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A Study of Literature on Robust Skew Student T Distribution for Parameter Estimation

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Abstract: This study aim of this research is to propose three new distributions for the distribution of stock returns and using those distributions proposed and estimates the parameters of stock returns. This proposed distribution will be dealt with in the area of some statistical properties. Real life data such as cancer and Stock returns will be analyzed against the common distributions to assess differences and similarities in the behavior of the distributions. They will be an exploration of the proposed distributions with a survival and hazard functions distributions on breath cancer and stock market returns and some comparison will be done using the model selection criteria. A simulation study would be used to compare both the stock returns and cumulative function of the simulated data.

Keywords: Skew-t, Distribution, Scaled t, Normal and Non-normal, Breath Cancer

1. Introduction

This study aimed to focus on three proposes distributions for the distribution of stock returns using the Exponentiated distribution generators on skew student t distribution of the non-Gaussian distribution for the distribution of stock returns in Nigeria and their distributional properties.

Distributions have a large impact for the distribution of stock market returns. In the early time, 1900, Louise Bachelier proposes a normal (Gaussian) distribution for the distribution of stock market returns which from its empirical analysis suggested that the stock market returns behave normally distributed. Williams (1938) also proposed the technical analysis will the used of graphical representation of the Gaussian distribution, But normal distribution was widely used to estimate the parameter of stock market returns in different works but due to the nature of the stock data which show an evidence of skewed or kurtosis behavior, Normal distribution has fails to be a good distribution model for data set that exhibit this kind of behavior especially the works of Mandelbrot (1963), Fama (1965) and Clark (1973) which shows clear evidence against the assumption of normality in stock return where they argued about the price of stock, which they say it either exhibit a fat tails or an infinite variance.

However, more distributions has being used for the distribution of stock market returns and it was evidence that among the well proving existing distributions used such as the normal (Gaussian), Generalized error, student t, skew student t, levy and Cauchy distribution. Skew student t distribution was empirically proven to be the best distribution in estimating the parameter for stock market returns and also in distribution of the stock.

This study is essential to the investors in the stock market where they all expect the returns of their investment from the financial stock market at the end of banded agreement of the investors. So, introducing others distribution or proposing three new distributions for the distribution of stock market returns will help investor to have better understanding of the stock market returns and also the academician in the area of the theoretical and empirical analysis of the three proposed distributions for the distribution of stock market returns.

This study will explore both stock market returns and simulation distributional data and will help assess the problems that come stock market returns, and find out

what distributions best fitted for the distribution of stock returns.

2. Literature Review

Louis Bachelier in 1900 was the first to performed analysis of stock returns using normal distribution and he was the first to relate the Brownian motion discovered by Robert Brown in 1827 to stock market returns where is estimated the parameter of the proposed distribution for the distribution of stock returns and concluded that stock returns are statistical independently distributed. However, since then no work have being done relating to stock returns in terms of distributions.

In 1938, William wrote on stock returns but was not subject to any distribution. What he did was to propose other method of estimating stock returns called the Intrinsic Value which have to do with the stock price by combining the periods, cash flows and discount rate of investment value to capture the future price of stock using the present cash flow. In conclusion, William work was to predict the price of any particular stock using the above indicator.

Maurice (1953) a statistician was the first to test for the distribution of stock returns of both price and commodity where he observed the behavior of stock price and commodity using a technical analysis of plot chart to explained the pattern within the price and commodity price.

Mandelbrot (1963) work was an improvement of Bachelier models of the Brownian motion on stock return, Mandelbrot made two changes to his work where he take the logarithm of each returns and also consider a non-normal distribution known as the Paretian distribution to estimate the parameter of the stock returns.

Samuelson's (1965) models stock distributions by considered random walk of a stochastic process to examine the behavior of stock in term of it returns and find out that the returns price of any market, that is, it past price could not be used to predict the future price of the stocks based on it empirical analysis.

Fama (1965) improved on Mandelbrot (1963) by adding another distribution for distribution of stock returns by comparing the normal distribution with that of the non-normal distribution of Paretian distribution and conclude that a Paretain distribution will show erratic behavior if and only if the exponent in the distribution is less than two (2) when considering a monthly data set. In his final note is state that monthly returns belonged to a non-normal distribution.

