

In this problem set, I am interested in testing whether GARCH model is realistic in analyzing stock return variance. The most commonly used version of GARCH model assumes that the stock return volatility for a given day is related to the stock return and the variance of the stock return in the previous day with an error term from a normal distribution. The model is as the following:

$$\sigma_t^2 = \omega + \alpha r_{t-1}^2 + \beta \sigma_{t-1}^2 + \epsilon_t \quad (1)$$

If the reality is close to what the model suggests, I should see a significant α and β as well as a insignificant ω . I want to test the significance of the parameters in such GARCH model to tell if this version of GARCH model makes sense in real life. So, I first scrapped a list of the most actively traded stocks on Nasdaq because the price data for these firms are least contaminated by abnormal trading activities. Then, I read the stock prices from Google Finance from 14 August, 201 to 13 November, 2017. Lastly, I analyzed the variances of the 20 companies stock returns. The p-values for the coefficients of the GARCH model are presented below.

p-values	ROKU	MAT	JD	MU	SIRI	SGYP	QCOM	INTC	NKTR	AAPL	CMCSA	NVDA	NVFX	CSCO	TVIX	WBA	QQQ	MSFT	ENDP	XNET
ω	0.162054	0.133275	1.000000e+00	0.119935	0.006172	0.171380	0.191738	0.000000	0.374707	0.000000	0.003012	0.009344	0.196678	0.000000	3.270498e-01	0.140633	0.000000e+00	0.000000e+00	0.981363	0.690995
α	0.397775	0.154340	1.000000e+00	1.000000	1.000000	0.551914	0.285348	1.000000	0.203502	1.000000	1.000000	0.205674	0.136573	0.999999	1.000000e+00	0.653389	9.998455e-01	1.000000e+00	1.000000	0.408368
β	0.005137	1.000000	2.209084e-15	0.151965	1.000000	0.422063	0.005347	0.000166	0.046418	0.049059	1.000000	0.163230	1.000000	0.000002	3.467206e-11	1.000000	1.071377e-100	4.420046e-96	0.880381	0.000779

Table 1: P-values for Coefficients in the GARCH Model

From the table, we can see that the coefficients of the majority of stocks returns are insignificant. In detail, 8 companies' ω , the intercept of the model, are significant. This means that contrary to the model assumptions, some of the variations of a given day's stock return cannot be explained by the proposed factors in the model. In terms of α , none of the alpha's is significant, which presents the greatest challenge to the model because the model maintains that σ_t can be explained by r_{t-1}^2 . Lastly, 10 companies' betas are insignificant. Along with the results for the other two coefficients, this shows that in a sample of 20 companies, this version of GARCH model can not offer good explanation for the returns' volatility. This is a caveat for practitioners who use this version of GARCH model.