



CHARLES UNIVERSITY
Faculty of mathematics
and physics

Miroslav Svoboda, M.S. Thesis Asian Perpetuities

Supervisor Report

June 30, 2020

The submitted thesis is the updated second version. The first version was returned to the author in order to fix in detail several mathematically questionable results that needed a more careful attention. The thesis is of a very high mathematical quality, the corresponding statements and proofs have been carefully checked and as a result, we have a superior document. Let me summarize the contributions of the author in more detail and partially repeat the previous supervisor report.

This thesis studies financial contracts based on various averages (arithmetic, geometric and harmonic) in the situation of infinite time horizon. This problem itself is interesting as these contracts are dynamically evolving in terms of hedging portfolios in contrast to being static which is the case in traditional European option contracts. Moreover, these contracts admit analytical solutions, which is not the case in finite time horizon.

The core results of the author are the pricing formulas for all types of these options, namely Theorem 3.3 for arithmetic average, Theorem 3.6 for geometric average and Theorem 3.11 for harmonic average. Moreover, these solutions (except for the harmonic average) satisfy pricing partial differential equations that are needed for construction of the hedging portfolios. This part has been verified explicitly in Mathematica as the partial derivatives become too complicated to put them in a text.

The author has established new general results regarding the theory of partial differential equations on infinite time horizon in Section 2, which goes even beyond the original task of the problem as only the pricing and hedging representation was required. This originally created a problem as the mathematics needed here is quite technical and one needs to make sure that all the results are correct and rigorous. This point has been achieved in this updated version. In general, both Sections 2

and 3 contain completely original results and they have a potential to be published in a respected journal.

Summary: The thesis satisfies conditions of a master thesis and I recommend that it is **accepted as such**.

A handwritten signature in blue ink, appearing to read 'Jan Vecer' with a stylized flourish at the end.

Jan Vecer,
KPMS, MFF UK,
Sokolovska 83
18675 Praha 8
Czech Republic
Email: vecer@karlin.mff.cuni.cz