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A STUDY ON COMPARITIVE ANALYSIS OF VOLATILITY OF EQUITY SHARE PRICES FOR SELECTED STEEL COMPANIES IN INDIA

Dr.M.A.ShakilaBanu
Assistant Professor in Management Studies,
Jamal Institute of Management,
Jamal Mohamed College (Autonomous),
Tiruchirapalli- 620 020.
rspazila@yahoo.com

Dr. M. Sheik Mohamed.
Professor and Vice Principal (SF),
Jamal Institute of Management,
Jamal Mohamed college (Autonomous),
Tiruchirapalli – 620 020.
drmsheik@jmc.edu

ABSTRACT

This paper explain the stock market volatility at the individual script level and at the aggregate stock price level. The empirical analysis has been done by using Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model. It is based on daily data for the time period from March 2012 to April 2013. The analysis reveals the same trend of volatility in the case of aggregate stock price and two different steel company. The GARCH (1,1) model is persistent for the two company share price.

The purpose of this research is to determine whether the trading of equity share price on the National Stock Exchange (NSE) for selected steel companies in India results in an increase in the volatility of the underlying spot indices.

Keywords: GARCH, Stock Market Volatility, Equity Share Price.

Purpose: To find out the volatility of selected steel company in India.

Findings: It can be observed that among the two company selected, SAIL company sector had got more volatility during the study period.

1. Introduction

Volatility is a theoretical construct. Models for volatility often use an unobservable variable that controls the degree of fluctuations of the financial return process. This variable is usually called the volatility. Generally, two different volatility models, will lead to different concepts of volatility.

In **finance**, **volatility** is a measure for variation of price of a financial instrument over time. Historic volatility is derived from time series of past market prices. An **implied volatility** is derived from the market price of a market traded derivative (in particular an option). The symbol σ is used for volatility, and corresponds to **standard deviation**.

2. TYPES OF VOLATILITY

2.1 Actual volatility

This is the measure of the amount of randomness in an asset return at any particular time. It is very difficult to measure, but is supposed to be an input into all option pricing models. In particular, the actual (or 'local') volatility goes into the Black–Scholes equation. There is no 'timescale' associated with actual volatility, it is a quantity that exists at each instant, possibly varying from moment to moment.

2.2Historical or realized volatility

This is a measure of the amount of randomness over some period in the past. The period is always specified, and so is the mathematical method for its calculation. Sometimes this backward-looking measure is used as an estimate for what volatility will be in the future.There are two 'timescales' associated with historical or realized volatility: one short and one long.

2.3 Implied volatility

The implied volatility is the volatility which when input into the Black–Scholes option pricing formulæ gives the market price of the option. It is often described as the market's view of the future actual volatility over the lifetime of the particular option.However, it is also influenced by other effects such as supply and demand.There is one 'timescale' associated with implied volatility: expiration.

2.4 Forward volatility

The adjective 'forward' can be applied to many forms of volatility, and refers to the volatility (whether actual or implied) over some period in the future.Forward volatility is associated with either a time period, or a future instant.

2.5 What's Stock Market Volatility?

When the stock market goes up one day, and then goes down for the next five, then up again, and then down again, called as stock market volatility. Volatility is measured by the Chicago Board of Options Exchange (CBOE), primarily through the CBOE Volatility Index (VIX) and, to a lesser extent, the CBOE Nasdaq Volatility Index (VXN) for technology stocks. The VIX tracks the speed of stocks' price movements in the S&P 100; the VXN tracks it in Nasdaq 100 stocks. Both indices take a weighted average of the estimated volatility of eight stocks on a particular index.

Both are calculated every 60 seconds over the CBOE's trading day, which means it records a great deal of fluctuation.

Seasoned traders who monitor the markets closely usually buy stocks and index options when the VIX is high. When the VIX is low, it usually indicates that investors believe the market will head higher. This, in turn, can trigger a market selloff, as speculators try tounload their holdings at premium prices.

2.6 EQUITY SHARES

Equity shares are commonly referred to common stock or ordinary shares. Even though the words shares and stocks are interchangeably used, there is a difference between them. Share capital of a company is divided into a number of small units of equal value called shares. The term sto`ck is the aggregate of a member's fully paid up shares of equal value merged into one fund. It is a set of shares put together in a bundle. The "stock" is expressed in terms of money and not as many shares. Stock can be divided into fractions of any amount and such fractions may be transferred like shares.

