Analyse Risk-Return Paradox: Evidence from Electricity Sector of Pakistan

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This study analysis risk return relationship of the electricity companies of Pakistan by using the return series of these electricity companies. Financial time series data have the property of autoregressive heteroscedasticity so move towards the ARCH family test. As the study want to analyse the risk return relationship so, GARCH-M Model of Engel et al (1987) is used, who empirically found relationship between risk and return. Results show that risk return in case of Pakistan electricity companies is not a specific relation (negative or positive) rather they show paradox of risk return.

Keywords: GARCH-M, Risk Return Relation, Paradox, GARCH-M

1. INTRODUCTION

Electricity is taken into account as a lifeline for the economy throughout the world. It is a very important component for the course of growth and development either talk about agriculture sector, industry sector or engineering sector, [Sahir and Qurashi (2007)]. Traditional theories argued that just labour and capital are the most important factors of production but recent studies considered electricity as a most important factor in production and consumption in the economy around the globe, [IEA (2005)]. Therefore, it will not be wrong if it is say that electricity sector is primary sector among all sector of Pakistan and all over the world. But unfortunately Pakistan is facing electricity shortage problem since its independence. Demand for electricity is more than the supply of electricity in Pakistan. So, if the investors invest in electricity sector in Pakistan then it will not be wrong if it is say that they have more opportunities for profit as compare to other sector of the economy. Therefore, national and international investors have great profitable opportunities to invest in electricity sector in Pakistan.

The quantity of net revenue from investment compare with the total quantity of capital invested represents the return on investment in a project. Return is the relation between the losses or gains of a company receives and its investment to attain the profit. While risk is like a chance that an investment's real return may be changed from the expected return. So risk includes the possibility of losing or gaining some of the investment and sometimes losing of all original investment. Usually risk is measured by calculating standard deviation and variance of return of investment. Risk on investment is

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significant for the future arrangement of business and investments. Low risks are associated with low potential returns. High level risk is associated with high potential returns.

The risk return trade-off is balanced where the desire for the lowest possible risk and the highest possible return equal. A higher standard deviation means a higher risk and higher possible return. Therefore it can be say that risk and return have any type of relationship either positive or negative or may have no relationship. Risk averse investors required a compensation in the form of premium for having a risky asset, and this premium is a positive function of risk.

Therefore, Risk and return study is important to private sector investment decisions. It guides how much to lend, to whom and for what, or how much to invest in a company or project. Investor emphasis on the capacity of the debtor, or project, to make loan settlements. Equity investor's emphasis on assessing the risk adjusted returns. The risk return study plays an important role in risk assessment, which helps to understand the project doing better job and to efficiently perform projects and strategies. The technique of risk valuation can give a project a better chance of success. The risk return tradeoff tells us that the higher risk gives us the possibility of higher returns. There are no guarantees. Just as risk means higher potential returns, it also means higher potential losses.

If take a glance in the history of risk return then the name of John Burr (1938) is very famous who explained the thinking of investors that investors wanted to find the best portfolio and also wanted to buy it at best price. Best and suitable portfolio can be selected on the portfolio's efficient frontier. Portfolio should be non-negative investment and also followed probability which is followed by the random variable [Markowitz (1952)].

2. SALIENT FEATURES OF ELECTRICITY SECTOR OF PAKISTAN

In 1947, the total electricity generation capacity of Pakistan was 60 Mega Watt (MW) and demand was more or less the same. The installed capacity of electricity increases with the passage of time such as 636 MW in 1970, 1331 MW in 1975, 3000 MW in 1980's and 800 MW in 1990-91. With the passage of time as the population grew so the demand for electricity also grew. In the era of 1960's to 1980 the policy makers mainly focused on Hydel electricity projects but no major projects were adopted by the government to scale up the demand requirements of electricity. As a result, country has been facing severe power shortages which is not only hampering the lives of ordinary people but also hinders the economic growth of the country. Electricity production in Pakistan has shrunk quickly in recent years due to over-reliance on the fossil fuel. The availability of power falls short of the population needs in Pakistan. A glance about the history of electricity sector of Pakistan depicts that the nation has experienced worst electricity crisis, when electricity production fell down by 6000MW. The most important problem with the Pakistan's electricity sector is political instability and lacking of efficiency in the production. The four major electricity producers in Pakistan are Water and Power Development Authority (WAPDA), Karachi Electric Supply Company (KESC), Independent Power Producers (IPPs), Pakistan Atomic Energy Commission (PAEC).

The installed capacity of electricity production in Pakistan was 22,797 MW in 20014 but due to inefficiency up to 17000 MW was produced. Pakistan is facing shortfall of 4000MW to 5000MW. The contribution of fossil fuel is 64.2 percent, hydro is 29 percent, and nuclear is 5.8 percent of the total production of electricity in Pakistan. Currently Pakistan is producing about 19,500MG of electric Power; WAPDA provides about 11,363MW, or 58 percent of this. The remaining is supplied by the Karachi Electric Supply Company and Independent Power Producers. Until the 1980s, the Water and Power Development Authority (WAPDA) and Karachi Electric Supply Company (KESC), the two public sector vertically integrated organisations responsible for the generation, transmission, and distribution of electricity were doing quite well [Malik (2012)].

By 1980's over 60 percent of electricity was generated from hydropower in Pakistan. The power policy was designed to install thermal power plants, most of which were fuel oil based. The government at the time considered this strategy to be the optimal one. By 2013, the proportion of electricity generation from hydro and nuclear sources was about 36 percent, while the proportion of generation from furnace oil-fired sources was almost equal at 35 percent. Gas-fired plants accounted for 29 percent of power generation, while coal-fired plants accounted for only 0.1 percent of generation.

The power policy in 1994 was built on a cost-plus-return basis in US dollar terms. Investors were to be provided a US dollar-based internal rate of return of 15–18 per cent over the 25–30-year-period of the power purchase agreement, after covering for operational costs. This was further backed by sovereign guarantees from the government of Pakistan. In addition, the IPPs could be built using up to 80:20 debt–equity ratios. The IPPs were to be paid every month in two parts i.e. a capacity payment and an energy payment. The deal also made sure that the WAPDA and the KESC became contractually liable to repay the debt (and its interest payments) taken to finance up to 80 per cent of the project cost whether or not electricity was produced reported by Munir, *et al.* (2012).

This arguments that only 40 per cent of the total population had access to electricity then. The government had anticipated that the average annual increase in power demand that would be about 8 percent in the short to medium term, and generation capacity of the order of 960-1,300 MW would have to be added to the system annually from the mid-1990s onwards to meet the demands discussed by Aftab (2014). A power policy was thus formulated in 1994 that offered profitable package of incentives to private investors. There is only one electricity transmission company is Pakistan Electric Power Company (PEPCO) which produces its own thermal generation plants and purchases electricity from various IPPs and Pakistan Atomic Energy Commission (PAEC) evoked by Jamil and Ahmad (2010). IPPs are private utilities that are licensed to produce electricity which has used to sell to utilities and end users. In Pakistan, Independent power producers (IPPs) are producing about 30 per cent of the total generation capacity, since 1990. IPPs contribute significantly in electricity generation in Pakistan but unfortunately, IPPs are producing below capacity as a result of working capital shortage caused due to outstanding amount of receivables from PEPCO.

Currently, round about 70 percent of the total population of 190 million have direct access to electricity and the government is making necessary arrangements to provide electricity to the entire population of Pakistan in the minimum possible time. The country is facing a deficit of 5000 MW of electricity during the peak demand hours. In face of present electricity demand supply gap, and consistent growth in demand force to make it necessary to meet the need and market for enhancing the country's current power generation capability. The Private Power and Infrastructure Board (PPIB) serves as a **one-window** facilitator for the processing of Private Power Generation projects above 50 MW. It is an investor-friendly that offers an attractive set of fiscal and financial incentives to the Private sector. The Policy provides a balanced risk profile for the investors, lenders, government, and power purchaser.

3. LITERATURE REVIEW

Investors having portfolio were unaware from the construction of portfolio and its best utilisation before 1930. Investors wanted to find the best portfolio and also wanted to buy it at best price (John Burr Williams, 1938). Best and suitable portfolio can be selected on the portfolio's efficient frontier. The best combination of Mean-Variance chosen on the efficient frontier of the given portfolio. Variance should be minimising for the given level mean (return) of portfolio and variance is convex function of expected return for all combination of Mean-Variance on the efficient portfolio. Portfolio should be non-negative investment and also followed probability which is followed by the random variable [Markowitz (1952)]. Maximum of expected return for a given quantity of risk, or minimising the risk for a given level of expected return can make the best choice of portfolio. Markowitz said it is batter to invest in multiple business rather than putting all eggs in one basket [Markowitz (1957)]. It is not necessary that there should be efficient portfolio. Mean-Variance combination of only specific portfolio can be chosen there would be no their choice as on efficient portfolio [Roy (1952)].

