

Dynamic Portfolio Optimization & Asset Pricing: Martingale Methods and Probability Distortion Functions.

*Doctoral Thesis By Mahmoud Hamada
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This doctoral thesis consists of three contributions to financial and actuarial research:

1. Dynamic portfolio optimization (risk-neutral martingale method versus stochastic dynamic programming),
2. Asset pricing using *probability distortions* (i.e. non-expected utility theory of Yaari),
3. Asset allocation using risk-measures based on probability distortions.

Of these three contributions I am most qualified to comment on the last two.

It is evident that the candidate has conducted extensive literature search, numerical computing and independent theoretical investigation:

- The candidate has demonstrated broad knowledge in financial economics and insurance mathematics. The literature review is extensive and up-to-date.
- The candidate has spent tremendous amount of time in dynamic programming computing. These massive computing are indispensable for gaining insights of the underlying theoretical problem.
- This reviewer had been curious about whether the option prices obtained by Wang's Transform are arbitrage-free. This thesis is the first to put a conclusion to this question. Furthermore, this thesis generalizes Wang's Transform to (i) assets with general symmetric return distributions other than normal, and (ii) securities with time-varying drift and volatility.
- The thesis investigates portfolio optimization using non-expected utility theory. The risk-measures considered include van der Hoek and Sherris' class, and Wang's transform. The findings are interesting and thought provoking. For assets with normally distributed returns, these risk-measures show similar behaviors to the standard deviation.

Other comments:

1. The thesis makes a major contribution to insurance mathematics by drawing subtle connections and differences between insurance pricing methods and financial pricing methods.
2. The new findings in this thesis can result in at least two research papers in top-ranking actuarial journals, with one from Chapter 5, and the other from Chapter 6.
3. Regarding Chapter 6, the author discussed the “plunging” behavior in optimal asset allocation. To overcome the “plunging” behavior, the author suggested using probability distortion in conjunction with expected utility approach (similar to John Quiggin’s anticipated utility theory). In real-life applications, the “plunging” behavior can be overcome by operating constraints (e.g., a threshold ruin probability) so that there exists a unique optimal asset (or capital) allocation.

Summary: This reviewer is very pleased by this excellent doctoral thesis.

Reviewer:

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