2.7 STANDARD DEVIATION

In statistics and probability theory, standard deviation (represented by the Greek letter sigma, σ) shows how much variation or dispersion exists from the average (mean), or expected value. A low standard deviation indicates that the data points tend to be very close to the mean; high standard deviation indicates that the data points are spread out over a large range of values.
Standard deviation = summation [fd^2]/n where f is the frequency and d = x-mean of x

2.8 SKEWNESS AND KURTOSIS

Skew, or skewness, can be mathematically defined as the averaged cubed deviation from the mean divided by the standard deviation cubed. If the result of the computation is greater than zero, the distribution is positively skewed. If it's less than zero, it's negatively skewed and equal to zero means it's symmetric.
Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. That is, data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. A uniform distribution would be the extreme case.

A normal distribution has kurtosis exactly 3 (excess kurtosis exactly 0). Any distribution with kurtosis ≅3 (excess ≅0) is called kurtosis.

A distribution with kurtosis <3 (excess kurtosis <0) is called leptokurtic. Compared to a normal distribution, its central peak is lower and broader, and its tails are shorter and thinner. A distribution with kurtosis >3 (excess kurtosis >0) is called leptokurtic. Compared to a normal distribution, its central peak is higher and sharper, and its tails are longer and fatter. Let X be a random variable. Let μ_n to the nth central moment.

$$\mu_n=E((X-\mu)^n)$$

In words this says the nth central moment is the expectation of the difference between the random variable X and it's mean to the nth power.

The first central moment is $\mu_1 = 0$
The second central moment is μ_2 is the variance.

The skewness is found by the equation (μ_3)/[(μ_2)^(3/2)]
It is a measure of the lack of symmetry of the probability density function.
The kurtosis is a measure of the peachiness of the density function and is the ratio between the fourth central moment and the square of the second central moment. =μ_4/[(μ_2)^2]
Both the skewness and the kurtosis are unit less.

3. NORMALITY TEST

In statistics, **normality tests** are used to determine whether a data set is well-modeled by a normal distribution or not, or to compute how likely an underlying random variable is to be normally distributed. More precisely, they are a form of model selection, and can be interpreted several ways, depending on one's interpretations of probability:

- In descriptive statistics terms, one measures a goodness of fit of a normal model to the data – if the fit is poor then the data are not well modeled in that respect by a normal distribution, without making a judgment on any underlying variable.
- In frequents statistics statistical hypothesis testing, data are tested against the nul hypothesis that it is normally distributed.
- In Bayesian statistics, one does not "test normality" per se, but rather computes the likelihood that the data come from a normal distribution with given parameters μ,σ (for all μ,σ), and compares that with the like lihood that the data come from other distributions under consideration, most simply using a Bayes factor (giving the relatively likelihood of seeing the data given different models), or more finely taking a prior distribution on possible models and parameters and computing a posterior distribution given the computed likelihoods.

4. GARCH model

The Generalized Autoregressive Conditional Heteroskedasticity model is another popular model for estimating stochastic volatility. It assumes that the randomness of the variance process varies with the variance, as opposed to the square root of the variance as in the Heston model. The standard GARCH(1,1) model has the following form for the variance differential:

$$d\nu_t = \theta(\omega - \nu_t)dt + \xi \nu_t \, dB_t$$

where ω is the mean long-term volatility, θ is the rate at which the volatility reverts toward its long-term mean, ξ is the volatility of the volatility process, and dB_t is, like dW_t, a gaussian with zero mean and $\sqrt{dt}$ standard deviation.

The GARCH model has been extended via numerous variants, including the NGARCH, TGARCH, IGARCH, LGARCH, EGARCH, GJR-GARCH, etc.

5. AUGMENTED DICKEY-FULLER TEST

In statistics and econometrics, an augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The augmented Dickey–Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence.

