포트폴리오의 수익률 과정 추정

금융통계 중간과제

통계학과 2018580028 정세린

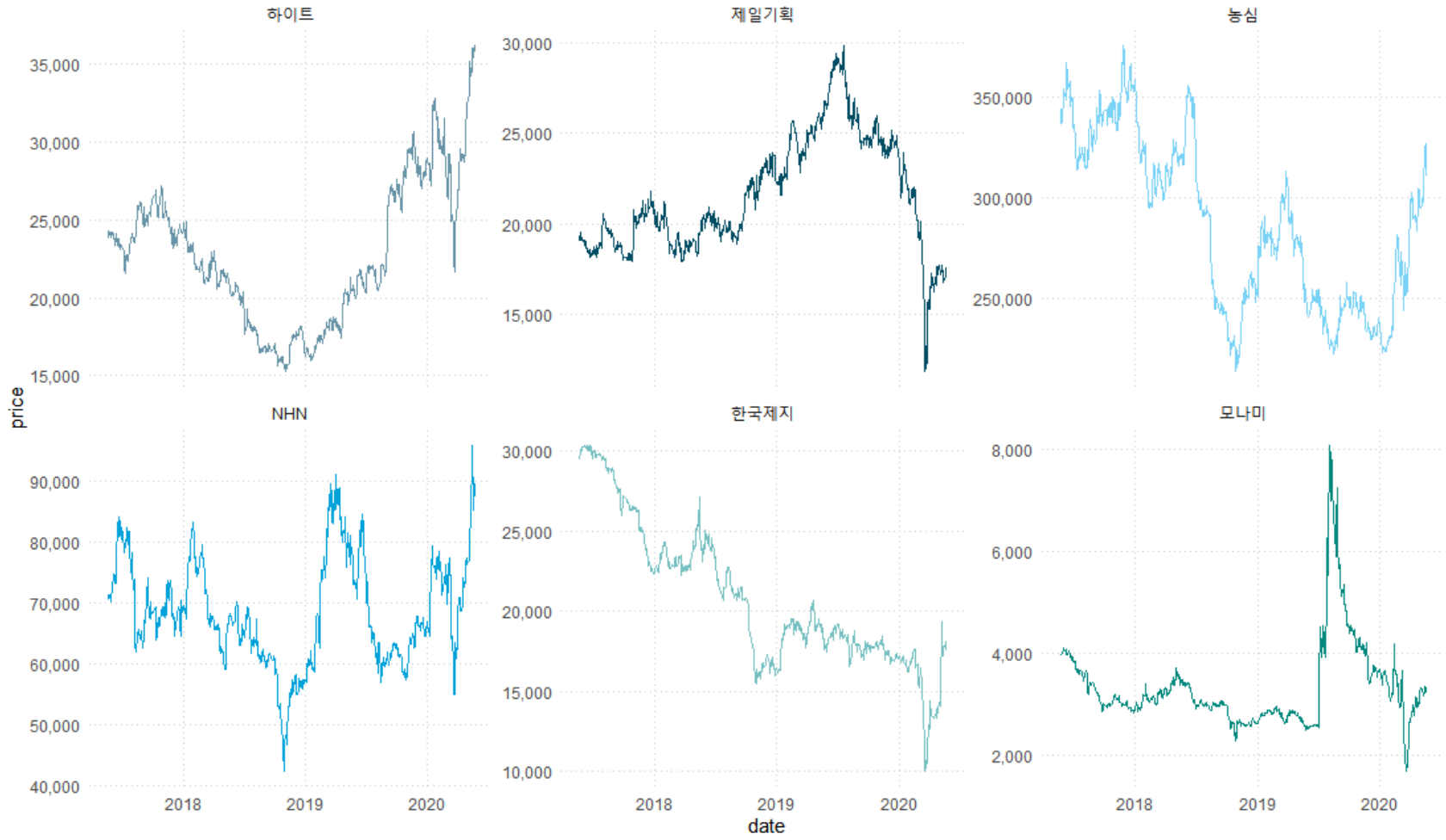
포트폴리오 소개

- 기간 : 2017년 5월 23 ~ 2020년 5월 20일

- 구성 종목 : 하이트진로, 제일기획, 농심, NHN, 한국제지 , 모나미
  (데이터 출처 : 한국거래소)