Calculation of variance and stander deviation is difficult before 1964 then the method for the calculation of these variable is given in the model named Capital Asset Pricing Model, and Capital Asset Pricing Model explain how to select a best asset from the given portfolio and variance and mean have positive relationship [Sharpe (1964)]. Risk return trade-off was measured in different time period in the history. Positive risk return trade-off which examined by Inter Temporal Capital Asset Pricing Model (ICAPM). In which conditional variance was incorporated in conditional mean equation and coefficient interpret the strength of risk aversion [Merton (1973)]. The relation between stock market stability and returns have different scenarios in different situations, as in case of stable economic conditions mean and variance will be directly proportional to each other such as in 1960's when the world economy is more stable as compare to the 1970's which is the era of energy crisis and unstable structural changings so people avoid to take risk in the business activities so mean and variance in this situation is negative [Bowman (1980); Bowman (1982)].

Mean (return) and variance (risk) relation vary with economic conditions as well as this relation also vary as the product diversification posture changes. Related diversification had negative risk return trade-off while unrelated diversification had positive risk return trade-off [Bettis and Hall (1982)]. Most of the studies used GARCH-M model to find out the dynamics of the return of risks. The expected risk premium of stock and level of predictable volatility of the stock have optimistic relation while stock market volatility and expected return showed significant and strong negative relation [French, *et al*. (1986)].

So the positive unexpected change in volatility increase the future expected risk premium. Quality of the stocks also have significant impact in taking risk on the particular shares. They concluded that quality of the asset which make the investor to bear the risk is proportional to the non-diversifiable risk which is measured by the covariance of the asset return with the market portfolio return [Bollerselv, *et al.* (1988)]. Risk return in related diversification high risk- high return firms and unrelated diversification characterised low risk- low return firms [Amit and Livnat (1988)]. If risk-return paradox is explained in the context of prospect theory then risk return is positive when cross-sectional data incorporated in the study in firms and industry level. While in case of alternative measures such as nature of the firm, size, divergence, risk measures and risk attitude the risk-return association is negative [Fiegenbaum (1988)]. The prediction of prospect theory. Prediction of the prospect theory was that risk-return attitude of a firm is not determined by the level of its output but by the outcome relation to some reference point [Jeger (1991); Thomas and Fiegenbaum (1988)].

If standard GARCH-M model is used then found positive and insignificant relation between profitability and risk of monthly excess return but If Campbell's instrumental variable model is used and the model estimate negative and significant relation because conditional variance allow the deterministic monthly seasonal to depend on the nominally risk free interest rate. So the final results showed that conditional risk and conditional variance of the return have negative relation [GJR (1993)]. When time varying risk and betas are introduced in the ICAPM the variations in the conditional variance of the returns causes the variations in the betas [Martin and Evans (1994)]. If ICAPM model and GMM estimation technique is used then most of the studies concluded that risk premium is positive and significant. Risk premium and hedge related risk also showed strong time variations. So it can be concluded that at aggregate level risk aversion concept have significant time variations [Brandt and Wang (2010)].

Impact of news on working of stock markets estimated by using GARCH-jump in mean model to capture the extreme news by allowing the jump component to incorporate in the GARCH-M model. Normal news associated with the normal risk premium which generates smooth volatility process. Jump risk premium is generated by the extreme news which is associated with the high volatility. As low volatility present positive and significant risk return trade off while high volatility showed negative and insignificant results. So time varying Jump intensity is important to capture the time varying risk premium of extreme events [Chan and Feng (2011)]. All the above mentioned studies concluded that risk return relationship is not necessary to remain always positive or negative. This relation vary according to the time, product diversification, economics conditions and structural changings etc. so risk return relation is a paradox.

4. METHODOLOGY

The study analysis risk return trade-off so Engle et al (1987) GARCH-M of is used. Engle, *et al.* (1987) empirically observed risk-return trade-off by using GARCH-M model in which variance (which is called volatility feedback effect) is incorporated in the mean equation and empirically found risk-return association.

(1) Conditional Mean Equation

$$R_t = \alpha + \beta R_{t-i} + \lambda\, \sigma_t^{\,2} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \text{(4.1a)}$$

$\varepsilon_t | \Psi_{t-1} \sim N(0, \sigma_t^2)$

(2) Conditional Variance Equation

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^2 \quad \ldots \quad \ldots \quad \ldots \quad \ldots (4.1b)$$

Where

In the conditional mean Equation (4.1a) R_t shows return of the electricity companies which are measured as log difference of current period closing prices and previous period closing prices. $R_t = \ln(P_t) - \ln(P_{t-1})$. β is vector of parameters, λ is measure of risk return trade-off. Positive values of λ ensures risk premium while negative values showed negative relation between risk and return. σ_t^2 is the conditional variance and ε_t is error term which is normally distributes with zero mean and variance σ_t^2. Ψ_{t-1} is the information set.

Conditional variance equation (4.1b) in which 1st term represents the ARCH term of order q and the 2nd term represents the GARCH term of order p. Necessary condition for this equation is variance covariance stationary $\alpha_0 > 0$, $\alpha_i \geq 0$ $\beta_i \geq 0$ and $\sum \alpha_i + \sum \beta_i < 1$. Sum of ARCH and GARCH parameters represents the persistence of shock to volatility. Higher persistence show that period of high volatility in the process and will last for longer while lower persistence show that period of low volatility in the process will last for shorter.

Technique

The study selected sample of ten electricity companies from the electricity sector of Pakistan which are as Altern Power Company (ALTN), Hub Power Co ltd (HUBCO), Ideal Energy (IDEN), Japan Power Generation ltd (JPGL), Kohinoor Electric (KOHN), Sitara Electric (SEL), Karachi Electric (KE), Southern Electric (SEPCO), S.G Power ltd (SGPL), TriStar Power (TSPL). Closing prices of these ten electricity companies transform into return series by using the log return.

$R_t = ln(P_t) - ln(P_{t-1})$

Log return series is used as a variable. As this study is using financial data so data must hold the property of ARCH. To find the ARCH effect in all the return series Engle's (1982) ARCH test is used. Volatility clustering or ARCH effect in residuals of the return series is the most important assumption of the return series in time series. ARCH effect means period of low volatility is followed by the period of low volatility for prolonged time period. And period of high volatility is followed by period of high volatility for prolonged time period this is called ARCH. All companies show ARCH effect except Japan power Generation (JPGL) and Tri-Star power ltd (TSPL) companies. In the next stationarity is checked in all the return series.

$$\Delta R_t = \alpha + t R_{t-1} + \delta_1 \Delta R_{t-1} + \delta_2 \Delta R_2 + \ldots\ldots + \delta_P \Delta R_{t-P} + \varepsilon_t \qquad \therefore \emptyset = \rho - 1$$

Before applying test of stationarity, serial correlation is checked by using Godfrey Lagrange Multiplier (LM) (1978) test is used to test the null hypothesis of serial correlation in the residual term of the log return series. Augmented Dickey Fuller (1979) Unit Root test is used. In the third step Maximum Likelihood Method is used for the estimation of risk return trade-off.

5. RESULTS AND DISCUSSION

At level financial time series data show random fluctuations such as upward and downward fluctuations in the original closing prices of the electricity companies. These random fluctuations represent that market players in the stock market having different behaviours regarding their interest in the financial market. From figure 5.1 up to figure 5.10 show original closing prices of the electricity companies of Pakistan. Random behaviour depict different approaches of the investors in the financial market for maximising their benefits. These graph show that closing prices are having the problem of heterosacadticity and autocorrelation. And series are also non-stationary in nature.