6. JARQUE-BERA TEST

In statistics, the Jarque–Bera test is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. The test is named after Carlos Jarque and Anil K. Bera. The test statistic JB is defined as

$$JB = \frac{n}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)$$

where n is the number of observations (or degrees of freedom in general); S is the sample skewness, and K is the sample kurtosis:

$$S = \frac{\hat{\mu}_3}{\hat{\sigma}^3} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^3}{\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2\right)^{3/2}}$$

$$K = \frac{\hat{\mu}_4}{\hat{\sigma}^4} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^4}{\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2\right)^{2}},$$

where $\hat{\mu}_3$ and $\hat{\mu}_4$ are the estimates of third and fourth central moments, respectively, $\bar{x}$ is the sample mean, and $\hat{\sigma}^2$ is the estimate of the second central moment, the variance.

7. LILLIEFORS TEST

In statistics, the Lilliefors test, named after Hubert Lilliefors, professor of statistics at George Washington University, is an adaptation of the Kolmogorov–Smirnov test. It is used to test the null hypothesis that data come from a normally distributed population, when the null hypothesis does not specify which normal distribution; i.e., it does not specify the expected value and variance of the distribution.

In statistics**,** the Shapiro–Wilk test tests the null hypothesis that a sample x_1, ..., x_n came from a normally distributed population. It was published in 1965 by Samuel Shapiro and Martin Wilk.

The test statistic is:

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}$$

where

- $x_{(i)}$ (with parentheses enclosing the subscript index i) is the ith order statistic, i.e., the ith-smallest number in the sample;
- $\overline{x} = (x_1 + \ldots + x_n)/n$ is the sample mean;
- the constants a_i are given by

$$(a_1, \ldots, a_n) = \frac{m^\top V^{-1}}{(m^\top V^{-1} V^{-1} m)^{1/2}}$$

where

$$m = (m_1, \ldots, m_n)^\top$$

and m_1, ..., m_n are the expected values of the order statistics of independent and identically distributed random variables sampled from the standard normal distribution, and V is the covariance matrix of those order statistics.

8. STATIONARITY

Stationarity, is defined as a quality of a process in which the statistical parameters (mean and standard deviation) of the process do not change with time.

- The most important property of a stationary process is that the auto-correlation function (acf) depends on lag alone and does not change with the time at which the function was calculated.

- A weaklystationary process has a constant mean and acf (and therefore variance)
- A truly stationary (or strongly stationary) process has all higher-order moments constant including the variance and mean.

The previous definition of stationarity is typical of what can be found in the literature. What is usually not explained in the literature is that strongly stationary processes are never seen in practice and are discussed only for their mathematical properties. Weakly stationary processes, are sometimes observed in the real world and are usually assumed to be "close enough" to stationarity in the strict sense (strong stationarity) to be treated as such. In addition, stationarity is really a relative term, rather than an absolute as the definition above may lead one to believe. Any process that "really" is stationary, can only be seen as stationary if the sampled data from the process is very long compared to the lowest frequency component in the data. In other words, if one collects data for only a short time, short compared to the length of wavelength of the data, then even a stationary process will appear to be nonstationary. Finally, no research exists which discusses what effect deviations, large or small, from stationarity may have on analysis techniques which require stationarity.
For the purpose of analysis, the stationarity property is a very good thing to have in ones data, since it leads to many simplifying assumptions. Again, the first step in using any methodology for time series analysis is to check if ones data is stationary.

9. BETA

Beta is a measure of an investment's relative volatility. The higher the beta, the more sharply the value of the investment can be expected to fluctuate in relation to a market index. For example, Standard & Poor's 500 Index (S&P 500) has a beta coefficient (or base) of 1. That means if the S&P 500 moves 2% in either direction, a stock with a beta of 1 would also move 2%. Under the same market conditions, however, a stock with a beta of 1.5 would move 3% (2% increase x 1.5 beta = 0.03, or 3%). But a stock with a beta lower than 1 would be expected to be more stable in price and move less. Betas as low as 0.5 and as high as 4 are fairly common, depending on the sector and size of the company.However, in recent years, there has been a lively debate about the validity of assigning and using a beta value as an accurate predictor of stock performance.

10. ALPHA

Alpha measures risk-adjusted return, or the actual return an equity security provides in relation to the return you would expect based on its beta. Beta measures the security's volatility in relation to its benchmark index.
If a security's actual return is higher than its beta, the security has a positive alpha, and if the return is lower it has a negative alpha.

