Report Type
    Mid Term Award Report
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Project Title
    Optimal investment and consumption problem under transaction costs
Project Start Date
    Oct 03, 2016
Project End Date
    Oct 03, 2017
Amount Awarded
    n/a
Project Abstract

    This project studies a Merton-style optimal investment and consumption problem
    under market frictions. In the classical setup, an agent has the opportunity to invest in
    a riskfree money market account and an illiquid risky asset where purchase and sale
    of this asset will incur a proportional transaction cost. We study the problems via a
    primal dynamic programming approach. A number of known results in the literature
    are recovered. Along the way we also provide several new analytical results related to
    the comparative statics of the no-transaction boundaries and demonstrate a new
    financial phenomenon that has not been documented to date. The methodology is
    extended to a multi-asset economy where the agent may also invest in another liquid
    risky asset without any transaction cost. This is a joint work with David Hobson
    (Warwick) and Yeqi Zhu (Credit Suisse).

Activities and Achievement
    We begin with the classical setup with a single risky asset. By adopting a novel
    transformation scheme, we reduce the key dynamic programming equation of interest
    to a simple first order differential equation which enables us to answer a number of
    relevant questions. Firstly, important (and known) analytical features of the problem,
    such as when the problem is well-posed for all level of transaction costs, when the
    problem is well-posed only for sufficiently large transaction costs, and when the agent
    might take a leverage position, can all be deduced from the shape of a simple
    quadratic function. Secondly, this formulation allows us to establish simple proofs for
    the comparative statics of the sale and purchase boundaries. Thirdly, a new financial
    phenomenon can be observed where for certain parameters combination the location
    of the sale boundary can be independent of the transaction cost on purchase.
    Leveraging on this machinery, we provide a comprehensive analysis to the multi-asset
    extension of the problem.
Dissemination
    Two working papers have been produced, one of which covers the single risky asset
    case while the other one covers the multi-asset extension. The former is currently
    under R&R at Mathematical Finance while the latter has been submitted to Finance
    and Stochastics. The work was also presented in The Fifth Asian Quantitative Finance
    Conference (AQFC) in Seoul in April 2017.
Outputs

The working papers are available on arXiv. Please refer to the links below for the abstracts, bibliographical references and any other relevant information.
1) Hobson, D., Tse, A. S., & Zhu, Y. (2016). Optimal consumption and investment under transaction costs. arXiv preprint arXiv:1612.00720.
(https://arxiv.org/abs/1612.00720)
2) Hobson, D., Tse, A. S., & Zhu, Y. (2016). A multi-asset investment and consumption problem with transaction costs. arXiv preprint arXiv:1612.01327.
(https://arxiv.org/abs/1612.01327)

Major Difficulties and Any Other Issues

The number of cases to be analyzed are numerous. The source of variations originates from whether the underlying risky asset has a positive mean return, whether the problem is unconditionally well-posed, whether the problem is conditionally well-posed only for large transaction costs, etc. It is thus challenging to provide a brief and tight analysis in our write up while retaining rigorousness with our expositions.

Web Links

Please refer to the "Outputs" section.