance community have been extraordinary. He was one of the early founders of the field, and played a very empowering role all along. In 2008, Mark hosted the 5^{th} Bachelier World Congress at Imperial College London which, with over 600 participants, was the largest the field has ever seen, before or since. He was the Editor-in-Chief of Stochastics and Stochastics Reports (1978-1995), a Managing

[1] RMS Research: Mark Davis, part 2, https://www.youtube.com/watch?v=HTpAVi0wyO8.

Editor of Quantitative Finance (1999-2012) and an Associate Editor of Annals of Applied Probability (1995-1998) and SIAM Journal on Financial Mathematics (2008-2012).

Despite his outsized role, Mark had a humble and understated demeanour. He was a wonderful colleague. Generous with ideas, supportive and caring, he brought energy and good spirits to any meeting. You could hear his contagious laughter from afar and know that a great mix of world class research and light-hearted humour was on the menu. His love of music and occasional invitation to a violin concerto were an inspiring reminder that life has so many wonders to offer. Mark passed away after a difficult battle with cancer, supported by his beloved wife Jessica. Obituaries and statements from his colleagues and friends make for an inspiring, if heart-breaking, read.

In 1989 at Cornell University, at one of the first meetings of the newly emerging field, Davis, Jarrow and Pliska, recommended that this new field needed its own academic journal. With Jarrow representing finance, Davis representing stochastics and optimization, and Pliska representing mathematical finance, they created Mathematical Finance, which has been a flagship academic journal ever since. This issue of Mathematical Finance is dedicated to Mark H. A. Davis, a great scholar who inspired several generations in our field and led with his unique academic style.

The volume includes 13 papers, all on topics which were close to Mark's heart, from Merton's classical optimal investment problem, through marginal utility pricing, risk-sensitive asset management, model uncertainty, pathwise approach to risk estimation and elicitability, and more. Many combine several of these to build novel insights, others offer a fresh take on classical problems. Two papers were co-authored by Mark himself. We trust that the volume offers a glimpse into Mark's rich legacy. It has been our honour to edit this volume and we are grateful to everyone who sent in their contributions.

The scientific publications of Mark H. A. Davis

Books

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