Analyzing VIX Term Structure

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Outline: The VIX is a volatility index that measures the expected risk-neutral volatility for the S&P 500 index return, produced by the Chicago Board Option Exchange. This project aims to analyze the VIX term structure using option data and the methodology of the VIX index, as described in Travis Johnson's paper. Johnson's paper uses data from 1996 through 2013 via OptionMetrics, and our objective is to extend this analysis to include data up to 2023. The paper introduces the concept of SLOPE, the 2nd principal component (PC), as the main source for predicting variance in asset returns. However, it raises three intriguing puzzles: (1) the insignificance of the first PC, (2) the relationship between SLOPE and the variance risk premium, and (3) the magnitude of predictability offered by SLOPE. We aim to investigate these puzzles over a longer time span and conduct additional tests on the VIX term structure in relation to asset returns.

Research Objectives: Our project's theoretical framework, hypotheses, and results align with Johnson's work. We intend to establish the methodology for generating VIX for various maturities, testing it over a more extended time period, including the COVID-19 period. Furthermore, we plan to develop and conduct additional tests to explore the relationship between VIX term structure and asset returns.

Outcomes: VIX is a crucial concept in the field of finance, and this project offers students the opportunity to gain practical experience in data processing and VIX index creation. We will develop various statistical tests to analyze VIX and its forecasting capabilities. Ultimately, this research will contribute to a better understanding of the stock market and its dynamics.
Prerequisites: Calculus-based Probability and Statistics, along with some programming experience.