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Modeling Volatility Cluster Changes in Stock Market using Accelerated Failure Time Model

Introduction

Stock market prediction focus on developing approaches to determine the future price of a stock or other financial products. Stock market predictions is regarded as a challenging task due to the high volatiity and non linear relationship, driven short term flactuations in investment demand. Some researchers have even found that man standard econemetric models are unable to produce better prediction than the random walk model which has also encouraged researchers to develope more predictive models.

Problem statement

In the field of stock market forecasting, most early models were dependant on convectional statistical methods such as time series models and multivariate analysis. In this method the stock movement was modelled as a function of time series and was solved as regression problem. However stock prices are difficult to predict due to their chaotic nature. Furthermore, there are some assumptions about the variables used in statistical methods, which may not be suitable for those dataset that do not follow the statistical distribution. Most models have not solved the problem for time untill voltility cluster changes in stock markets.
More generally survival analysis involve the modeling of time to event data. in the context of volatility in stock market forecast , volatility clustering are considered as two events in survival analysis literature. We attempt to answer quetions about volatility changes at different states and what rate will stock prices fall or rise.

Research Objectives

General Objectives

To model the time until volatility cluster changes which can be used as the indicators to determine the future stock price.

Specific objectives

- To fit K-means algorithm using the closing price to determine high and low volatility cluster.
- To fit Accelerated Failure Time model.
- To test adequacy of the model.
- To model time until the volatility clustering change.
- To check the accuaracy of the model.

Methodology

In this work we are addres this problem by adopting Accelerate Failure Time model (AFT) to predict a stock future price changes. We define the problem of volatility cluster changes in terms of survival analysis perspective.

$$d = \sqrt{(x_2 - x_1)^2} \tag{1}$$

$$(x_{\text{centroid}}) = (\frac{\sum x_i}{m}) \tag{2}$$

$$\ln(T_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \epsilon \tag{3}$$

Where:

d : is the Euclidean distance between each data pont to each centroid
T_i : Survival time
β_0 : Intercept
$x_1, x_2, \ldots, x_p$: Vector of covariates
$\beta_1, \beta_2, \ldots, \beta_p$: Vector of coefficients of covariates
ϵ : Error term

Data Description

The study is based on the dataset of 61 companies listed in NSE foe period 2018 to 2023. There are four variables inflation, exchange rates, closing price and Duration and event that occured. The data source is from:
CBK for exchange rates https://www.centralbank.go.ke/rates/forex-exchange-rates/.
Inflation rate for similar period is https://www.centralbank.go.ke/inflation-rates/.
Wall street Journal for Stock market data https://www.wsj.com/market-data/quotes/KE/XNAI/KCB/historical-prices

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