Fig. 5.1. Closing Prices of Altern Power (ALTN) Company

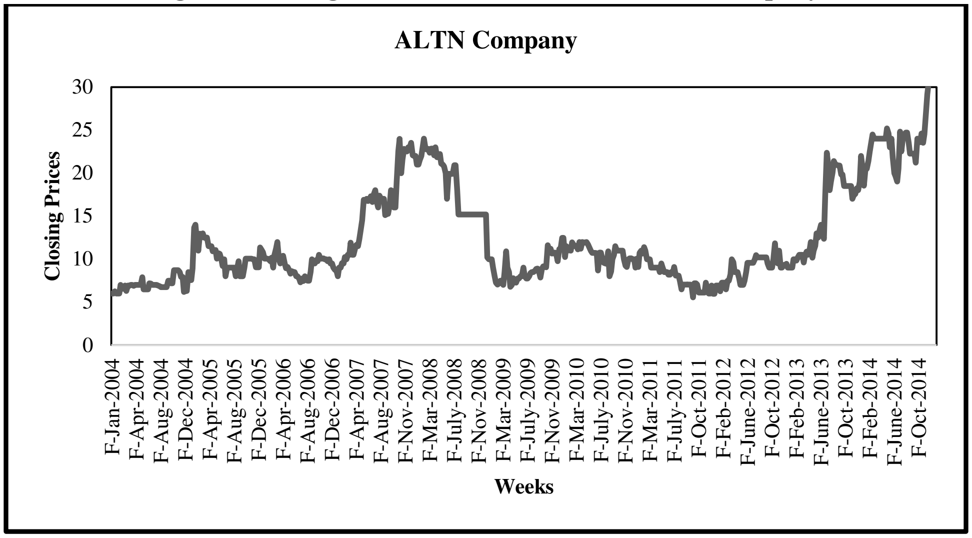


Fig. 5.2. Closing Prices of Hub Co Power ltd (HUBCO) Company

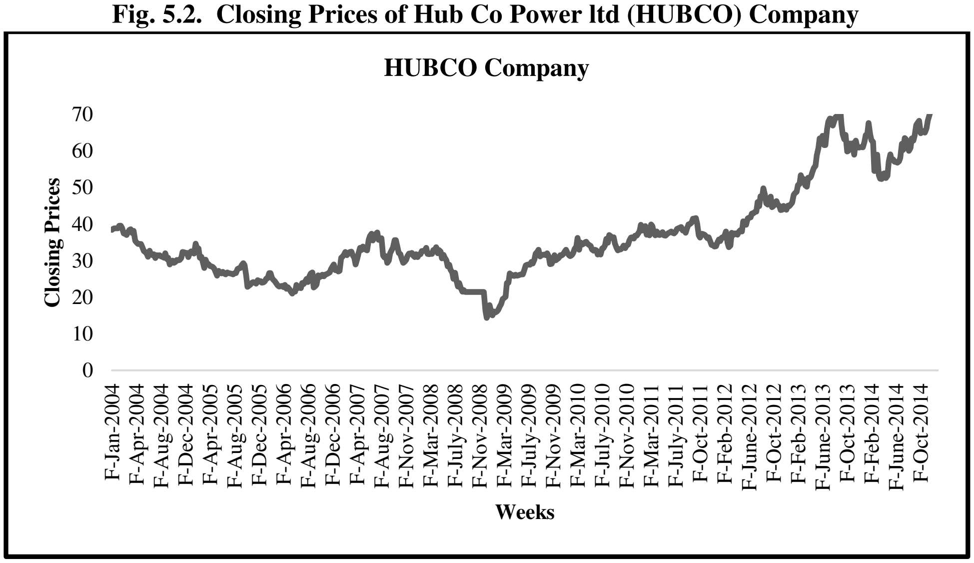


Fig. 5.3. Closing Prices of Ideal Energy (IDEN) Company

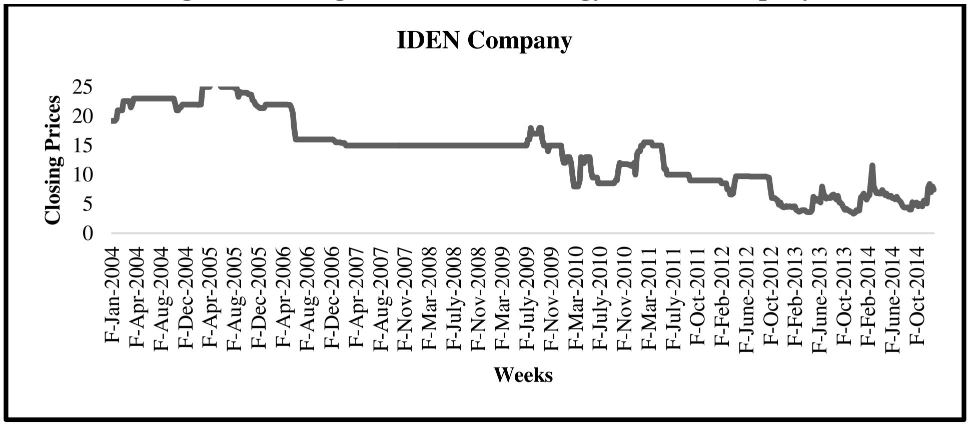


Fig. 5.4. Closing Prices of Japan Power Generation (JPGL) Company

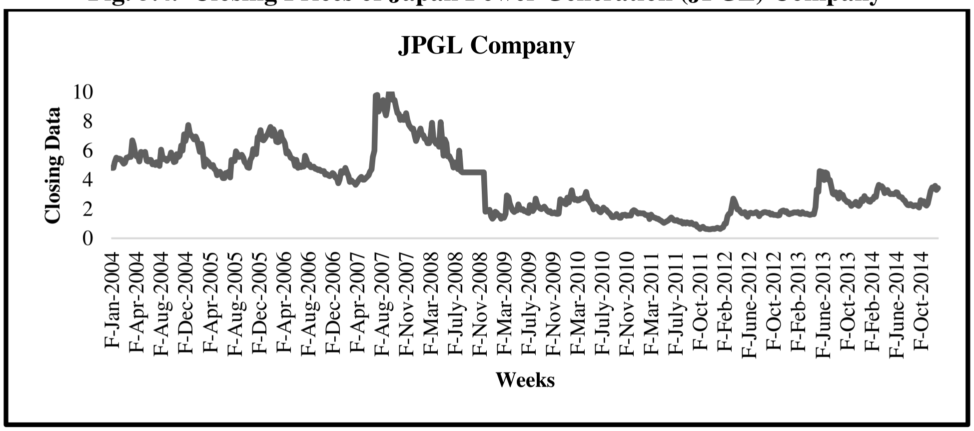


Fig. 5.5. Closing Prices of Karachi Electric (KE) Company

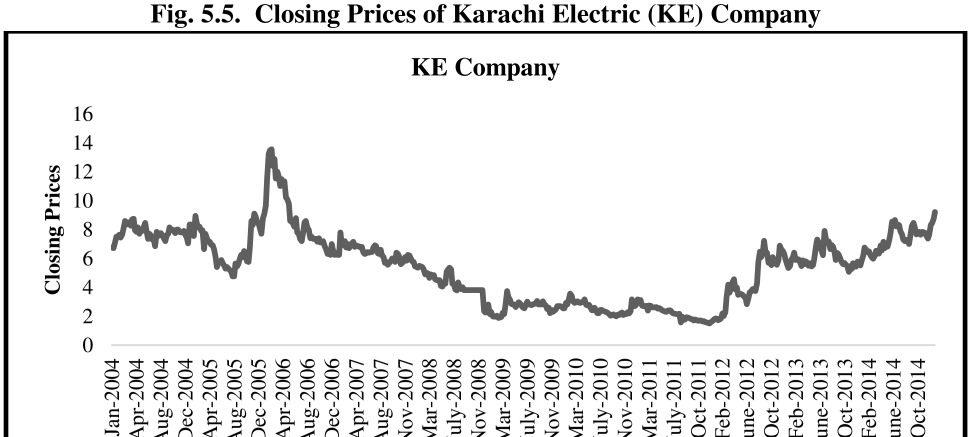


Fig. 5.6. Closing Prices of Kohinoor Electric (KOHN) Company

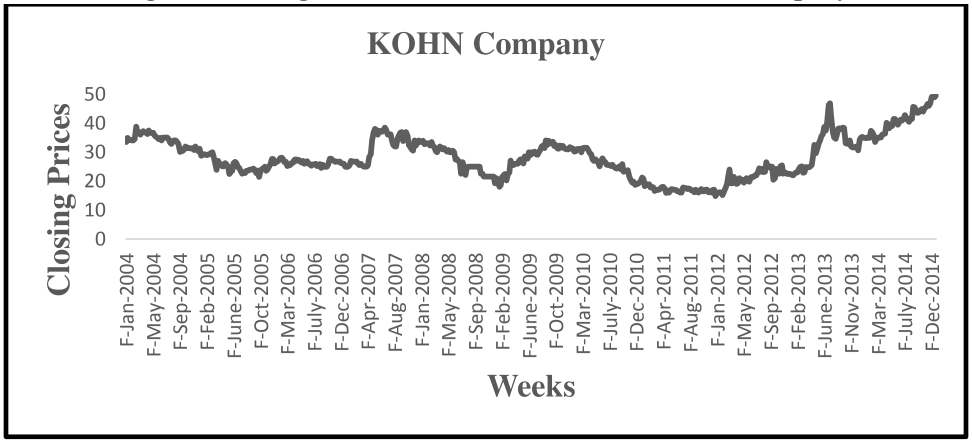


Fig. 5.7. Closing Prices of S.G Power Ltd (S.GPL) Company

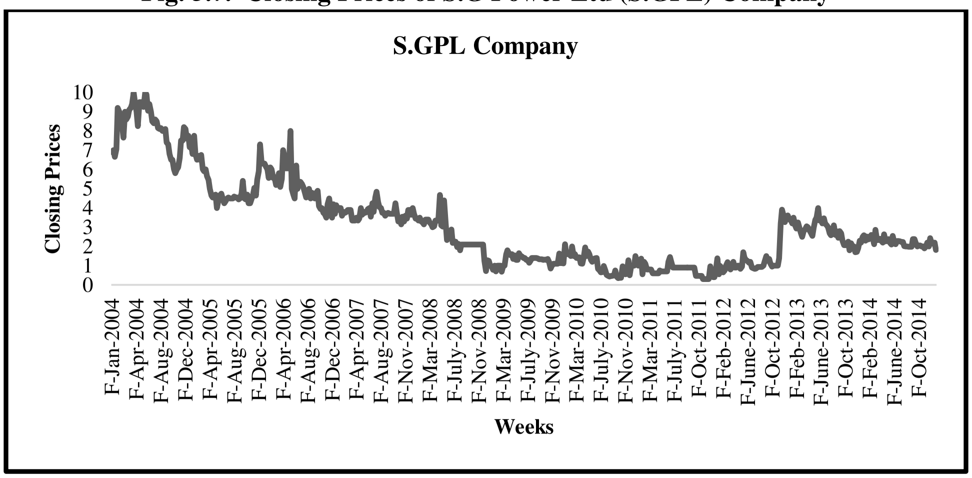


