Market Risk Model: Statistical Framework for Bank’s Early Warning System

Quantifying market risks with statistics to predict losses and ensure stability.

Data Overview

	Date	Close	High	Low	Open	Volume
0	5/21/2015	8421.000000	8446.349609	8382.500000	8434.500000	143800
1	5/22/2015	8458.950195	8489.549805	8420.599609	8432.500000	187300
2	5/25/2015	8370.250000	8441.950195	8364.150391	8438.150391	121300
3	5/26/2015	8339.349609	8378.900391	8320.049805	8377.099609	116800
4	5/27/2015	8334.599609	8342.849609	8277.950195	8302.750000	165500
5	5/28/2015	8319.000000	8364.500000	8270.150391	8345.700195	232300
6	5/29/2015	8433.650391	8443.900391	8305.700195	8327.099609	363900
7	6/1/2015	8433.400391	8467.150391	8405.400391	8417.250000	122200
8	6/2/2015	8236.450195	8445.349609	8226.049805	8442.799805	146800
9	6/3/2015	8135.100098	8236.700195	8094.149902	8232.450195	171400

Market Risk Model Overview

VaR

Estimates potential portfolio losses statistically.

Stress Testing

Simulates adverse market scenarios for risk assessment.

Role in EWS

Early detection of market-driven financial risks.

Value at Risk (VaR) - Statistical Approach

Definition	Max loss over time at confidence level (e.g., 95%).
Methods	Historical VaR: Past data percentile modeling. Monte Carlo: Random scenario simulations.
Formula & Optimization	VaR = Z-score × Volatility × Portfolio Value. Adjust for fat-tailed distributions.

Stress Testing - Scenario Analysis

- **Objective** — Simulate extreme market conditions for resilience testing.
- **Statistical Tools** — Scenario modeling, Monte Carlo simulations, CVaR measurement.
- **Optimization** — Use copula models for risk factor dependencies.

Statistical Optimization

1

Data Quality

Clean historical data for accuracy.

2

Model Calibration

Backtest VaR with Kupiec test.

3

Advanced Techniques

Machine learning and Bayesian methods for real-time updates.

4

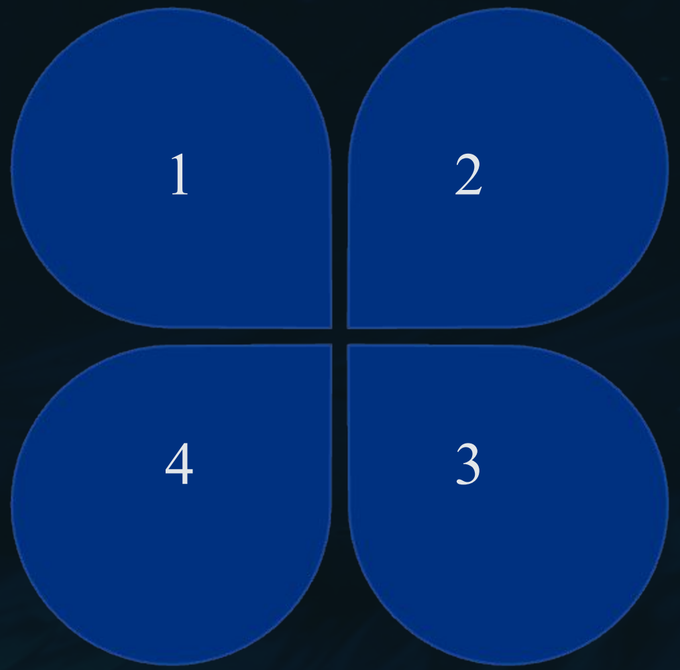
Goal

Enhance precision and reliability.

Why It Matters

Precision

Data-driven risk decisions.



Proactivity

Early risk detection enables timely action.

Trust

Builds stakeholder confidence.

Compliance

Aligns with Basel III standards.

Conclusion & Next Steps

Key Takeaway

Statistical model strengthens EWS by predicting volatility.

Implementation

Apply VaR and stress testing with ongoing validation.