- $V_{P,t} = 42 \times S_{1,t} + 52 \times S_{2,t} + 3 \times S_{3,t} + 14 \times S_{4,t} + 34 \times S_{5,t} + 253 \times S_{6,t}$

포트폴리오 소개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2018
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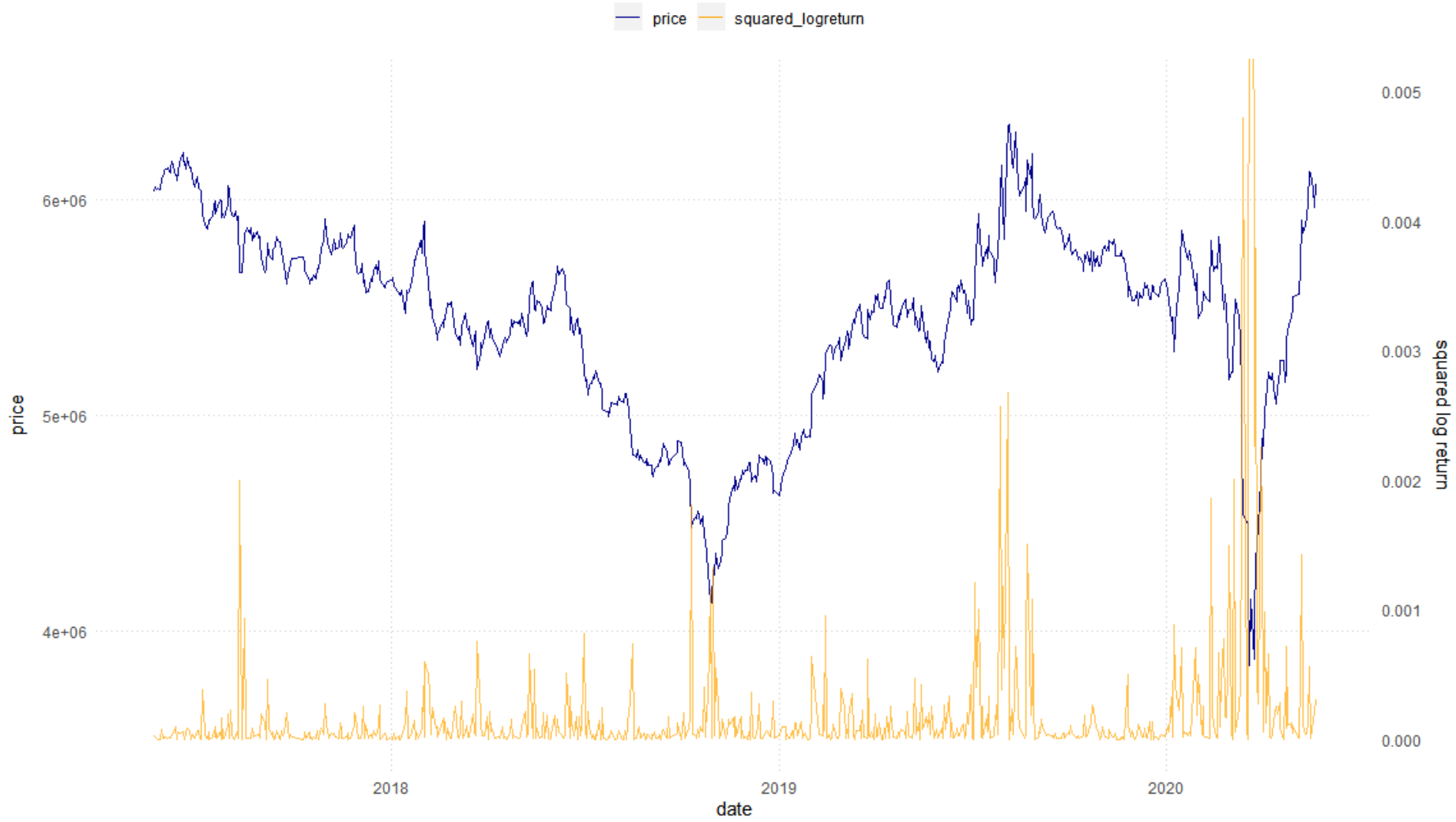
2020