Fig. 5.8 Closing Prices of Sitara Electric ltd (SEL) Company

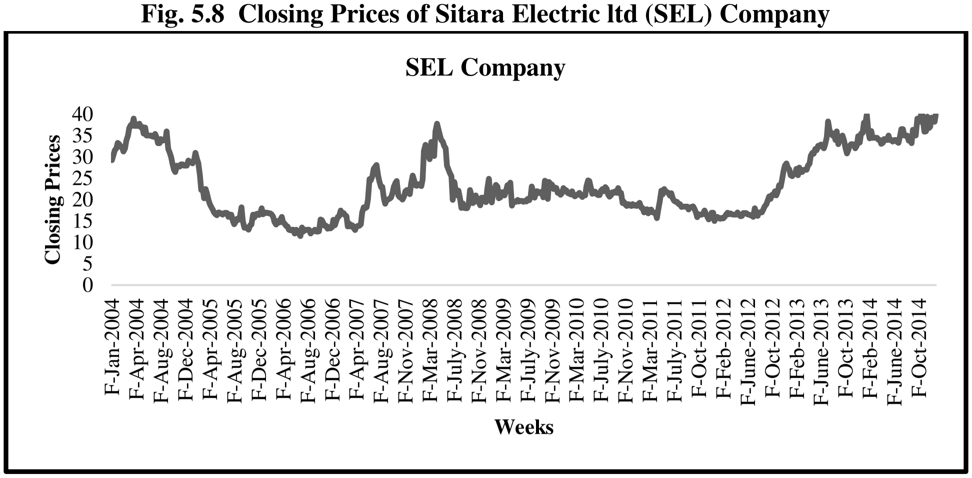


Fig. 5.9. Closing Prices of Southern Electric Power (SEPCO) Company

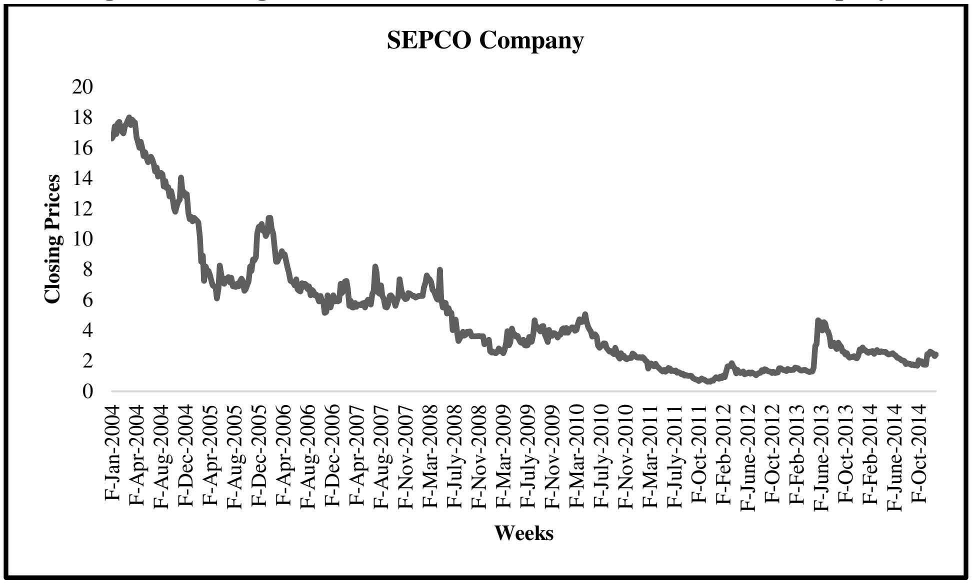
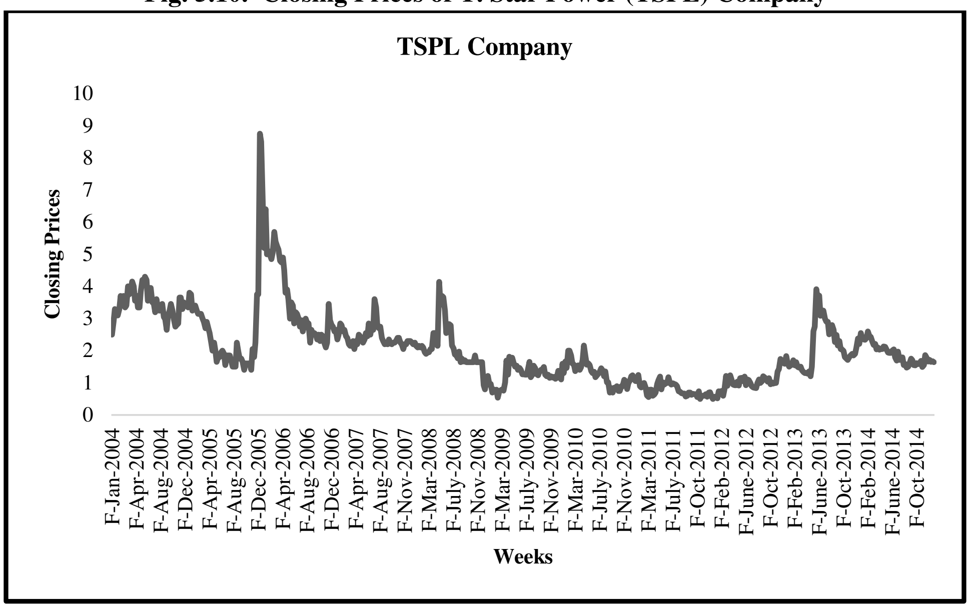


Fig. 5.10. Closing Prices of T. Star Power (TSPL) Company



Return Series of the Electricity Companies of Pakistan

For the estimation of robust GARCH-M Model these random trending is not suitable. So closing prices should transform into log return series for further analysis. As return have more attractive statistical properties and it has scale free assessment of the asset of the return instead of prices of the asset. From figure 5.11 to figure 5.20 is the representation of Log Return Series.

