Q7_EGARCH

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Read and prepare data

```
data = read.csv("m-gmsp5008.txt", sep="")
log_ret = log(data$gm + 1)
```

Q7.a As omega term is not statistically different from 0 with 95% confidence level, we should remove it

from the model.

```
##
## Title:
##  GARCH Modelling
##
## Call:
##  garchFit(formula = ~garch(1, 1), data = log_ret, cond.dist = "norm",
##     trace = FALSE)
##
## Mean and Variance Equation:
##  data ~ garch(1, 1)
## <environment: 0x0000022f7361ca20>
##  [data = log_ret]
##
## Conditional Distribution:
##  norm
##
## Coefficient(s):
##         mu       omega      alpha1       beta1
## 0.00900750  0.00012171  0.11593859  0.87379548
##
## Std. Errors:
##  based on Hessian
##
## Error Analysis:
##         Estimate  Std. Error  t value Pr(>|t|)
## mu     9.007e-03   2.403e-03    3.748 0.000178 ***
## omega  1.217e-04   6.547e-05    1.859 0.063032 .
## alpha1 1.159e-01   2.620e-02    4.424 9.67e-06 ***
## beta1  8.738e-01   2.889e-02   30.244  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Log Likelihood:
##  871.0899    normalized:  1.230353
##
## Description:
##  Tue Sep 24 01:11:17 2024 by user: kamin
##
##
## Standardised Residuals Tests:
##                                 Statistic      p-Value
##  Jarque-Bera Test   R    Chi^2  32.4120956 9.158047e-08
##  Shapiro-Wilk Test  R    W       0.9907205 1.953336e-04
##  Ljung-Box Test     R    Q(10)  12.4098555 2.585622e-01
##  Ljung-Box Test     R    Q(15)  18.4305926 2.407049e-01
##  Ljung-Box Test     R    Q(20)  22.7911177 2.991671e-01
##  Ljung-Box Test     R^2  Q(10)   7.8147719 6.469241e-01
##  Ljung-Box Test     R^2  Q(15)  17.3922734 2.959600e-01
##  Ljung-Box Test     R^2  Q(20)  21.0500231 3.941935e-01
```

```
##  LM Arch Test       R    TR^2   12.9239126 3.745952e-01
##
## Information Criterion Statistics:
##       AIC       BIC       SIC      HQIC
## -2.449407 -2.423630 -2.449470 -2.439448
```

Q7.b As the estimated shape v = 9.418 with S.E. = 2.968, the t-statistic of v = (9.418-6)/2.968 = 1.15, meaning we do not have enough evidence to reject

the null hypothesis.

```
##
## Title:
##  GARCH Modelling
##
## Call:
##  garchFit(formula = ~garch(1, 1), data = log_ret, cond.dist = "std",
##     trace = FALSE)
##
## Mean and Variance Equation:
##  data ~ garch(1, 1)
## <environment: 0x0000022f6e01d1a0>
##  [data = log_ret]
##
## Conditional Distribution:
##  std
##
## Coefficient(s):
##         mu       omega      alpha1       beta1       shape
## 0.00865507  0.00012626  0.10419690  0.88243502  9.41766418
##
## Std. Errors:
##  based on Hessian
##
## Error Analysis:
##         Estimate  Std. Error  t value Pr(>|t|)
## mu     8.655e-03   2.365e-03    3.659 0.000253 ***
## omega  1.263e-04   8.067e-05    1.565 0.117530
## alpha1 1.042e-01   2.820e-02    3.694 0.000220 ***
## beta1  8.824e-01   3.445e-02   25.612  < 2e-16 ***
## shape  9.418e+00   2.968e+00    3.173 0.001506 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Log Likelihood:
##  878.5255    normalized:  1.240855
##
## Description:
##  Tue Sep 24 01:11:17 2024 by user: kamin
##
##
## Standardised Residuals Tests:
##                                 Statistic      p-Value
##  Jarque-Bera Test   R    Chi^2  34.5900312 3.082266e-08
##  Shapiro-Wilk Test  R    W       0.9903888 1.405864e-04
##  Ljung-Box Test     R    Q(10)  12.5128156 2.521998e-01
##  Ljung-Box Test     R    Q(15)  18.6085727 2.320224e-01
##  Ljung-Box Test     R    Q(20)  22.8862925 2.944123e-01
##  Ljung-Box Test     R^2  Q(10)   7.6305822 6.648705e-01
##  Ljung-Box Test     R^2  Q(15)  17.0412728 3.164031e-01
```

```
##  Ljung-Box Test     R^2  Q(20)  20.5284044 4.253417e-01
##  LM Arch Test       R    TR^2   12.7715378 3.858627e-01
##
## Information Criterion Statistics:
##       AIC       BIC       SIC      HQIC
## -2.467586 -2.435366 -2.467685 -2.455138
```