포트폴리오 소개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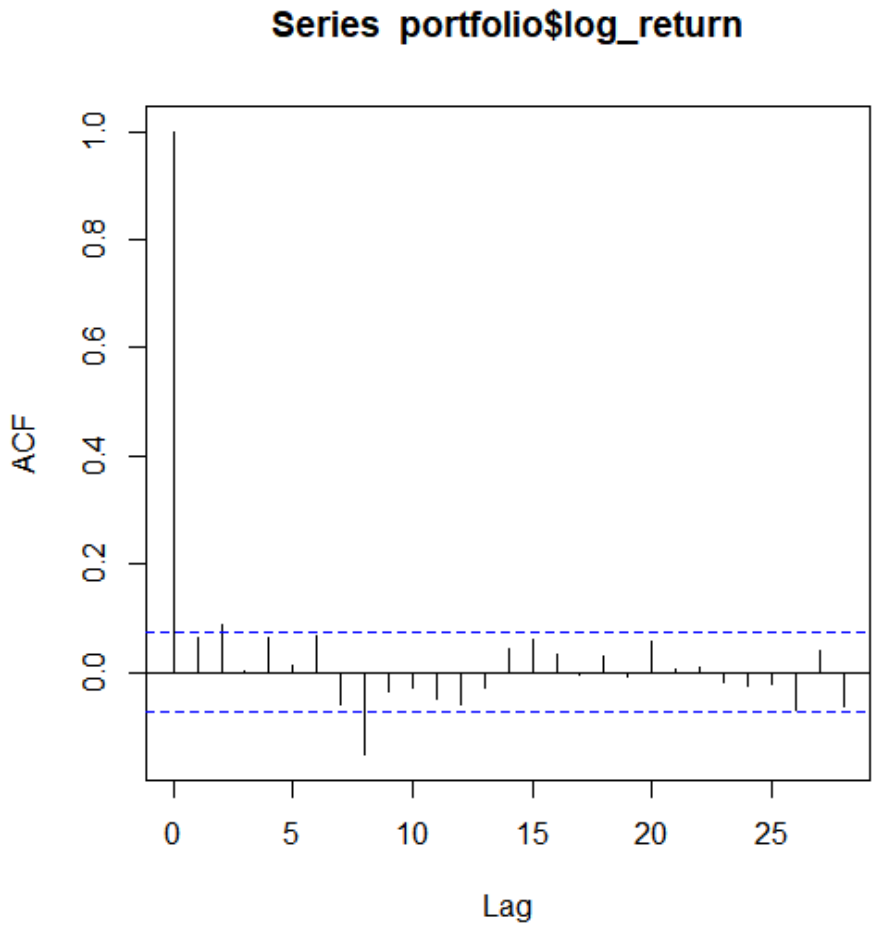
포트폴리오 소개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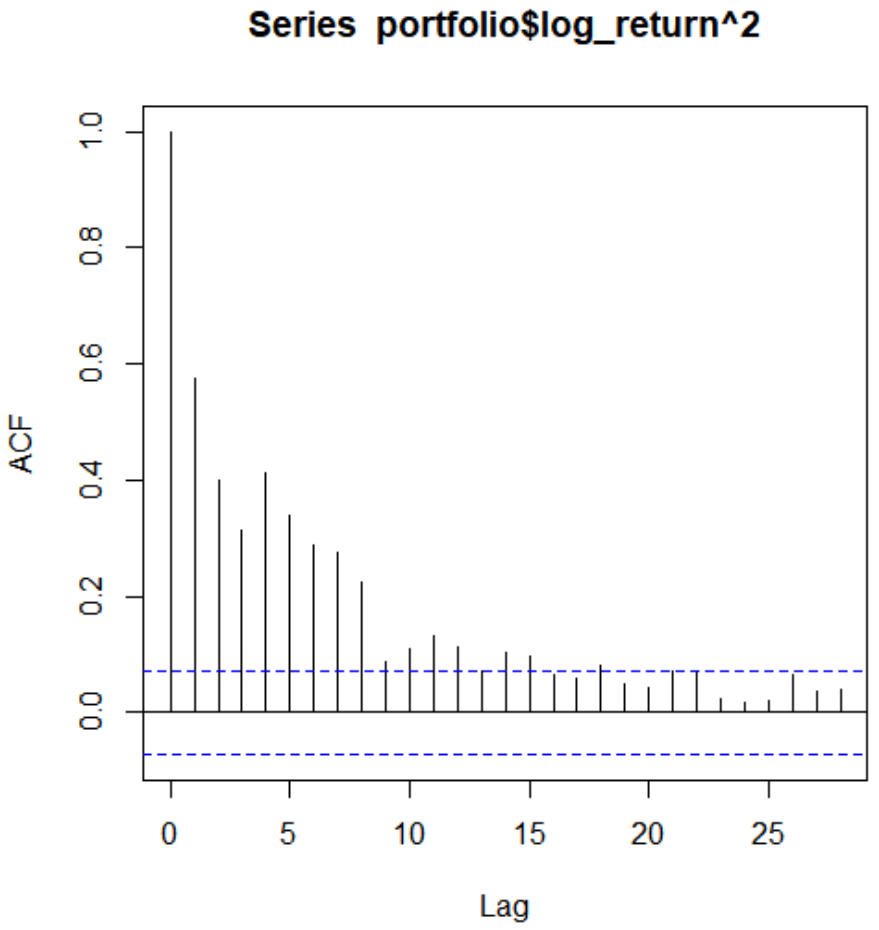
Lag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25
Lag