For example, if a stock's beta is 1.5, and its benchmark gained 2%, it would be expected to gain 3% (2% x 1.5 = 0.03, or 3%). If the stock gained 4%, it would have a positive alpha. Alpha also refers to an analyst's estimate of a stock's potential to gain value based on the rate at which the company's earnings are growing and other fundamental indicators. For example, if a stock is assigned an alpha of 1.15, the analyst expects a 15% price increase in a year when stock prices are generally flat. One investment strategy is to look for securities with positive alphas, which indicates they may be undervalued.

11. OBJECTIVES

- To study the profile of selected steel company in India.
- To evaluate the distribution of equity share price of the selected company.
- To find out the normality of equity share price of the selected company.
- To compute the stationery position of equity share price of the selected company.
- To identify the Volatility position of equity share price of the selected company.

- To provide necessary finding and suggestion.

2 REVIEW OF LITERATURE

"Volatility persistence and trading volume in an emerging futures market: Evidence from NSE Nifty stock index futures" by Pratap Chandra Pati, Prabina Rajib Volume: 11 Issue: 3 2010 - The purpose of this paper is to estimate time-varying conditional volatility, and examine the extent to which trading volume, as a proxy for information arrival, explain the persistence of futures market volatility using National Stock Exchange S&P CRISIL NSE Index Nifty index futures.

"Equity index futures contracts and share price volatility: A South African perspective"by I. Nel, W. De K Kruger Volume: 9 Issue:1 2001 - The purpose of this research is to determine whether the trading of equity index futures contracts on the South African Futures Exchange (SAFEX) results in an increase in the volatility of the underlying spot indices. Since equity index futures contracts were first listed in the USA in 1975, various studies have been undertaken to determine whether the volatility of shares in the underlying indices increases as a result of the trading of such futures contracts. These studies have lead to the development of two schools of thought: [a] Trading activity in equity index futures contracts leads to an increase in the volatility of index shares. [b] Trading activity in equity index futures contracts does not lead to an increase in the volatility of the index shares and could in fact lead to greater stability in equity markets. Although some evidence of higher volatility in expiration periods was found, volatility in the expiration periods was not consistently higher than in the corresponding pre-expiration period.

"Return and Volatility Spillovers from Developed to Emerging Capital Markets: The Case of South Asia" by Yun Wang, Abeyratna Gunasekarage, David M. Power, Volume: 86,2005 This study examines return and volatility spillovers from the US and Japanese stock markets to three South Asian capital markets – (i) the Bombay Stock Exchange, (ii) the Karachi Stock Exchange and (iii) the Colombo Stock Exchange. We construct a univariate EGARCH spillover model that allows the unexpected return of any particular South Asian market to be driven by a local shock, a regional shock from Japan and a global shock from the USA. The study discovers return spillovers in all three markets, and volatility spillovers from the US to the Indian and Sri Lankan markets, and from the Japanese to the Pakistani market. Regional factors seem to exert an influence on these three markets before the Asian financial crisis but the global factor becomes more important in the post-crisis period.

"Volatility and foreign equity flows: evidence from the Philippines" by Joseph J. French, Vijay Kumar Vishwakarma Volume: 30 Issue: 1 2013 The purpose of this paper is to dissect the dynamic linkages between foreign equity flows, exchange rates and equity returns in the Philippines.

"Stock market liberalization, structural breaks and dynamic changes in emerging market volatility"by Duc Khuong Nguyen, Mondher Bellalah, Volume: 7 Issue: 4 2008. This paper aims to empirically reexamine the dynamic changes in emerging market volatility around stock market liberalization. First, a bivariate GARCH-M model which counts for partial market integration is developed for modeling stock market volatility in emerging market countries. Second, the Bai and Perron stability test in a linear framework and a pooled time-series cross-section model were employed to examine the empirical relationship between stock market liberalization and volatility. Structural breaks detected in emerging market volatility series did not take place at the time of official liberalization dates, but they rather coincide with alternative events of liberalization process. The effects of official liberalization on return volatility are on average insignificant. The stock return volatility is however lowered when the participation of the US investors becomes effective and important on emerging markets, and when emerging markets increase in size.

