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A Bellman View of Jesse Livermore

Nick Polson and Jan Hendrik Witte

Richard Bellman's Principle of Optimality, formulated in 1957, is the heart of dynamic programming, the mathematical discipline that studies the optimal solution of multi-period decision problems.

In his 1923 book *Reminiscences of a Stock Operator*, the legendary trader Jesse Livermore gave a detailed account of his methods. In this article we examine some of them—Livermore's rules for trading—to show how they are directly reflected in Bellman's Principle, and to demonstrate how in their striving for optimality, two of the greatest minds of the 20th century were neatly aligned.

Bellman's 1957 book on dynamic programming introduces his conceptual framework for the solution of multi-stage decision processes. While having multiple different mathematical formulations, the problems studied by Bellman all share the following characteristics:

- There is a system characterized at each stage by a set of parameters and state variables.
- At each stage of either process, we have a choice of a number of decisions.
- The effect of a decision is a transformation of the state variables.
- Past history is of no importance in determining future actions.
- The purpose is to maximize a function of the state variables.

In Bellman's words, a "policy" is any rule for making decisions that yields an allowable sequence of decisions,



Jesse Livermore
Photo courtesy of Wikipedia

and an "optimal policy" is one that maximizes a pre-assigned function of the final state variables. For every problem with the above listed properties, Bellman establishes the following rule, his Principle of Optimality: "An optimal policy has the property that whatever the initial state and initial decision are, the remaining decisions must constitute an optimal policy with regard to the state resulting from the first decision."

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Additional information

Notes on contributors

Nick Polson is a Bayesian statistician who conducts research on financial econometrics, Markov chain Monte Carlo, particle learning, and Bayesian inference. Inspired by an interest in probability, Polson has developed a number of new algorithms and applied them to statistics and financial econometrics, including the Bayesian analysis of stochastic volatility models and sequential particle learning for statistical inference.

Jan Hendrik Witte

Jan Hendrik Witte is a numerical analyst who has developed a number of new algorithms in the area of numerical optimal stochastic control. Witte is generally interested in the areas of numerical mathematical finance, systematic trading, and portfolio optimization.

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