모형 적합

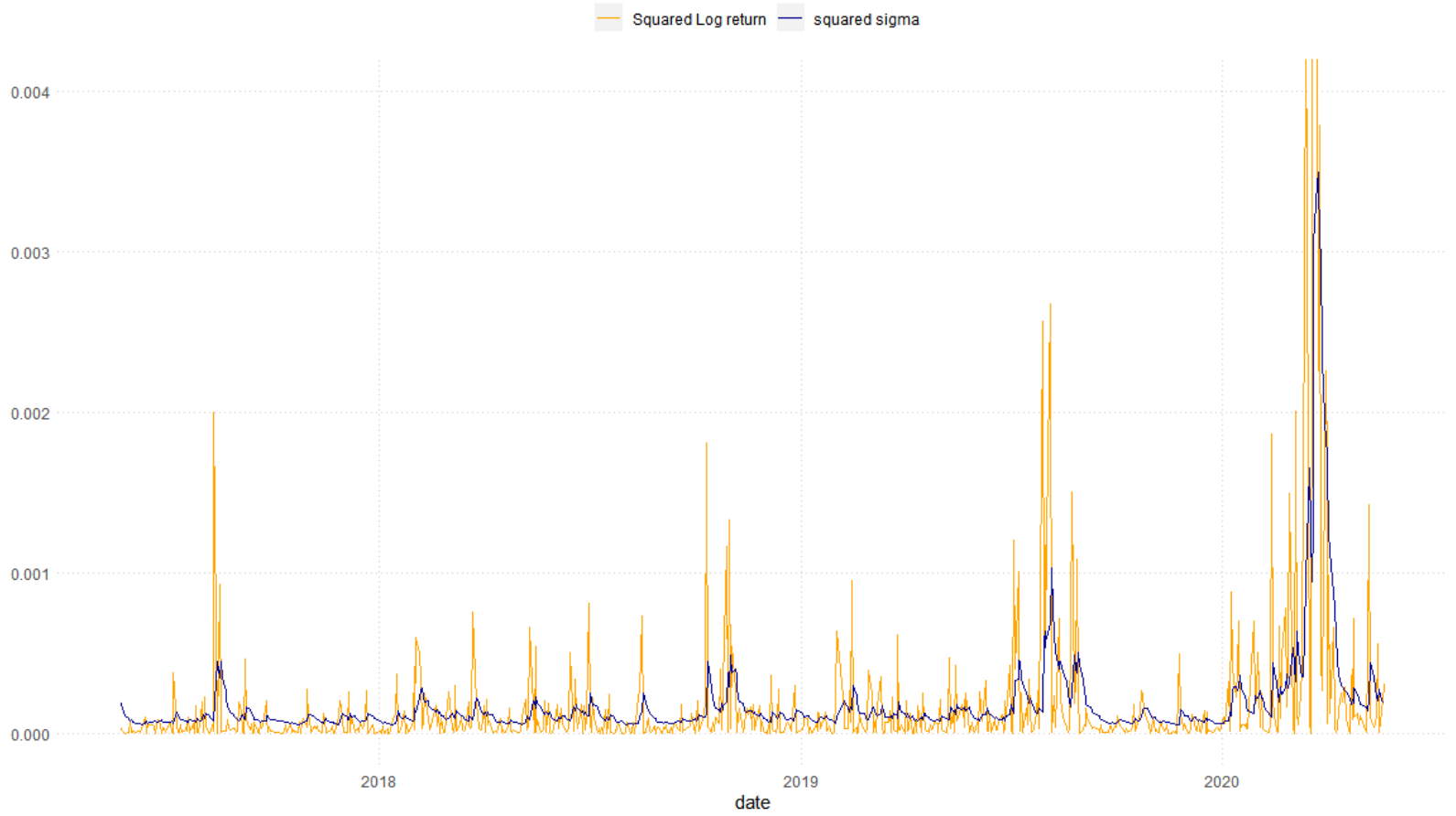
- 포트폴리오의 로그 수익률 과정을
  Garch(1, 1), GJR-Garch(1, 1), E-Garch(1, 1) 모형에 각각 적합한다.

