Chapter 3
Disruptive Technologies in Computational Finance

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ABSTRACT

Computational finance plays a pivotal role in addressing the challenges posed by the dynamic and interconnected nature of financial markets. By combining mathematical rigor with computational power, this field contributes to the development of innovative solutions for pricing, risk management, and decision-making in the financial industry. Computational finance is a field that leverages mathematical techniques, statistical methods, and computational tools to analyze and solve complex financial problems. In recent years, the intersection of finance and technology has given rise to a transformative wave, reshaping the landscape of traditional financial systems. This study delves into the dynamic realm of computational finance, exploring the profound impact of disruptive technologies on established practices and processes of computational finance.

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1. INTRODUCTION

In recent years, the intersection of finance and technology has given rise to a transformative wave, reshaping the landscape of traditional financial systems. This chapter delves into the dynamic realm of computational finance, exploring the profound impact of disruptive technologies on established practices, processes, and paradigms within the financial industry (Hickey & Conway, 2021). As we navigate through an era characterized by rapid technological advancement, it becomes evident that these innovations are not mere catalysts but rather formidable forces that are fundamentally altering the way financial transactions are executed, risks are managed, and decisions are made.

1.1 Computational Finance

Computational Finance is an interdisciplinary field that leverages mathematical techniques, statistical methods, and computational tools to analyze and solve complex financial problems. It resides at the intersection of finance, mathematics, and computer science, aiming to develop models, algorithms, and numerical solutions to address challenges in the financial industry (in ’t Hout et al., 2018; Mathis & Almarzoqi, 2022). At its core, Computational Finance seeks to enhance decision-making processes, risk management, and the understanding of financial markets through the application of advanced computational methods. This field emerged in response to the increasing complexity of financial instruments, the growing volume of financial data, and the need for more sophisticated modeling techniques to capture the dynamics of financial markets (Serov & Vasiliev, 2023; Trapletti & Hornik, 2017).

1.2 The Key Components of Computational Finance Include

Mathematical Models: Computational Finance relies on mathematical models to describe and understand financial phenomena. These models may range from simple ones, such as the Black-Scholes model for option pricing, to more complex models that account for factors like market frictions, transaction costs, and behavioral aspects.

Numerical Methods: Given the mathematical complexity of financial models, numerical methods play a crucial role in solving equations and simulating financial scenarios. Techniques such as finite difference methods, Monte Carlo simulations, and optimization algorithms are commonly employed to obtain numerical solutions.

Statistical Analysis: Computational Finance heavily incorporates statistical methods for data analysis, risk assessment, and model validation. Techniques