Figure 5.11. Return Series of Altern Power (ALTN) Company

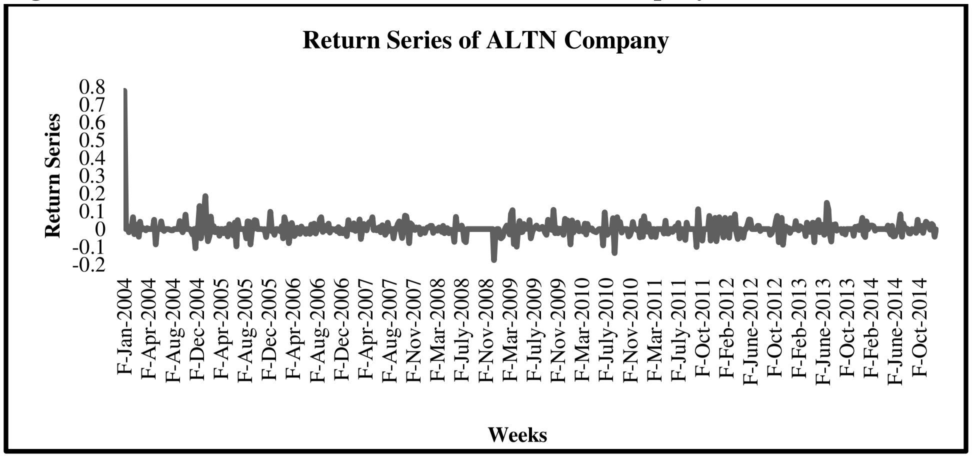


Fig. 5.12. Return Series of Hub Co Ltd (HUBCO) Company

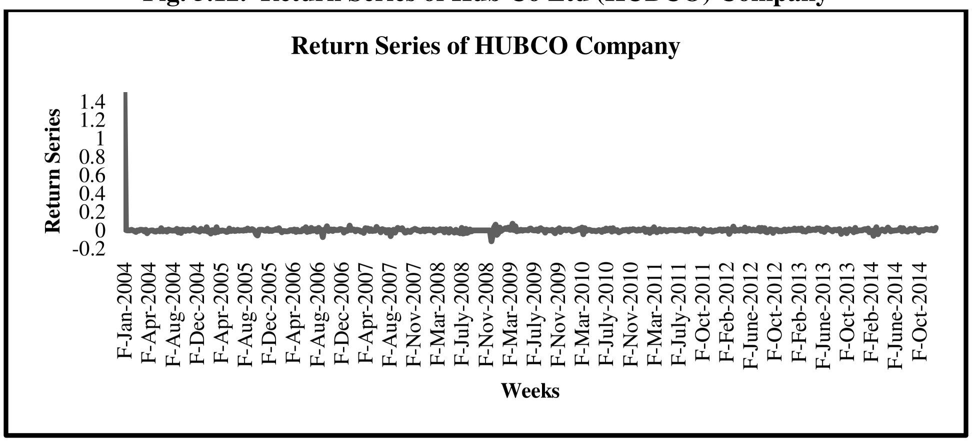


Fig. 5.13. Return Series of Ideal Energy (IDEN) Company

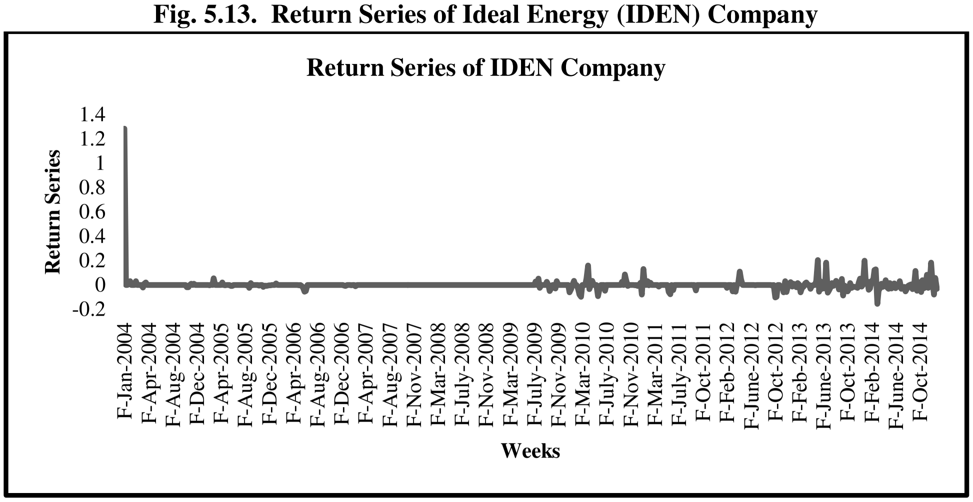


Fig. 5.14. Return Series of Japan Power Generation (JPGL) Company

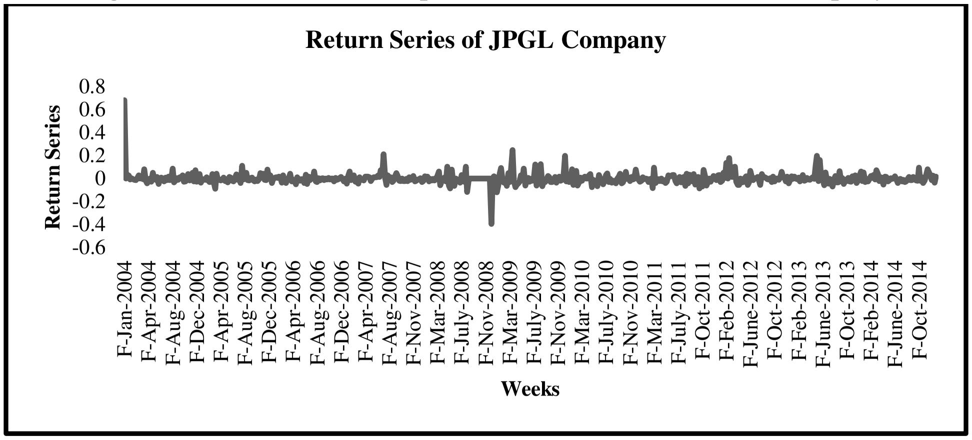


Fig. 5.15. Return Series of Kohinoor Electric (KOHN) Company

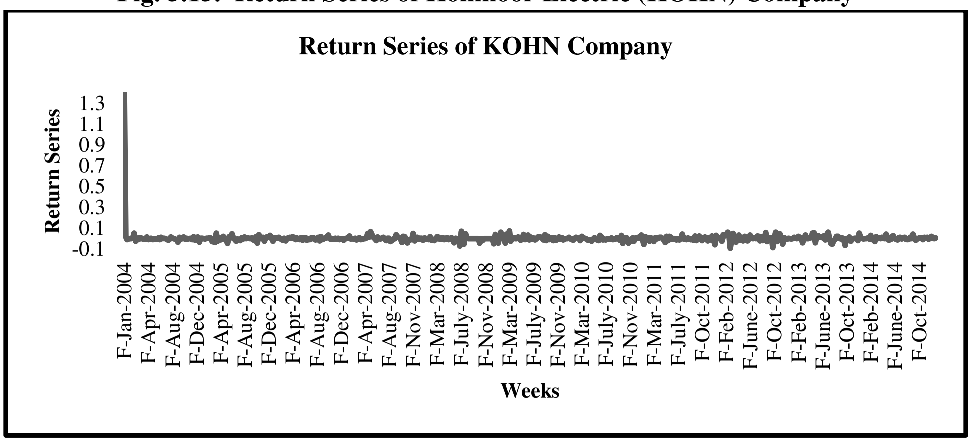


Fig. 5.16. Return Series S.G Power (SGPL) Company

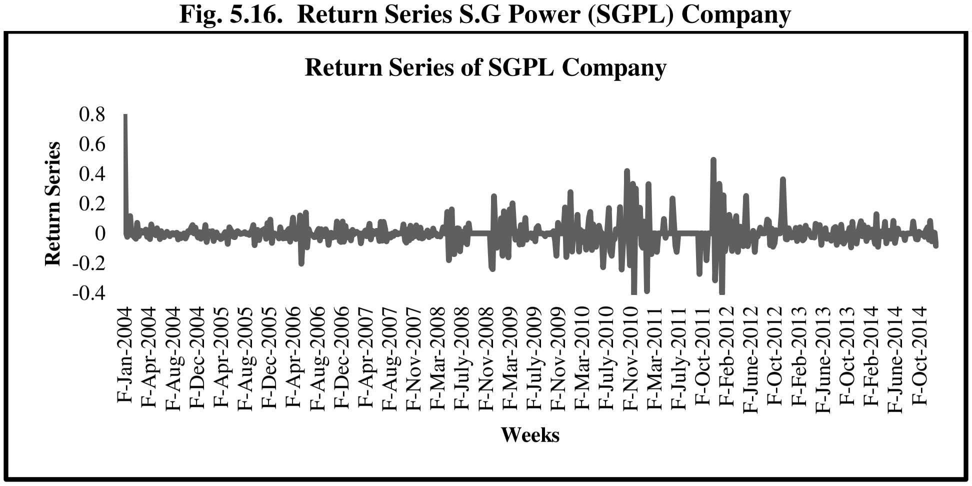


Fig. 5.17. Return Series of Sitara Electric (SEL) Company

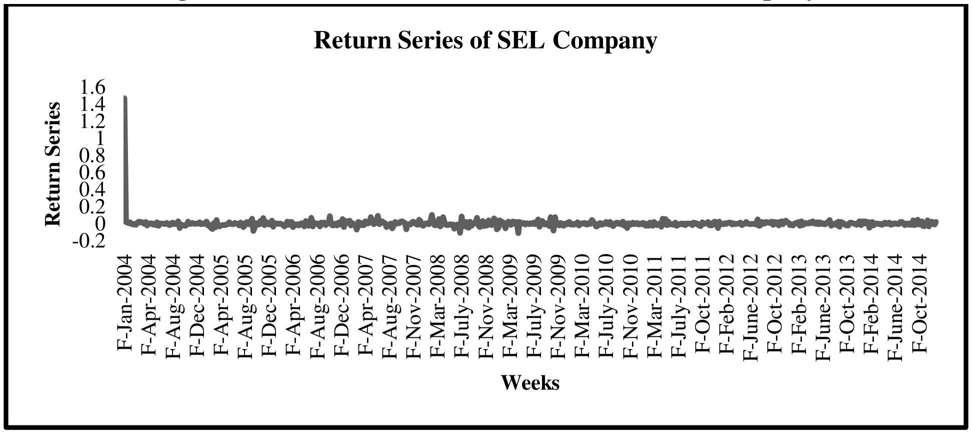


Fig. 5.18. Return Series of Southern Electric Power (SEPCO) Company

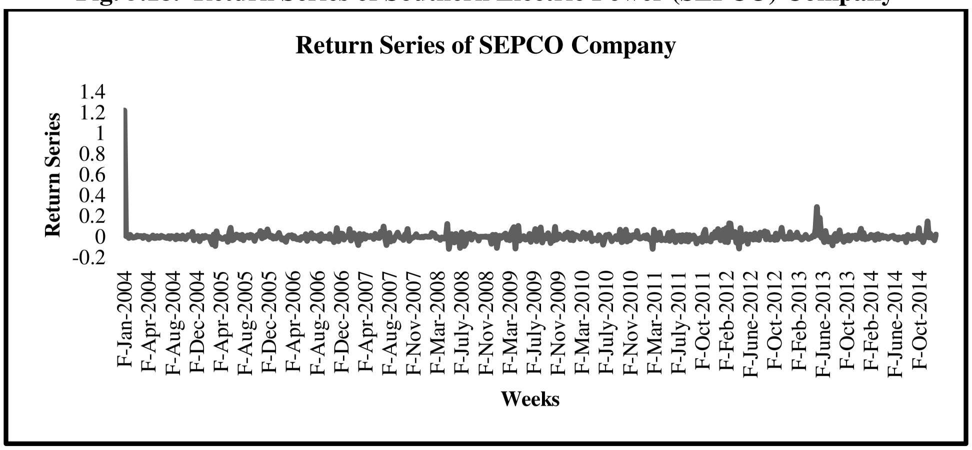


Fig. 5.19. Return Series of Tri Star Power (TSPL) Company

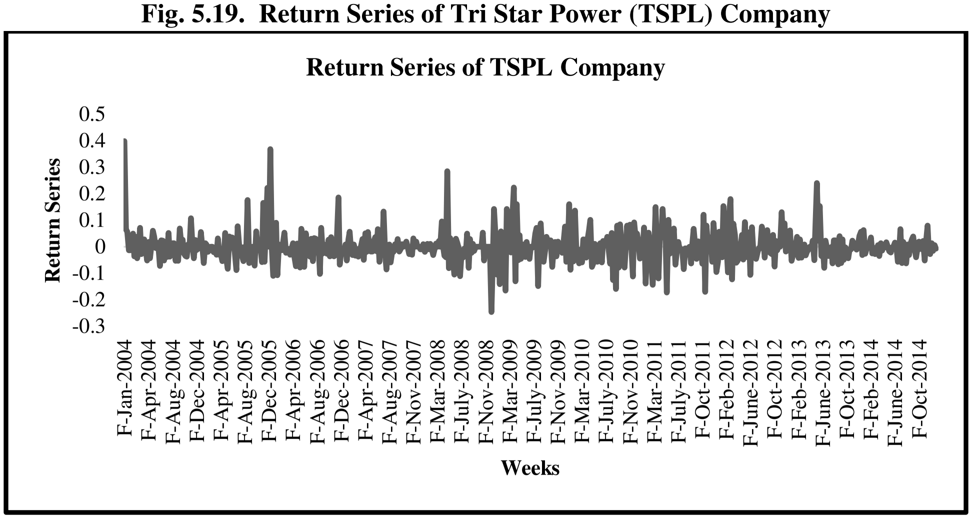


Fig. 5.20. Return Series of Karachi Electric (KE) Company

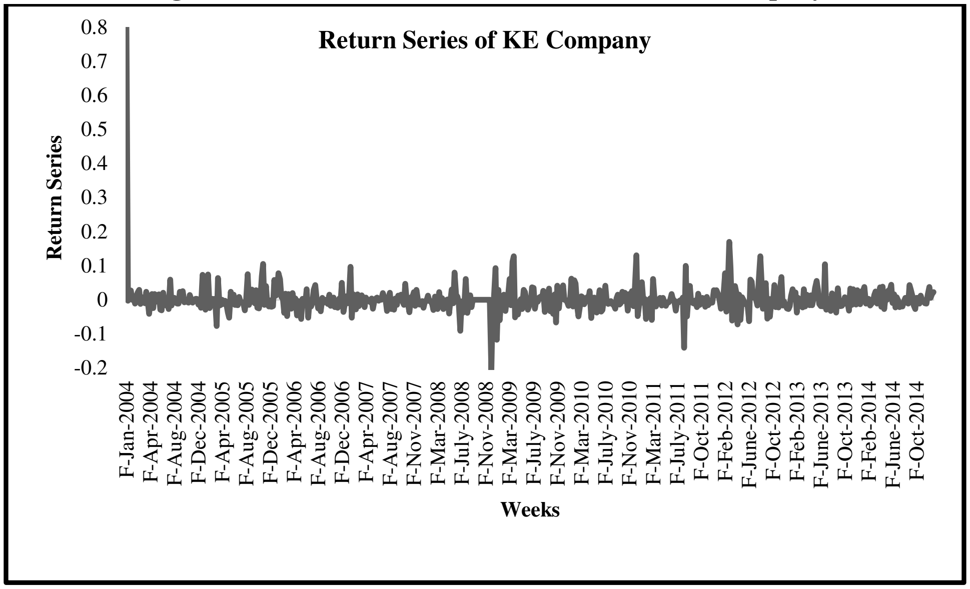


Table 5.1

Results of Engel's LM ARCH Test on the Return Series. (1/2/2004-12/26/2014)

Variable	C	Variance	LM-ARRCH (1) $\chi^2_{(1,0.05)}$	Remarks
R-ALTN	0.0011	0.0188	10.79	ARCH Effect.
R-KE	-3.32	0.0340	16.80	ARCH Effect.
R-SEPCO	-0.00155	0.00606	4.05	ARCH Effect.
R-HUBCO	0.0006	-0.004	12.87	ARCH Effect.
R-IDEN	-0.0009	0.01455	12.30	ARCH Effect.
R-SGPL	-0.0016	0.0624	68.85	ARCH Effect.
R-JPGL	-0.000	0.0652	0.026	No ARCH Effect.
R-SEL	0.00019	0.0186	16.41	ARCH Effect.
R-KOHN	0.00020	0.00355	11.75	ARCH Effect.
R-TSPL	-0.004	0.8408	2.81	No ARCH Effect.

Table 5.1 Explanation: Apply Engel's LM ARCH test on the return series of the electricity companies of Pakistan. Regress return series on the variance series of the return. The check ARCH diagnostic test for ARCH effect in return series of electricity companies of Pakistan.

H_0 = return series has no ARCH Effect
H_A = return series has ARCH Effect

