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Fallacy of OLS in End Distribution and Its Implication for Investment Decision

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ABSTRACT

The present study compares the Fama-French three factors coefficients estimates obtained from both OLS and quantile regression for 25 size-value sorted portfolios of BSE 500. The study empirical results, residual graphs and other plots confirm the inefficiency of OLS in end distribution estimation. Quintile regression reveals that the slope direction for all coefficients of predictor variables is not same across the quintiles and time. Finally study shows empirically that quantile regression estimates gives more comprehensive and clear picture of the varying effect of the predictors on the response variables to analyst or investors in making investment decision.

INTRODUCTION

To understand the risk return relationship researchers extensively uses different factor models. These factor models are generally linear in nature. Linear by nature means dependent and independent variable of those factors are linearly related. OLS method is used in most of these studies to model the independent variables (various risk factors) for a dependent variable return. The investors and the risk managers are more interested in the tailed value of the distributions. OLS mainly based on the mean values of the covariates and is not efficient in evaluating the tailed distributions. For evaluating these extremes of the distribution Quantile regression is better than OLS. In this paper 25 size-value sorted portfolios returns analysed that are obtained from Fama-French (1993) model using the both OLS and Quantile regression.

METHEDOLOGY

Fama-French three factor models as discussed below:

$$R_{Pt} - R_{Ft} = a + b\,(R_{Mt}-R_{Ft}) + s\,SMB_t + l\,LMH_t + e_t$$

Where,

SMB mimics the risk factor in returns considering size

LMH mimics the risk factor in returns considering value

s and l are the portfolio's responsiveness to (sensitivity coefficients) SMB and LMH factors respectively.

QUANTILE REGRESSION

Linear regression represents the linear relationship between the dependent and in dependent variables with an error term in it. OLS estimates conditional mean value of the dependable variable for the given independent variables. OLS loses its effectiveness particularly in the extreme of the distributions or tailed analysis. Koenker and Bassett (1978) introduce Quantile regression, which is based on the conditional Quantile functions. Quantile regression estimates the conditional median or the conditional quartile of the dependable variables for the given independent variables.

Titled absolute value function $\varrho_T(*)$ is shown in the below figure that gives the τth quantile

sample solutions. After calculating the directional derivatives (right and left direction) for objective function with respect to the ξ, the optimal problem will yield the sample quintiles as its solutions.