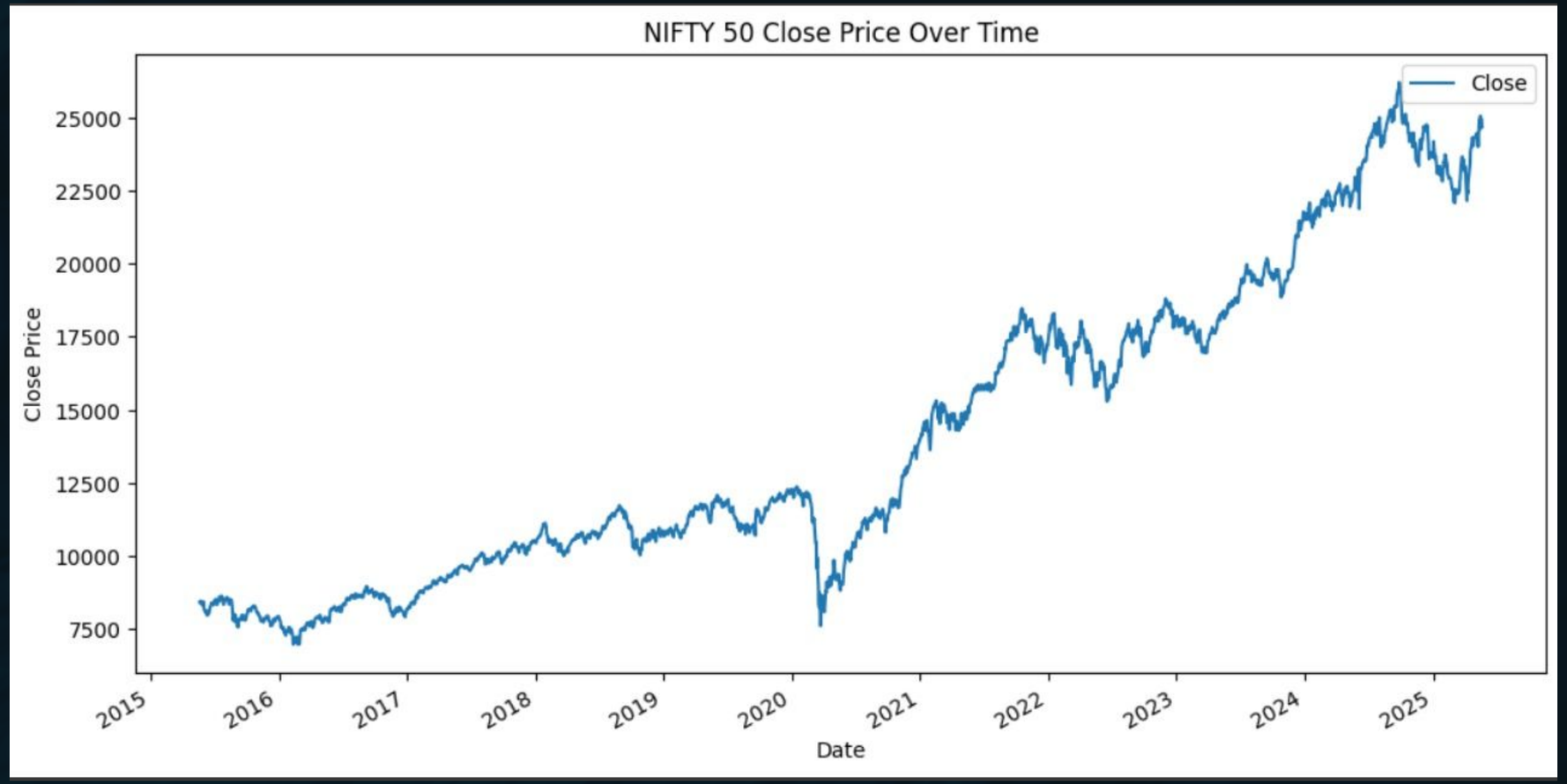
Integration

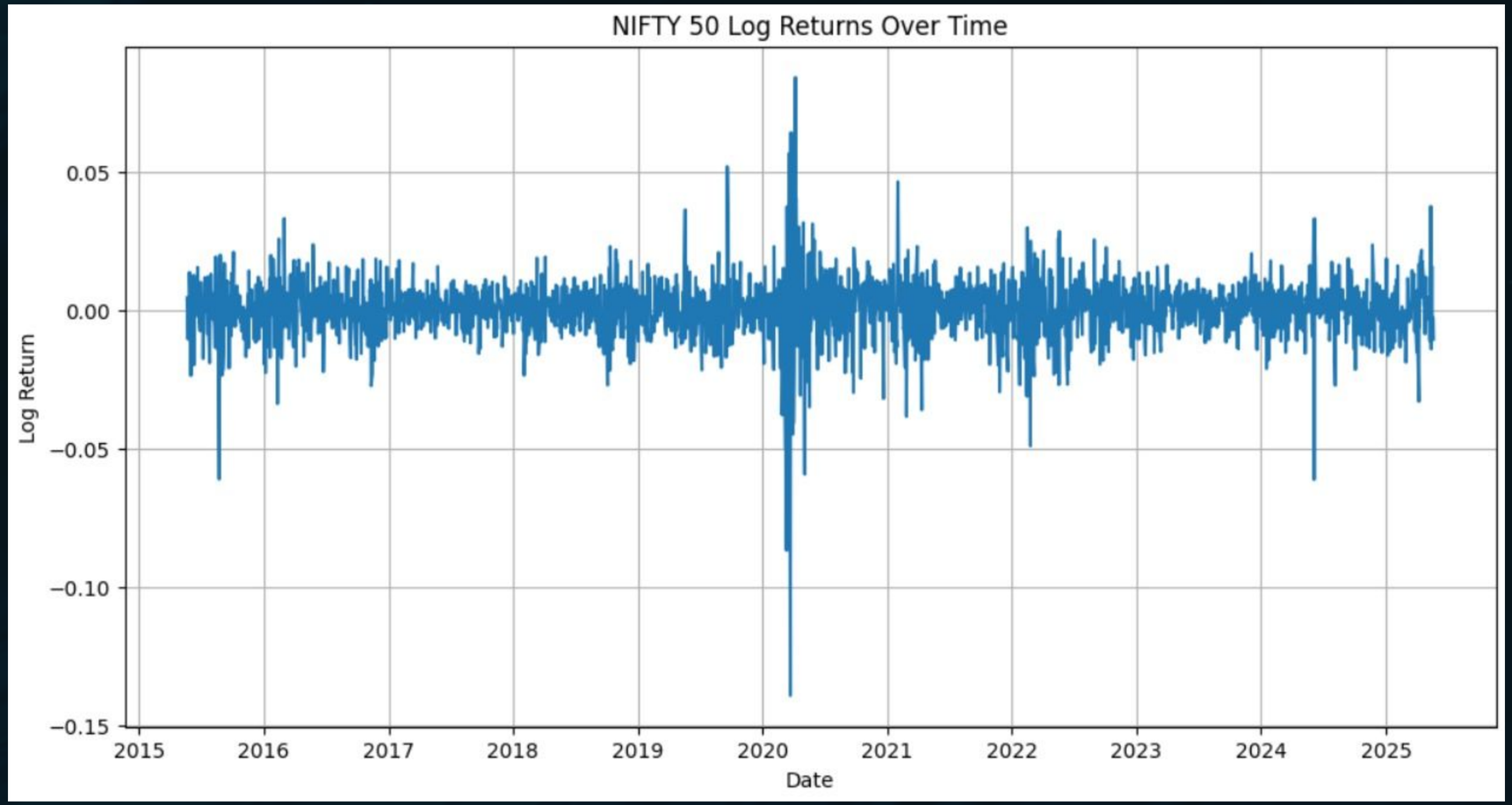
Combine with other EWS components.

Exploration

Use extreme value theory for advanced risk prediction.

Data Preprocessing




NIFTY 50 Log Returns Over Time
Log Return
0.05
0.00
−0.05
−0.10
−0.15
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date