LM-ARCH test follow χ^2 Distribution. Except two return series all the return series have ARCH effect.

Test of Stationarity

Augmented Dickey Full (1979) test of unit root is used to check the stationarity of the return series of all electricity companies. Which show that the return series of electricity companies are stationary at level while S.G Power and Kohinoor Electric (KOHN) companies are stationary at first difference. The result of ADF (1979) test is given in the Table 5.2.

Table 5.2

Test of Stationarity (Augmented Dickey Fuller) for the Return Series of Electricity Companies of Pakistan. (1/2/2004-12/26/2014)

Variable	Constant(t)	Trend(t)	Lags	$\rho_{(\tau)}$	Q-Stat ($\mathcal{X}^2$)	Remarks
R-ALTN	C	t	0	-34.26	1.466	No unit root
R-KE	C	t	0	-36.15	0.429	No unit root
R-SEPCO	C	t	0	-41.65	1.5790	No unit root
R-HUBCO	C	t	0	-99.0	0.0719	No unit root
R-IDEN	C	t	0	-49.12	0.0572	No unit root
R-SGPL	C	t	1	-24.101	0.3332	No unit root
R-JPGL	C	t	0	-29.06	0.0351	No unit root
R-SEL	C	t	0	-6.911	3.046	No unit root
R-KOHN	C	t	1	-78.814	5.356	No unit root
R-TSPL	C	t	0	-28.525	0.4349	No unit root

ADF tabulated value for the sample size N > 500 is -1.95.

Autocorrelation and Partial Autocorrelation of Return Series

Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) are used to identify the order ARMA (m, n) process in the Conditional Mean Equation of GARCH model. Straight line in the ACF and PACF show 95 percent confidence interval $\pm 1.96/\sqrt{N}$. ACF and PACF the order of MA and AR significance lags in the Conditional Mean Equation respectively. While ACF and PACF of the residual of return series is used to identify the GARCH (p,q) order in the Conditional Variance Equation. ACF and PACF mostly used to identify the significance lags in the respective equation or model. Figure 5.21 to figure 5.30 show the ACF and PACF of Return Series of all electricity Companies.