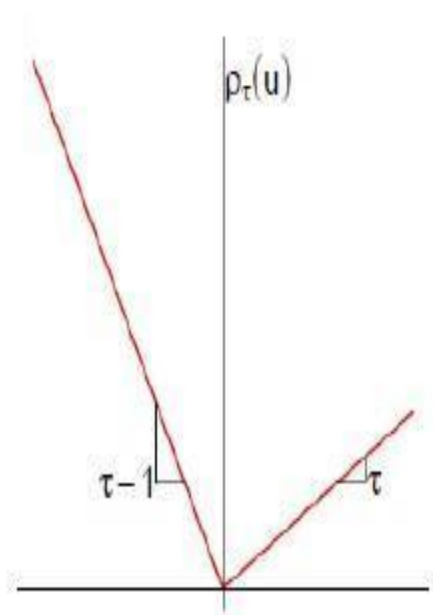


Figure No. 1: Quantile regression

SAS CODE USED

For OLS, descriptive statistics, graphics and quantile regression

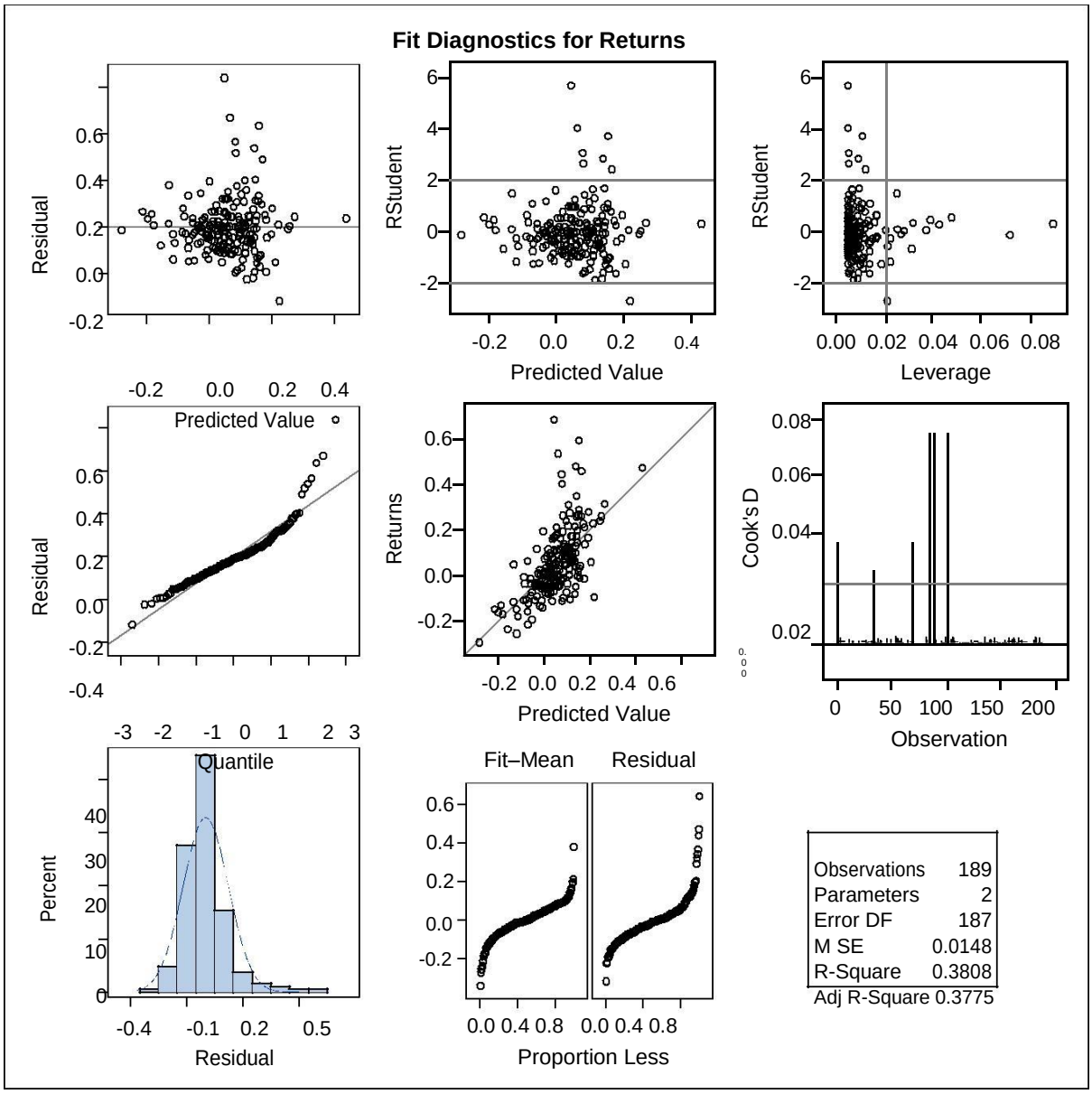
```
data sreg;
input Returns BetaReturns Beta Alpha;
CARDS;
(data)
Returns          Beta
run;
title "sreg data";
PROC PRINT DATA=sreg(obs=190); run;
PROC FREQ DATA=sreg; TABLES Returns;
RUN;
Proc Freq data=sreg; Tables Beta;
Run;
PROC univariate data=sreg; Var Beta;
Run;
Proc reg data=sreg; model Returns = Beta; run;
run;
ods graphics on; proc reg data=sreg;
        model Returns = Beta; run;

proc quantreg data=bmimen algorithm=interior ci=resampling; model logreturn = (call the function
quantile regression)
/ diagnostics cutoff=4.5 quantile=.5; id seqn rm smb lmh;
run;
```

