

Volatility Clustering in Semiconductor Stock Returns: The Role of ChatGPT Inception, Version Upgrade, and the Launch of the DeepSeek AI Model — A Case Study on NVIDIA, AMD, and Intel

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ABSTRACT

This study investigates the impact of major artificial intelligence (AI) milestones, including the inception of ChatGPT (Nov 30, 2022), its subsequent upgrade (May 13, 2024), and the release of the DeepSeek AI model (Jan 20, 2025), on stock return volatility in the global semiconductor industry. Focusing on NVIDIA, AMD, and Intel, the research integrates event study methodology with GARCH-family models (GARCH, EGARCH, DCC-GARCH) to assess volatility clustering, asymmetric responses, and inter-firm spillover effects at the firm level.

Daily stock returns from January 2015 to March 2025 were analysed, with AI-related events categorised by type to capture differential market reactions. Results reveal pronounced

volatility clustering in all three firms, with persistence levels highest for Intel. EGARCH estimates confirm asymmetric volatility, showing stronger market reactions to adverse AI-related news, particularly competitive threats such as DeepSeek's entry. DCC-GARCH modelling indicates significant time-varying volatility spillovers, especially between NVIDIA and AMD, suggesting sector-wide contagion effects during AI innovation cycles.

The findings extend financial market literature by providing firm-level evidence on how AI-driven technological developments influence volatility dynamics within a strategically critical sector. The study offers actionable insights for investors, corporate strategists, and policymakers seeking to navigate innovation-induced risk, while demonstrating the methodological value of combining event study and advanced volatility models for high-tech market analysis.

Keywords: Artificial Intelligence, Volatility Clustering, Asymmetric Volatility, Spillover Effects, GARCH, EGARCH, DCC-GARCH, Event Study, Semiconductor Industry, NVIDIA, AMD, Intel.