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Discrete Optimization

# Buying and selling an asset over the finite time horizon: A non-parametric approach

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## Abstract

We consider the problem of buying an asset and selling it later in the open market within a limited time-period. In such a situation, it is usually assumed that the market prices are random observations from a known distribution. However, we propose in the paper the rank-based trading strategy that does not require any distributional assumption. We only assume that the agent's utility depends on the actual ranks of the purchase and selling prices of the asset. The non-parametric trading policy, which maximizes the agent's expected utility, can be stated with a sequence of critical ranks; the agent must buy an asset at time  $j$  if the relative rank of its purchase price is larger than the pre-specified critical rank at that time. Likewise, the agent must sell the asset at time  $k$  if the relative rank of its selling price is less than the pre-specified critical rank at time  $k$ . Finally, we conduct a simulation experiment to analyze the effect of the auto-correlation in market prices on the performance of the optimal trading policy. © 2002 Elsevier Science B.V. All rights reserved.

*Keywords:* Dynamic programming; Sequential decision analysis; Optimal stopping rule

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## 1. Introduction

We propose in the paper a simple decision model for the problem of buying an asset and selling it back to the market within a limited period of time. The market price of the asset at time  $i$  is represented by  $X_i, i = 1, 2, \dots, n$ , where  $n$  is the number of time periods allowed. The sequentially observed random variable  $X_i$  may represent the  $i$ th bid in the house-selling problem (Albright, 1977), the value of the  $i$ th offer in the job search problem (Lippman and McCall, 1976; Whipple, 1973), or the rate of return associated with the  $i$ th investment opportunity in the investment problem (McCall, 1965). After observing the market price  $X_i$ , the agent must decide whether or not to buy an asset at the market price or, if an asset has already been

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