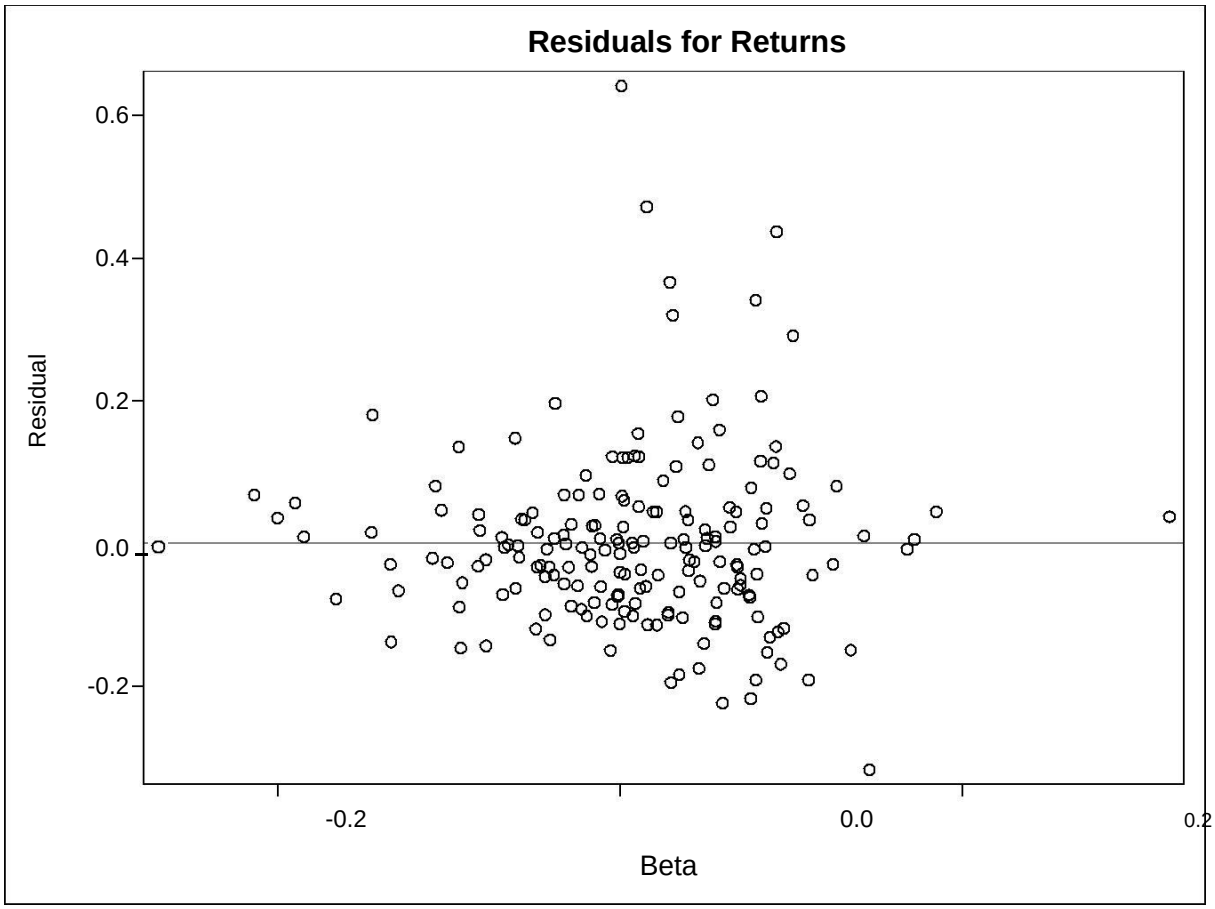
FEW SAS OUTPUT

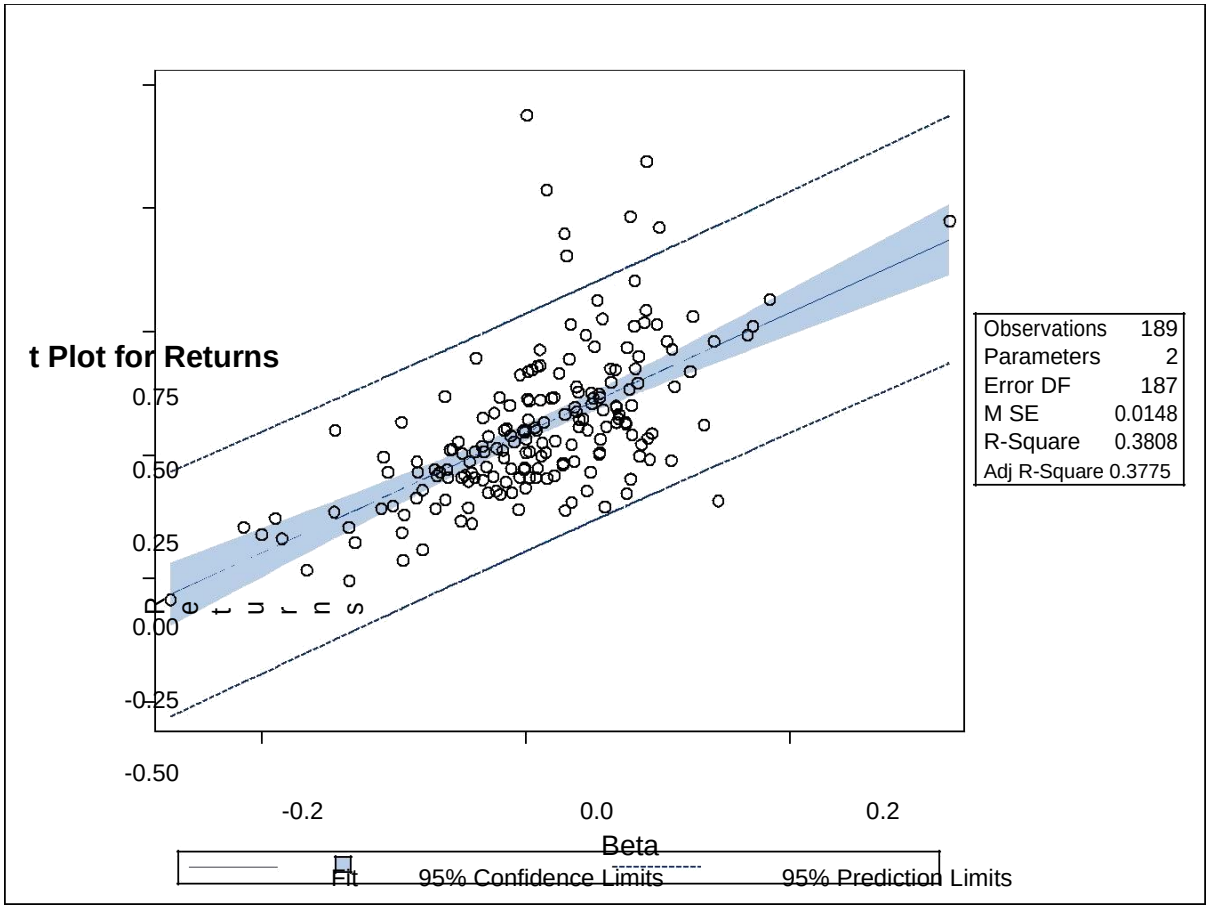
Moments			
N	190	**Sum Weights**	190
Mean	0.00864226	**Sum Observations**	1.64202947
Std Deviation	0.0784179	**Variance**	0.00614937
Skewness	-0.2730338	**Kurtosis**	1.74204372
Uncorrected SS	1.17642119	**Corrected SS**	1.16223035
Coeff Variation	907.377189	**Std Error Mean**	0.00568903

Basic Statistical Measures			
Location		**Variability**	
Mean	0.008642	**Std Deviation**	0.07842
Median	0.010309	**Variance**	0.00615
Mode	.	**Range**	0.59060
		Interquartile Range	0.09298

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	1.519109	**Pr > |t|**	0.1304
Sign	**M**	14	**Pr >= |M|**	0.0499
Signed Rank	**S**	1595.5	**Pr >= |S|**	0.0352


Fit Diagnostics for Returns
Residual
RStudent
Predicted Value
Leverage
Returns
Cook's D
Observation
Percent
Quantile
Fit–Mean
Residual
Proportion Less
Observations 189
Parameters 2
Error DF 187
M SE 0.0148
R-Square 0.3808
Adj R-Square 0.3775


Residuals for Returns
Residual
0.6
0.4
0.2
0.0
-0.2
-0.2
0.0
0.2
Beta



CONCLUSION

The study finds that the estimates for the coefficients of the independent variables from OLS and quantile regressions are significantly different. Further residual graphs plot of both OLS and quintile regression confirms better model fit for the quintile regression at 0.05 & 0.95 quantiles. Then year wise surface graph plot across the quantiles reveals the slope direction for all coefficients across the quintiles and time are not same. Frequencies are also changes rapidly from positive to negative while moving towards the higher quintiles and vice versa for all predictor variables (independent variables). Finally study shows how one can make mistake in investment decision, relying on OLS estimates. Hence, the present study will help analysts and investors by providing more significant insight about the varying effect of the predictor variables over different quantile in making investment decision and maximising returns.

REFERENCES

Koenker, Roger W and Bassett, Gilbert, Jr, (1978), "Regression Quantiles," *Econometrica*, Econometric Society, vol. 46(1), pages 33-50,

ACKNOWLEDGMENTS

I ACKNOWLEDGE PONDICHERRY UNIVERSITY LIBRARY FOR PROVIDING ACCESS TO THE BLOOMBERG TERMINAL.

RECOMMENDED READING

- *Base SAS® Procedures Guide*
- *SAS® For Dummies®*

CONTACT INFORMATION

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