

Quantum Algorithmic Trading: Economic Efficiency, Market Regulation, and Antitrust Law Implications

Ece Kozan
Enka Schools

Abstract—The rise of quantum computing introduces transformative possibilities for financial markets, particularly in the realm of algorithmic trading. Quantum algorithms—such as Quantum Approximate Optimization Algorithm (QAOA), amplitude amplification, and quantum-enhanced machine learning—promise substantial gains in processing speed, portfolio optimization, arbitrage detection, and real-time market forecasting. However, these technological advantages also raise significant concerns regarding market stability, regulatory oversight, and the preservation of competitive fairness. This study examines how quantum algorithmic trading may alter the economic efficiency of financial markets while simultaneously challenging existing regulatory and antitrust frameworks. Through qualitative analysis of economic theory, legal scholarship, and emerging quantum-finance research, the paper highlights potential risks including informational asymmetry, hyper-accelerated arbitrage cycles, systemic fragility, and the concentration of quantum capabilities among dominant market participants. The findings reveal that while quantum trading technologies may enhance liquidity and price discovery, they also necessitate proactive regulatory modernization to prevent monopolistic behavior, protect smaller market actors, and maintain transparent, resilient trading environments. Ultimately, this research argues that the integration of quantum computing into algorithmic trading represents a critical inflection point that requires coordinated economic, legal, and technological policy responses.

■ Financial markets have undergone rapid technological transformation over the past two decades, driven by advancements in automation, artificial intelligence, and high-frequency trading infrastructures [2]. These innovations have reshaped how liquidity is supplied, how prices respond to information, and how traders interact with global

financial systems. The emergence of quantum computing represents the next—and potentially most disruptive—wave of change [7]. By leveraging quantum phenomena such as superposition and entanglement, quantum processors offer exponential speed-ups for optimization problems that are central to trading strategies, including portfolio allocation, risk management, arbitrage detection, and predictive modeling [4]. As a result, quantum algorithmic trading has the capacity to redefine competitive advantage within global markets.

Digital Object Identifier 10.62802/8hpnq947

Date of publication 10 12 2025; date of current version 10 12 2025