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The Importance of Importance Sampling: Measure Change in Probability, Statistics and Rare Event Simulation

Arguably nothing has contributed more to the practice of statistics than measure change and likelihood ratios. These are fundamental objects throughout statistics, probability and finance and provide the underpinning of much of statistical estimation and testing, and much of modern finance theory. We provide a brief review of many uses of Radon-Nikodym derivatives or likelihood ratios, together with some practical cautionary notes on their use. We will show examples of the extraordinary power of importance sampling, especially for simulation of stochastic processes and for rare event simulation, including the use of the generalized extreme value distributions for rare event simulation.