Option Pricing Models:
From Black-Scholes-Merton to Present

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KEY FINDINGS

- A review of fundamental option pricing models from Black-Scholes-Merton to the present day is presented.

- Alternative option pricing methods, including those for options on different underlying assets as well as those with different asset price and volatility dynamics, are discussed.

- Contemporary topics in options, including applications to novel risks such as climate-related risks and volatility risk, as well as implementation of novel methodologies from data science and machine learning also are reviewed.

ABSTRACT

Its intuitiveness and the simplicity of its calculations make the seminal Black-Scholes-Merton option pricing model the most commonly known and used among all asset pricing models ever developed. Almost half a century after it was introduced, a massive literature has been devoted, and is still being generated, to empirical testing of the original model, to developing new models addressing its original assumptions and biases, and to extending the framework of option pricing. This article presents a review of fundamental option pricing models from Black-Scholes-Merton to the present day, covering alternative option pricing approaches, including those for options on different underlying assets as well as those with different asset price and volatility dynamics. This article also reviews contemporary topics in options, including applications to novel risks such as climate-related risks and volatility risk, as well as implementation of novel methodologies from data science and machine learning.

The seminal option pricing model based on research by Black and Scholes (1973) and Merton (1973) is characterized by its simple formula rooted in a continuous-time model of stock prices in an arbitrage-free world. While it was developed at the cost of very restrictive assumptions, the model's intuitiveness and the simplicity of its calculations made it the most commonly known and used among all asset pricing models ever developed.

In 1997, the Royal Swedish Academy of Sciences awarded the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel to Professors Robert C. Merton and Myron S. Scholes "for a new method to determine the value of derivatives." The Academy in its announcement (Royal Swedish Academy of Sciences 1997) stated that

"Robert C. Merton and Myron S. Scholes have, in close collaboration with the late Fischer Black [who died in 1995], developed a pioneering formula for the valuation of stock options. Their methodology has paved the way