# Mathematical Models for Volatility in Financial Markets

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## Introduction

This document provides an overview of mathematical models used for volatility forecasting in financial markets. It discusses the importance of accurate volatility forecasts for risk management and trading strategies.

## GARCH Model

Formula:

σ\_t^2 = α\_0 + α\_1 ε\_{t-1}^2 + β\_1 σ\_{t-1}^2

Description:

The GARCH model captures time-varying volatility by considering past squared errors (ε\_{t-1}^2) and past variances (σ\_{t-1}^2). Parameters (α\_0, α\_1, β\_1) determine the model's sensitivity to recent volatility changes.

## EWMA Model

Formula:

σ\_t^2 = λ σ\_{t-1}^2 + (1 - λ) ε\_{t-1}^2

Description:

The EWMA model assigns exponentially decreasing weights (λ) to past squared returns (ε\_{t-1}^2), making it responsive to recent changes in volatility.

## Stochastic Volatility Models

Formula:

σ\_t = σ\_{t-1} exp(η\_t)

Description:

Stochastic Volatility models assume volatility follows a stochastic process (η\_t), often modeled using a log-normal distribution. They capture the inherent uncertainty and time-varying nature of volatility in financial markets.

## Applications and Use Cases

This section discusses practical applications of these models in volatility forecasting, risk management strategies, and optimization of trading decisions.

## Conclusion

In conclusion, these mathematical models play a crucial role in understanding and forecasting volatility in financial markets. They provide valuable tools for risk management and decision-making.