In 1967, the work of Press beginning to create a larger world for distributions, Press introduced compound distribution for the distribution of stock returns, and the compound distribution was called the Poisson mixture normal distributions to model the Dow and Jones Industrial stocks data. The work of Press actually creates new rooms for innovation where people and researcher now consider the joining of two distributions to fit particular problems. Press proposed this distribution and also obtained each parameter using the method of Maximum Likelihood Estimator (MLE) to check for the significant of the parameter. From the empirical analysis, the price variation was significant.

In 1968, the work on residual estimation started with Blume in his Ph.D. dissertation where he estimate stock returns using their residual estimation to validate the work of Fama (1965) but using another approach which from his empirical analysis, the results he obtained was consistency with Fama work which state that the distribution of stock returns are on a non-normal distribution.

Lester (1970) worked on analyzing the American Income distribution by developing some techniques to fit analytic distributions for the observed distributions of income and its causal factors of both white and black household in U.S between the period of 1949 and 1966. He first analyzes the impact of macroeconomic factors on the distribution of incomes and secondly determined the impact of microeconomic distributions on the distribution of income in comparison with white and black income using beta distribution. From the result, there are median increases in the incomes of white household than of the black household.

The work of Peter (1972) also continuous to increase the scope of stock returns where the theoretical and empirical analysis of four distributions he considered was evaluated. Peter considered using stable Paretian, compound, scaled student t and normal distributions for the distribution of stock returns. From his empirical analysis, scaled student-t outperformed the other distributions.

Robert and Nicholas (1974) compared a stable and scaled t distribution as statistical models for stock prices by using the distributions to accessed daily returns. A simulation study was conducted for stable and scaled t distribution to compare their performance on the two distributions even after testing the distributions on real life data. From the empirical evidence, the scaled t distribution was a better fit than the stable distribution.

McDonald (1984) worked on some generalized functions for the size of distribution of income in United State (U.S) of 1970, 1975 and 1980 data points where he considered seven (7) different distributions which at the time of his study, has not been used to model distribution of income. Method of MLE was used to estimate the parameters of the distributions and sum of squares error (SSE), Chi-Square (χ^2) or Log-likelihood was used as their performance Criteria test. Among the distributions considered for this study, Generalized Beta of the Second Kind (GBII) provided a better fit followed by Singh Maddala (Burr) than the other distributions using the performance criteria.

Gray and French (1990) compared four distributions to model stock index returns, the distributions are logistic, scaled t, exponential power and normal distributions for the distribution of stock returns using S&P stock of 500 composite index Firstly, they examine the logistic distribution for the distribution of stocks and secondly, examined the four distribution models simultaneously. Finally their empirical results rejected the used of normal distribution and shows significant results for the others distributions.

Shittu *et al.,* (2014) worked on beta generator proposed by

Corderio while using skew t distribution as the parent distribution. They generated a new distribution called Beta Skew t distribution to model stock returns in Nigeria. The parameters of the proposed distribution were estimated using MLE. The proposed distribution was compared with other distribution to check their performance. Using the selection criteria, their proposed distribution was the best compare to others distribution used.

Ahmet et al (2015) made a comparative Goodness of fit analysis of some levy processes and Heston Model to stock index returns. The levy distribution they considered is the Variance Gamma (VG), Generalized Hyperbolic (GH) and Normal Inverse Gaussian distribution. But based on the four models for distribution of stock index returns used, Heston model performed well from others distribution as retain on the goodness of fit test. Furthermore, some of the compared distributions yielded significantly from the results of the parameter estimate.

3. Conclusion

This study review work done on stock returns where different authors used different models statistic in modelling stock price or returns. We are able to bring to conclusion and area in which stock price or stock returns have been dealt with. Therefore, we are going to look at other area in which our propose distribution will be used; especially in two field such as financial field; the stock returns or price and life data such as cancer or breast cancer. These propose models will be compared in the area of performance of the distributions using selection model criteria statistic.

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