3. SCOPE

- The report examines the stationery position and the volatility position of equity share price of the selected Companies. The scope of the research comprises of information derived from secondary data from various websites.
- This study can be used by investors, traders and other professionals as a supplement to their own research.
- This study can be used to individual who are at initial stage of investment in stock market.
- To different Organization who provides tips for Buying and Selling shares. To review market forecast provided by the organization about fluctuation in the market.
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4. DATA ANALYSIS AND INTERPRETATION

From Table 1 it can be observed that in case of JSW steel company, the skewness and Kurtosis value (-0.215694, -0.0179353 , -0.549156, -0.463960) has shown negative impact during the pre and post announcement and in case of SAIL also the skewness and Kurtosis value (-0.576539, -0.390066, -0.104548, -0.821593) has shown negative impact during the pre and post announcement. It is noted that both the company shows only negative impact for the announcement of equity share.

Table 2 visualizes the test of univariate normality for the JSW STEEL LTD and Steel Authority of India Ltdprice based on four different types of test namely Doornik-Hansen test, Shapiro-Wilk test, Lilliefors test, Jarque-Bera test. The results were performed for the JSW steel ltd and SAIL. As for as analysis the JSW steel ltd and SAIL follows the normality at 1% level. Hence, we can conclude that the JSW steel ltd and SAIL in NSE had followed the normal distribution.

The table 3 exhibits the maximum lag length for JSW steel ltd and SAIL. By using the Schwarz Bayesian criterion the optimum lag length of company was finalized, the minimum BIC was achieved for the JSW steel ltd and SAIL equity price with a optimum lag length of 1 and 1.

The table 4 exhibits the results of the Augumented Dicky-fuller test (or) unit root test which helps to find out the stationerity for the **JSW STEEL LTD AND SAIL** equity price in NSE. The ADF test confirms that the price **JSW STEEL LTD AND SAIL** Company are stationery over a period of time.

From the table 5 it is identified that the 90.55% and 107.57% are relates to alpha so the equity share price is affected with random stock of both the company. 2% and 10% are relates to beta so the new information affects the price of both the company. As the result the stock is voltail in nature for both the company.

Table 1 Distribution of the Equity share prices

Variables	JSW		SAIL	
	Pre	Post	Pre	Post
Mean	692.039	759.283	90.5277	78.9923
SD	47.4773	62.8447	5.80638	10.4698
Skewness	-0.215694	-0.0179353	-0.576539	-0.390066
Kurtosis	-0.549156	-0.463960	-0.104548	-0.821593

Table 2 Test of Normality

	Doornik-Hansen test	Shapiro-Wilk test	Lilliefors test	Jarque-Bera test

	Critical Value	P Value	Critical Value	P Value	Critical Value	P Value	Critical Value	P Value
JSW STEEL LTD	5.11342	0.0775597	0.981581	0.000841333	0.0738877	0	4.03352	0.133086
SAIL	83.3946	7.78205e-019	0.922708	3.94052e-011	0.0946709	0	37.9402	5.77294e-009

Table 3 Maximum lag length

	Minimum BIC	Lags
JSW STEEL LTD	8.456320	1
SAIL	3.865785	1

BIC = Schwarz Bayesian criterion

Table 4 Test result for Augumented Dicky-Fuller test

	ADF Test statistic	P Value
JSW STEEL LTD	0.5116	>0.05
SAIL	0.1304	>0.05

Table 5 Univariate Volatility model Estimators of JSW Steel ltd and Steel Authority of India ltd price

	JSW steel ltd				SAIL			
Independent Variable	**Coefficient**	**Std.Error**	**Z Statistics**	**P Value**	**Coefficient**	**Std.Error**	**Z Statistics**	**P Value**
Constant	729.578	6.51601	112.0	0.0000	87.7174	4.13836	21.20	1.04e-099 ***
U2t	199.250	53.5037	3.724	0.0002 ***	3.66699	0.897439	4.086	4.39e-05 ***
U 2 t-1	0.905533	0.0591392	15.31	6.37e-053 ***	1.07574	0.263201	4.087	4.37e-05 ***
Y t-1	0.0276789	0.0423556	0.6535	0.5134	0.104854	0.240438	0.4361	0.6628