Fig. 5.21. ACF and PACF of Atltern Power Company

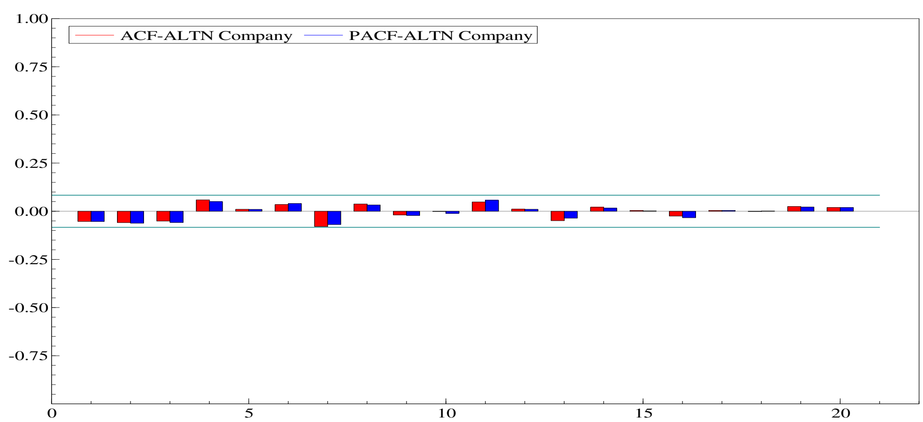


Fig. 5.22. ACF and PACF of Hub Co ltd Company

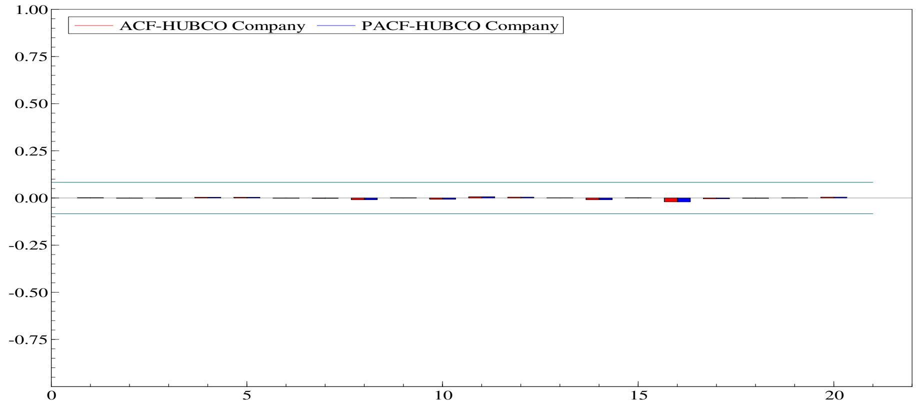


Fig. 5.23. ACF and PACF of Ideal Generation (JPGL) Company

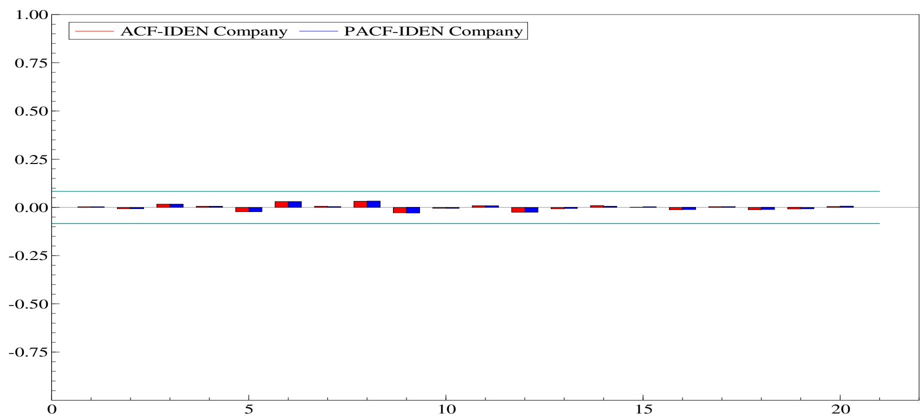


Fig. 5.24. ACF and PACF of Japan Power Energy (IDEN) Company

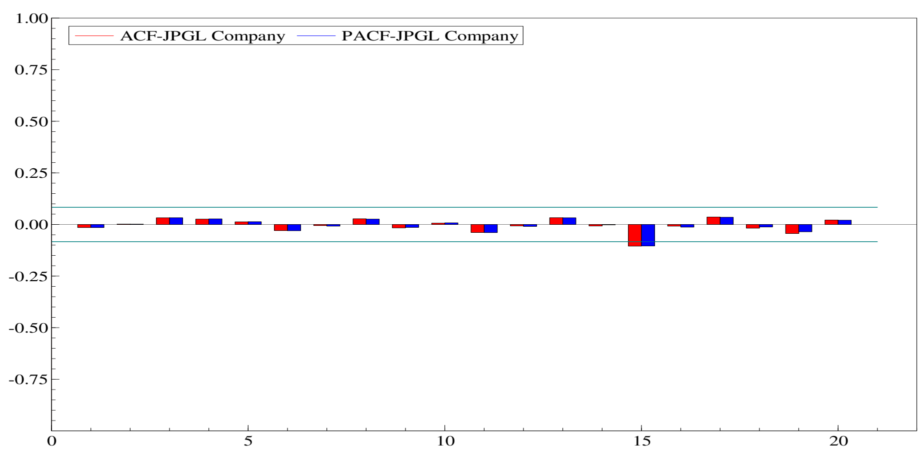


Fig. 5.25. ACF and PACF of Karachi Electric (KE) Company

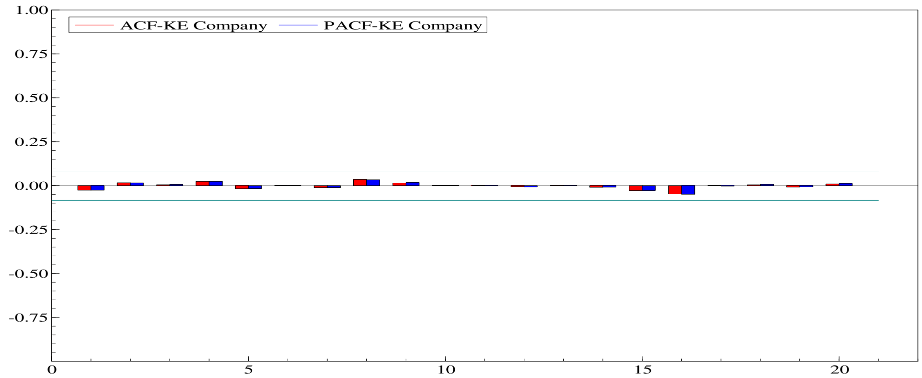


Fig. 5.26. ACF and PACF of Kohinoor Electric (KOHN) Company

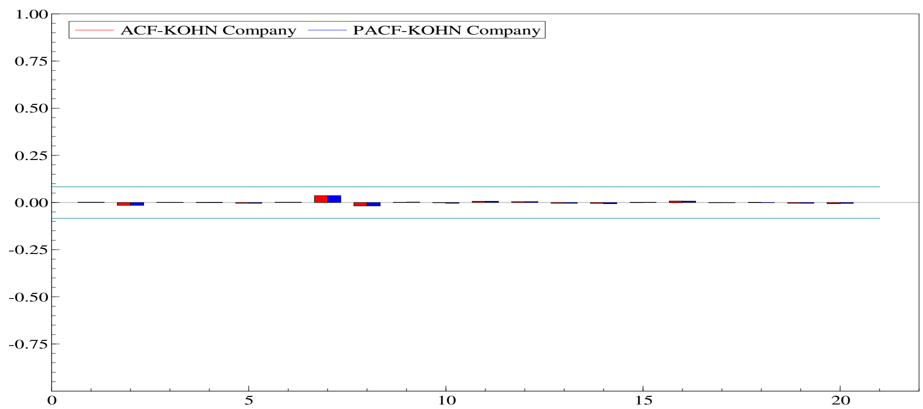


Fig. 5.27. ACF and PACF of S.G Power (SGPL) Company

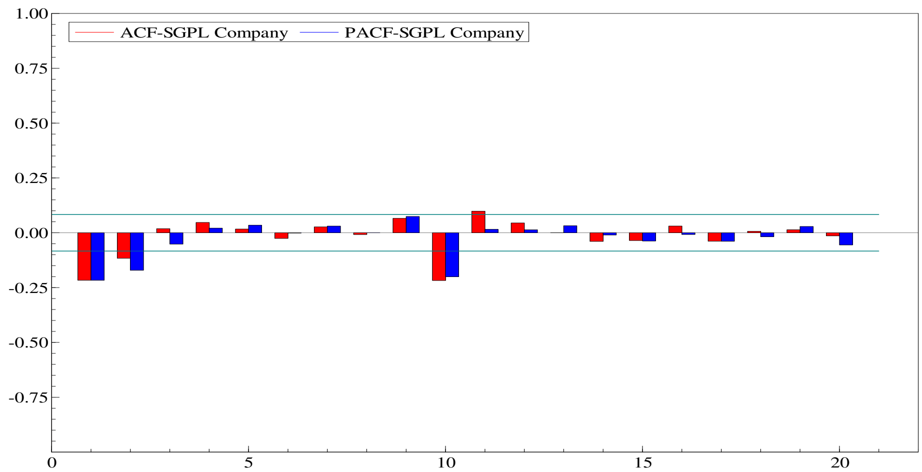


Fig. 5.28. ACF and PACF of Sitara Electric Ltd (SEL) Company

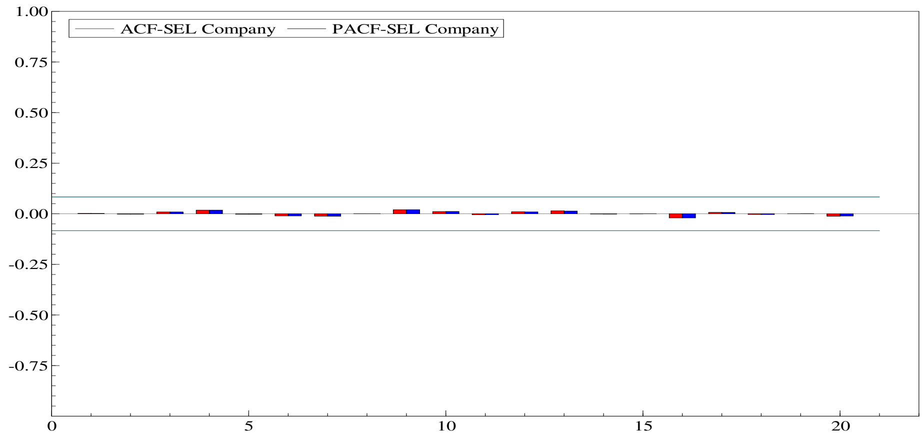


Fig. 5.29. ACF and PACF of Southern Electric Power (SEPCO) Company

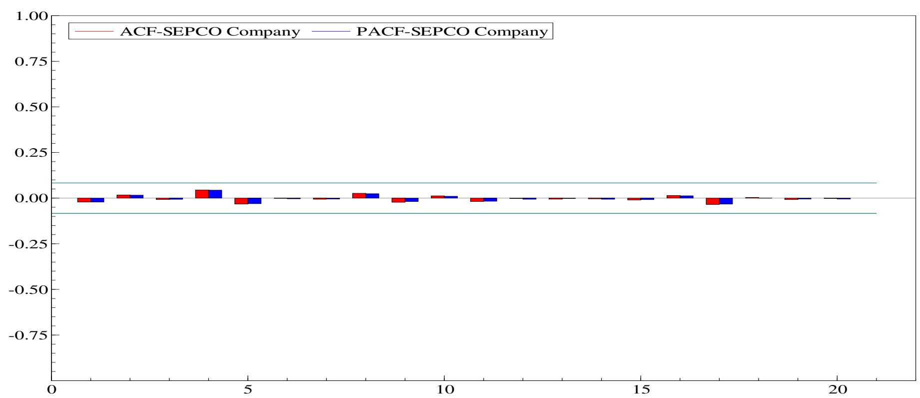


Fig. 5.30. ACF and PACF of Tri. Star Power (TSPL) Company

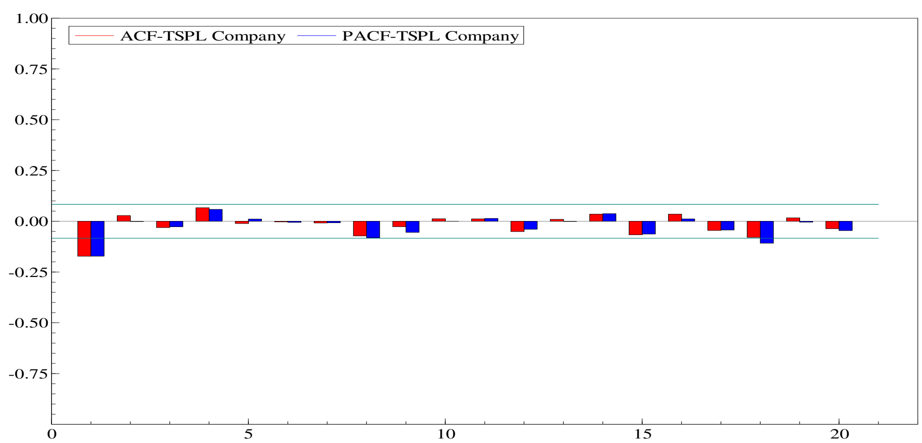


Table 5.3

Results of Risk Return of Electricity Companies Pakistan

Conditional Mean Equation			Conditional Variance Equation				Concluding Remarks
Return Series of all Companies	Intercept	Coefficient,σ_t^2 (Risk)	σ_t^2	Intercept	ε_{t-1}^2	σ_{t-1}^2	(Risk Return Relationship)
R-ALTN		0.8519 (0.7781)	RALTNσ_t^2	0.000567 (8.054)	0.28102 (5.776)	0.2909 (3.88)	Positive/ Insignificant
R-KE	−0.007921 (2.186)	7.33711 (−2.558)	RKEσ_t^2	0.00057 (6.750)	0.2156 (5.15)	0.2233 (2.04)	Positive/ Significant
R-SEPCO		−1.333109 (−1.139)	RSEPCOσ_t^2	0.00038 (5.525)	0.2722 (11.43)	0.4655 (7.454)	Negative/ Insignificant
R-HUBCO	−0.00504 (−2.042)	22.0763 (2.22)	RHUBCOσ_t^2	9.61E (2.615)	0.00181 (3.56)	0.94591 (59.52)	Positive/ Significant
R-IDEN		-0.5575 (-1.085)	RIDENσ_t^2	4.01E − 0 (25.86)	1.4888 (14.85)	0.4714 (28.92)	Negative/ Insignificant
R-SGPL		−0.0051 (−0.016)	RSGPLσ_t^2	0.0007 (3.678)	0.2501 (8.55)	0.5648 (173.51)	Negative/ Insignificant
R-JPGL		−0.72453 (−0.757)	RJPGLσ_t^2	0.00824 (5.019)	0.14392 (4.131)	0.4272 (3.839)	Negative/ Insignificant
R-SEL		0.30686 (0.179)	RSELσ_t^2	6.83E-06 (2.826)	0.03468 (3.846)	0.9548 (91.63)	Positive/ Insignificant
R-KOHN		0.0538 (0.021)	RKOHNσ_t^2	4.45E-05 (4.107)	0.1290 (5.41)	0.761 (19.79)	Positive/ Insignificant
R-TSPL		0.52360 (−1.056)	RTSPLσ_t^2	-0.0955 (5.222)	-0.2516 (6.262)	0.523 (8.374)	Positive/ Insignificant

In Table 5.3 the results of risk return relationship is given. There is no ARCH effect and autocorrelation in the residual of GARCH-M Model by using Engle et al (1982) LM ARCH test and Q-Statistic test respectively at 5 percent significant level. Conditional mean equation for Hub power Electricity Company which show that risk return relationship is positive and significant. Its mean that when risk of HUBCO electricity company increase by 1 percent the return on the HUBCO electricity company will increase by 22.07 percent. While the conditional variance equation which consists of ARCH and GARCH term. ARCH term show that if return of HUBCO Electricity Company increase by 1 percent the volatility of HUBCO electricity will be increased by 0.018 percent. And GARCH term show when lag of the risk is changed by 1 percent it will increase the risk by 0.94 percent.

