Name: Gathu Macharia Registration Number: S030-01-2954/2021
Name:Collins Kipyegon Registration Number: S030-01-2154/2021

Modeling the Recovery Time of Stock Prices using Accelerated Failure Time Model

Introduction

In financial markets, the assessment of recovery time for stock prices is of paramount importance for investors and stakeholders alike. This is especially true in the context of distressed securities, where understanding the expected timeframe for a return to normalcy can inform crucial decision-making. One statistical approach that has shown promise in this regard is the Accelerated Failure Time (AFT) model. Originally developed in the field of survival analysis, the AFT model has been successfully applied to various areas, including finance and economics.

Problem statement

In the world of finance, how long it takes for a stock's price to go back up after a market downturn is important for making smart investments and managing risk. However, there is currently no good way to estimate how long this will take or to measure the uncertainty around these estimates. Additionally, it is not well understood how things like inflation rates, exchange rates, and sector performance can affect how quickly a stock's price recovers.

Research Objectives

General Objectives

The main objective is to model recovery time of a stock following decreases in share prices of companies using Accelerated Failure Time model (AFT).

Specific objectives

1. To estimate the parameters using efron method.
2. To estimate the survival rates using Kalbfleisch-Prentice method.
3. To compare the survival rates of different markets using weighted log rank test.
4. To fit an Accelerated Failure Time model.

Methodology

The Accelerated Failure Time (AFT) model is a type of survival analysis model used to analyze time-to-event data, where the event of interest is the failure or recovery of a system or process. The AFT model assumes that the survival time of a system or process is affected by a set of covariates, represented by the parameter θ.

$$\ln(T) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \epsilon \tag{1}$$

where :
T_i is the survival time.
β_0 is the intercept.
$X_1, X_2 \ldots X_k$ are the covariates
$\beta_0, \beta_2 \ldots \beta_k$ are the coefficients of covariates.
ϵ is the error term.

Data Description

The study is based on the dataset of 62 companies listed in NSE for the period 2018 to 2023. There are five variables: inflation, exchange rates, closing price, duration, events that occurred, and sectors which are a category of 3 macrosectors (industry, finance and service). The data sources are as follows:

- **Stock Market Data:** Stock market data is sourced from the Wall Street Journal. Historical prices for the Nairobi Securities Exchange (NSE) can be found at `https://www.wsj.com/market-data/quotes/KE/XNAI/NSE/historical-prices`.
- **Exchange Rates:** Central Bank of Kenya (CBK) provides exchange rates data. The data can be accessed at `https://www.centralbank.go.ke/rates/forex-exchange-rates/`.
- **Inflation Rate:** Inflation rate data for a similar period is obtained from the Central Bank of Kenya. The data can be accessed at `https://www.centralbank.go.ke/inflation-rates/`.

References

[1] Bieszk-Stolorz, Beata, and Krzysztof Dmytrów. (2021). Evaluation of Changes on World Stock Exchanges in Connection with the SARS-CoV-2 Pandemic. Survival Analysis Methods *article* https://doi.org/10.3390/risks9070121

[2] Ahmed Yahaya, Stephen Alaba John.(2023). Stock Market liquidity and volatility on the Nigerian Exchange Limited. World Journal of Advanced Research and Reviews*Resarch Article* https://doi.org/10.30574/wjarr.2023.20.3.2333

[3] C SilambarasanRe, ElangovanRe Elangovan. (2023). Accelerated Failure Time Model as an Alternative to the Cox's Regression Model Time to Event Data. *Journal Article* https://www.researchgate.net/publication/368757083

[4] Tasneem Fatima Alam1, M. Shafiqur Rahman1 and Wasimul Bari2. (2022). On estimation for accelerated failure time models with small or rare event survival data *Journal article* https://doi.org/10.1186/s12874-022-01638-1