

Utility, Rationality and Beyond - From Behavioral Finance to Informational Finance

Doctoral dissertation submitted by Sukanto Bhattacharya in 2004



School of Information Technology

Bond University

Signed Certification

This thesis is submitted to Bond University in fulfilment of the requirement for the Degree of Doctor of Philosophy (Information Technology).

This thesis represents my own work and contains no material which has been previously submitted for a degree or a diploma at this University or any other Institution, except as and where due acknowledgement is made.

Acknowledgements

I gratefully acknowledge the continued support, guidance and inspiration from my supervisor Dr. Kuldeep Kumar, Associate Professor of Statistics in the School of Information Technology, Bond. Dr. Kumar has indeed been a remarkable academic supervisor - taking time to sift through pages and pages of computational results and offering his invaluable advice as and where he deemed fit. I am also indebted to my friend and research colleague, Dr. Mohammad Khoshnevisan, Lecturer in Finance, Griffith University for being a constant source of inspiration. I am also grateful to Professor Richard Hicks, Head of the Department of Psychology, Bond University for his help and guidance on handling some of the critical psycho-cognitive issues that went into this work. I am also thankful to Dr. Jefferey Kline, Associate Professor of Economics, School of Business, Bond University for his thoughtful insights on some of the utility theory constructs. Last but not the least, I am grateful to the Schools of Information Technology and Business, Bond University for financially supporting me with a generous postgraduate fellowship, without which it would have been impossible for me to carry on.

Peer-reviewed publications produced as direct spin-offs from this PhD research

International journals:

1. Bhattacharya, S., “Mathematical modeling of a generalized securities market as a binary, stochastic system”, *Journal of Statistics and Management Systems*, ISSN 0972-0510, Vol. 4 No. 2, pp137-145
2. Bhattacharya, S. and Samanta, S. “Exploring the Applicability of a Relative Entropy Measure for Assessment of Dynamical Market Prediction Utility”, *Journal of Ultra Scientist of Physical Sciences*, ISSN 0970-9150, Vol. 15(3)M, 255-260
3. Bhattacharya, S., Allen, J. and Smarandache, F. “Fuzziness and funds allocation in portfolio optimization”, *International Journal of Social Economics*, ISSN 0306-8293, Vol. 30 No. 5 and 6, pp619-632
4. Bhattacharya, S. and Allen, J., “Critical Trigger Mechanism – a Modeling Paradigm for Cognitive Science Application in the Design of Artificial Learning Systems”, *Smarandache Notions Journal*, ISSN 1084-2810, Vol. 13 No. 1-2-3, pp43-47

Radisson Plaza Hotel at the Pier; Sponsors: Fusion 2003 Organizers, ONERA (France), University of New Mexico (USA), Cairns, Queensland, Australia

Books/Monographs:

Khoshnevisan, M., Bhattacharya, S. and Smarandache, F., *Artificial Intelligence and Responsive Optimization*, Xiquan, Phoenix, U.S.A., 2003, cited by the International Statistical Institute in "Short Book Reviews", Vol. 23, No. 2, p. 35, August 2003, Kingston, Canada.

Table of Contents:

I. Summary	... 7
II. Background and Literature Survey	... 8
III. Structure and Methodology	... 18
IV. Chapters:	
1. Neutrosophic Notion of Irresolvable Risk – A Proposed Behavioral Explanation of Investor Preference for Downside-protected Investments	... 22
2. Theorem of Consistent Preference and the Utility Structures Underlying a Simple Portfolio Insurance Strategy	... 39
3. Exploring the Biological Basis of Utility Functions – Computational Implementation of a Genetic Algorithm Scheme to Illustrate the Evolutionary Efficiency of Black-Scholes Delta Hedging Using Multi-asset Options	... 49
4. A Proposed Information Theoretic Model of Utility Applicable to Active Risk Management Engineered by Multi-asset Options-based Portfolio Insurance Strategy for Distinct Investor Profiles	... 66
5. Concluding Perspectives	... 91
V. Appendices	
(i). Monte Carlo output of utility forms evolving out of a sample options-based portfolio insurance strategy involving an exchange-traded put option	... 94
(ii). Genetic Algorithm demonstration of the biological basis of the Black-Scholes -type expected utility functions	... 109
(iii). Computational exposition of the proposed <i>information theoretic utility measure</i> scheme for a multi-asset, capital-guaranteed financial structured product	... 122
VI. <i>Bibliography</i>	... 130