***-pvalue-1%

SHARE PRICE MOVEMENTS OF JSW STEEL LTD

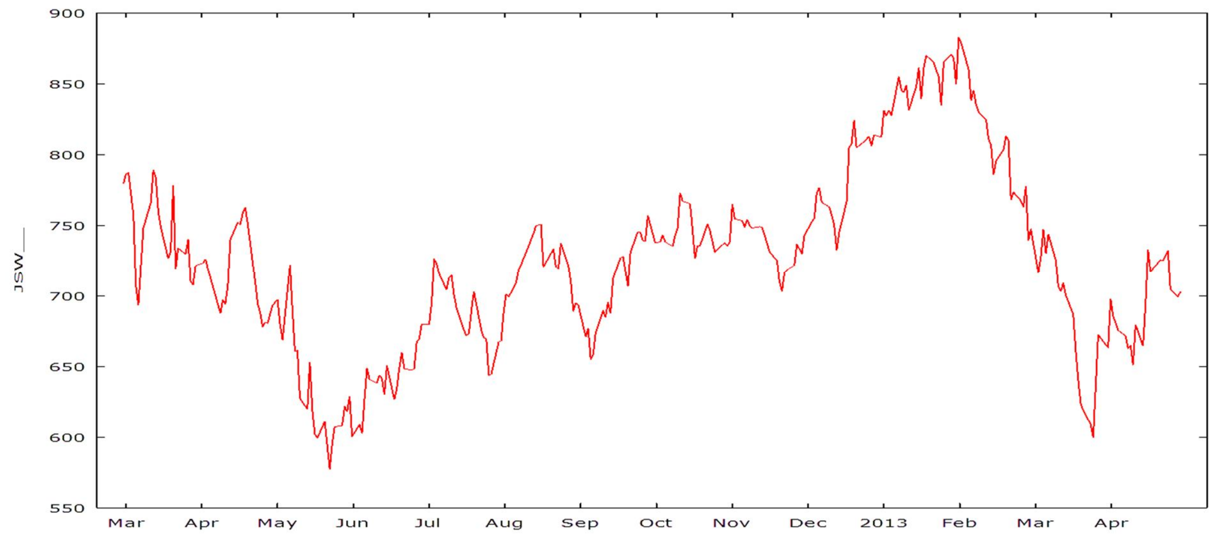

Figure 1 :SHARE PRICE MOVEMENTS OF SAIL

5. SUGGESTIONS

It is suggested when there is normaility in equity share prices it is safe to invest. The investment in short term leads to high risk. It is better to invest in long term period.

6. CONCLUSION

This study in particular addresses the stock market volatility of selected company in National Stock Exchange of India using GARCH (1, 1) model. It can be observed that among the two company selected, SAIL company sector had got more volatility during the study period.

7.FURTHER STUDY

A study on comparative analysis of volatility of equity share prices for selected automobile industries in India. A study on comparative analysis of volatility of equity share prices for selected steel company and automobile industry in India.

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Author Profile:

Dr.M.A.Shakila Banu (b.24th March 1983) working as Assistant Professor in Jamal Institute of Management, Jamal Mohamed College, Trichy-20. She obtained her M.Com in Jamal Mohamed College securing a rank holder, Bharathidasan University, M.Phil (commerce) in Jamal Mohamed College as college First Student, Bharathidasan University, M.B.A in Bharathidasan University, M.Phil (Management) specialization in Finance in Jamal Institute of Management, Jamal Mohamed College, PGDFM in Annamalai University, FGDFT in Annamalai University, HDCA in TNPCS, Dip in Arabic and Dip in Hindi.Ph.D in Bharathidasan University.She has 7 years of teaching experience handling various subjects in Management like International Business Environment, Production Management, Financial Market, Financial Management, Management Accounting, Accounting for Manager and e-commerce.
e-mail: rspazila@yahoo.com

Dr.M.Shaik Mohamed (b. 05.01.1952) working as Professor in Jamal Institute of Management, Vice Principal (SF) Jamal Mohamed College, Trichy-20. He obtained his Haji.CMA.Dr.M.Shefk Mohamed., M.Com., M.Phil., Ph.D., PGDCA., FCMA., FMSPI.,PGDFM., Dip.M.A., M.B.A., M.Phil., from various university..He has 38 years of teaching experience handling various subjects in Management and Commerce like Financial Management, Management Accounting, Accounting for Manager, Principles of Accounts, Cost and Management Accounts. email:drmsheik@jmc.edu