Accepted Manuscript

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PII: S0167-6377(18)30059-2
DOI: https://doi.org/10.1016/j.orl.2018.09.001
Reference: OPERES 6392

To appear in: *Operations Research Letters*

Received date : 7 February 2018
Revised date : 6 September 2018
Accepted date : 6 September 2018

Please cite this article as: S. Desmettre, et al., Portfolio optimization with early announced discrete dividends, *Operations Research Letters* (2018), https://doi.org/10.1016/j.orl.2018.09.001

Portfolio Optimization with Early Announced Discrete Dividends

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Abstract

In this article we include discrete dividends in the stock price model and solve the corresponding generalized portfolio optimization problem. For this, we develop a new discrete dividend model that allows for the possibility of early announcement and ensures that the drop of the stock price at the ex-dividend date equals the dividend. The resulting portfolio problem can be solved explicitly for both the wealth and the trading strategy. We find that the resulting optimal portfolio process differs from the Merton strategy.

Keywords: discrete dividends, optimal portfolios, early announcement
JEL: G11, G15

1. Introduction

Continuous-time portfolio optimization is concerned with finding a trading strategy that maximizes expected utility from terminal wealth and/or consumption of an investor in a continuous-time financial market. The pioneering work in this area was done by Merton ([1, 2]) using methods from stochastic control theory, and recent years have seen significant progress in the field; we refer the reader to, e.g., the monographs [3] and [4] for overviews of the subject. Portfolio optimization in the presence of discrete dividends has to the best of our knowledge only been addressed by the model of Korn and Rogers [5], which assumes that the stock equals the expectation of the sum of discounted future dividends. They find that the solution of the optimal investment problems including discrete dividends - but without the possibility for an early announcement - is the same as in the classical Merton setting when the dividens are just reinvested in the stock. Moreover, the presence of dividend parts in stock prices is often ignored or dealt with in a non-realistic way in popular stock price models (see e.g. [6, 7, 8]).

To address these issues, the contribution of this work is twofold: On the one hand we include multiple early announced discrete dividends in the model for the stock price by introducing models that do not require that the dividends are already known today and on the other hand we solve a continuous-time portfolio optimization problem of Merton type in the presence of these early announced discrete dividends. We find that the optimal strategy differs from the one of the related paper [5].

The paper is structured as follows: In Section 2 we give the general notation and settings. Section 3 develops new models for the stock price which allow for early announced discrete dividend payments. Finally, we generalize the terminal wealth problem with respect to that effect and derive its solution in Section 4.

2. General Framework

Let $(\Omega, \mathfrak{A}, \mathbb{P})$ be a probability space, $[0, T]$ the time horizon and $W(t)$ a Brownian motion with $\mathcal{F} = (\mathcal{F}_t)_{t\in[0,T]}$ the Brownian filtration generated by W and satisfying the usual conditions where $\mathcal{F}_0$ is $\mathbb{P}$-trivial and $\mathcal{F}_T = \mathfrak{A}$.
Our primary purpose is to deal with a dividend paying stock within portfolio problems. Therefore, we refer to S as a dividend paying stock. In order to have a proper basis for our calculations and to outline the differences, we also consider the case of a non-dividend-paying stock which is denoted by $\tilde{S}$.

Standard Financial Market Model. We consider a standard frictionless financial market as e.g. given in Section 2.1 of [9] including a bond and a stock with prices $B(t)$ and $\tilde{S}(t)$ given by

$$B(t) = B(0)e^{rt},$$
$$\tilde{S}(t) = \tilde{S}(0)e^{(\mu-\frac{1}{2}\sigma^2)t+\sigma W(t)},$$

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