Conditional mean equation for K-Electric Electricity Company which show that risk return relationship is positive and significant. Its mean that when risk increase by 1 percent the return of KE Electricity Company will increase by 7.33 percent. While the conditional variance equation which consists of ARCH and GARCH term. ARCH term show that if return of KE Electricity Company increase by 1 percent the volatility of asset will be increased by 0.21 percent. And GARCH term show when lag of the risk is changed by 1 percent it will increase the risk by 0.22 percent.

Conditional mean equation for Japan Power Generation Electricity Company which show that risk return relationship is negative and significant. As risk on JPGL Electricity Company increase by 1 percent the return of JPGL will decrease by 0.138 percent. While the conditional variance equation which consists of ARCH and GARCH term. ARCH term show that if return of JPGL electricity Company increase by 1 percent the volatility of JPGL Electricity Company will be increased by 0.14 percent. And

GARCH term show when lag of the risk is changed by 1 percent it will increase the risk by 0.42 percent.

From the results of GARCH-M Model which show in the above portion can conclude that Altern Power Company, Kohinoor and Sitara Energy follow GJR (1993) study which concluded that risk return relationship is positive and insignificant i-e investors are not taking risk on their investments. While Karachi Electric and Hub Power Co ltd show positive and significant risk return relationship. As risk increases investors increase their investments then automatically return will also increases. So, Karachi Electric Company of Pakistan follow Markowitz (1952), Sharpe (1964), Merton (1973) and Nyberg (2012) theory about risk return relationship. Japan Power Generation Company show negative risk return relationship i-e as risk increases investors decrease investment in the risky assets in the result return will also decreases. So investors of Hub Power Company are risk averse. While all the other remain Companies Ideal Energy, Southern Power Co ltd Tri-Star Power Company and S.G power Company show negative but insignificant results.

6. CONCLUSIONS AND FURTHER STUDY

Conclusions

The results of the study show that risk return relationship is not stable in case of electricity sector of Pakistan rather risk return relationship is a paradox. Most of the companies show insignificant risk return relationship such as, Ideal Energy (IDEN), Southern Power Co ltd (SEPCO), Tri-Star Power Company (TSPL) and S.G power Company (SGPL). While two companies Hub Power Co ltd (HUBCO) and Karachi Electric Company (KE) has significant and positive risk return relationship. Only Japan Power Generation (JPGL) has negative and significant relationship.

Further Study

- The two main issues of economic are impact of oil prices and monetary policy. So, suggestion for the further studies is that monetary policy through its indicator (Interest rate) can affect the return of the electricity sector of Pakistan.
- Oil prices and returns of the electricity sector may also affect each other. It is the other side of the dimension which can also be studies in future.

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