Q7.c As the fitted model indicates no significance for omega term, we should exclude it and the rest

parameters should work fine.

```
##
## *---------------------------------*
## *          GARCH Model Fit        *
## *---------------------------------*
##
## Conditional Variance Dynamics
## -----------------------------------
## GARCH Model  : eGARCH(1,1)
## Mean Model   : ARFIMA(0,0,0)
## Distribution : norm
##
## Optimal Parameters
## ------------------------------------
##         Estimate  Std. Error  t value Pr(>|t|)
## mu      0.007670    0.002247   3.4140 0.000640
## omega  -0.098527    0.054398  -1.8112 0.070104
## alpha1 -0.049594    0.023040  -2.1525 0.031360
## beta1   0.980054    0.010190  96.1812 0.000000
## gamma1  0.208773    0.039654   5.2648 0.000000
##
## Robust Standard Errors:
##         Estimate  Std. Error  t value Pr(>|t|)
## mu      0.007670    0.002268   3.3820 0.000720
## omega  -0.098527    0.055444  -1.7770 0.075562
## alpha1 -0.049594    0.028472  -1.7418 0.081536
## beta1   0.980054    0.010012  97.8898 0.000000
## gamma1  0.208773    0.040887   5.1061 0.000000
##
## LogLikelihood : 875.4198
##
## Information Criteria
## ------------------------------------
##
## Akaike       -2.4588
## Bayes        -2.4266
## Shibata      -2.4589
## Hannan-Quinn -2.4464
##
## Weighted Ljung-Box Test on Standardized Residuals
## ------------------------------------
##                         statistic p-value
## Lag[1]                      1.896  0.1685
## Lag[2*(p+q)+(p+q)-1][2]     2.035  0.2569
## Lag[4*(p+q)+(p+q)-1][5]     2.945  0.4173
## d.o.f=0
## H0 : No serial correlation
##
## Weighted Ljung-Box Test on Standardized Squared Residuals
## ------------------------------------
```

```
##                         statistic p-value
## Lag[1]                    0.07287  0.7872
## Lag[2*(p+q)+(p+q)-1][5]   1.26279  0.7979
## Lag[4*(p+q)+(p+q)-1][9]   3.08547  0.7448
## d.o.f=2
##
## Weighted ARCH LM Tests
## ------------------------------------
##             Statistic Shape Scale P-Value
## ARCH Lag[3]    0.1641 0.500 2.000  0.6854
## ARCH Lag[5]    2.0108 1.440 1.667  0.4689
## ARCH Lag[7]    3.2833 2.315 1.543  0.4617
##
## Nyblom stability test
## ------------------------------------
## Joint Statistic:  1.3874
## Individual Statistics:
## mu     0.28651
## omega  0.29730
## alpha1 0.22991
## beta1  0.23614
## gamma1 0.04683
##
## Asymptotic Critical Values (10% 5% 1%)
## Joint Statistic:          1.28 1.47 1.88
## Individual Statistic:     0.35 0.47 0.75
##
## Sign Bias Test
## ------------------------------------
##                    t-value   prob sig
## Sign Bias           0.9929 0.3211
## Negative Sign Bias  0.3911 0.6958
## Positive Sign Bias  0.2153 0.8296
## Joint Effect        3.8985 0.2726
##
##
## Adjusted Pearson Goodness-of-Fit Test:
## ------------------------------------
##   group statistic p-value(g-1)
## 1    20     19.74      0.41037
## 2    30     27.68      0.53518
## 3    40     50.42      0.10410
## 4    50     70.39      0.02423
##
##
## Elapsed time : 0.09939599
```