- 먼저 Noise(ϵ_t)가 i.i.d.하게 표준정규분포를 따른다고 가정, 모형을 적합한다.

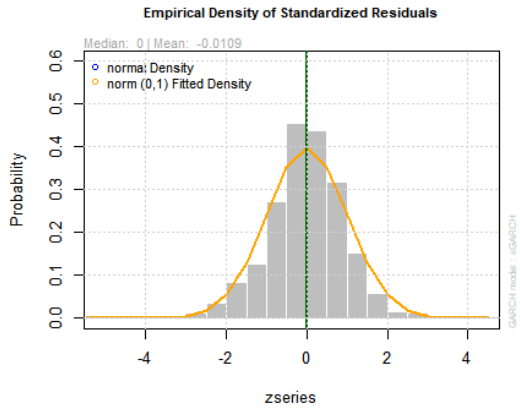
Garch(1, 1) : standard normal distribution

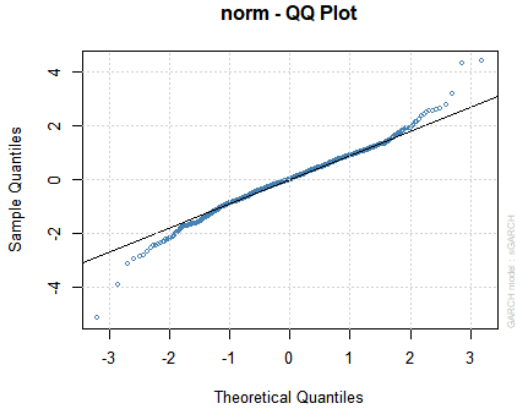
$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ N(0,1)$

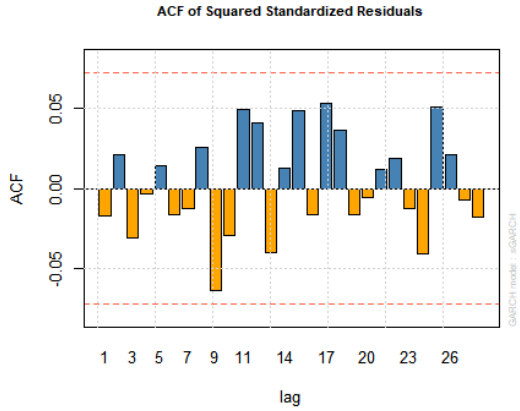
$\sigma_t{}^2 = 1.097 \times 10^{-5} + 0.192 R_{t-1} + 0.744 \sigma^2{}_{t-1}$



Garch(1, 1) : standard normal distribution







* Normality tests on the residuals

Normality test	Statistic	p-value
Kolmogorov-Smirnov	$D = 0.043$	0.003
Shapiro-Wilk	$W = 0.980$	2.085×10^{-8}
Jarque-Bera	$JB = 139.85$	$< 2.2 \times 10^{-16}$
Anderson-Darling	$A = 2.341$	6.246×10^{-6}

* Ljung - Box test on the squared residuals

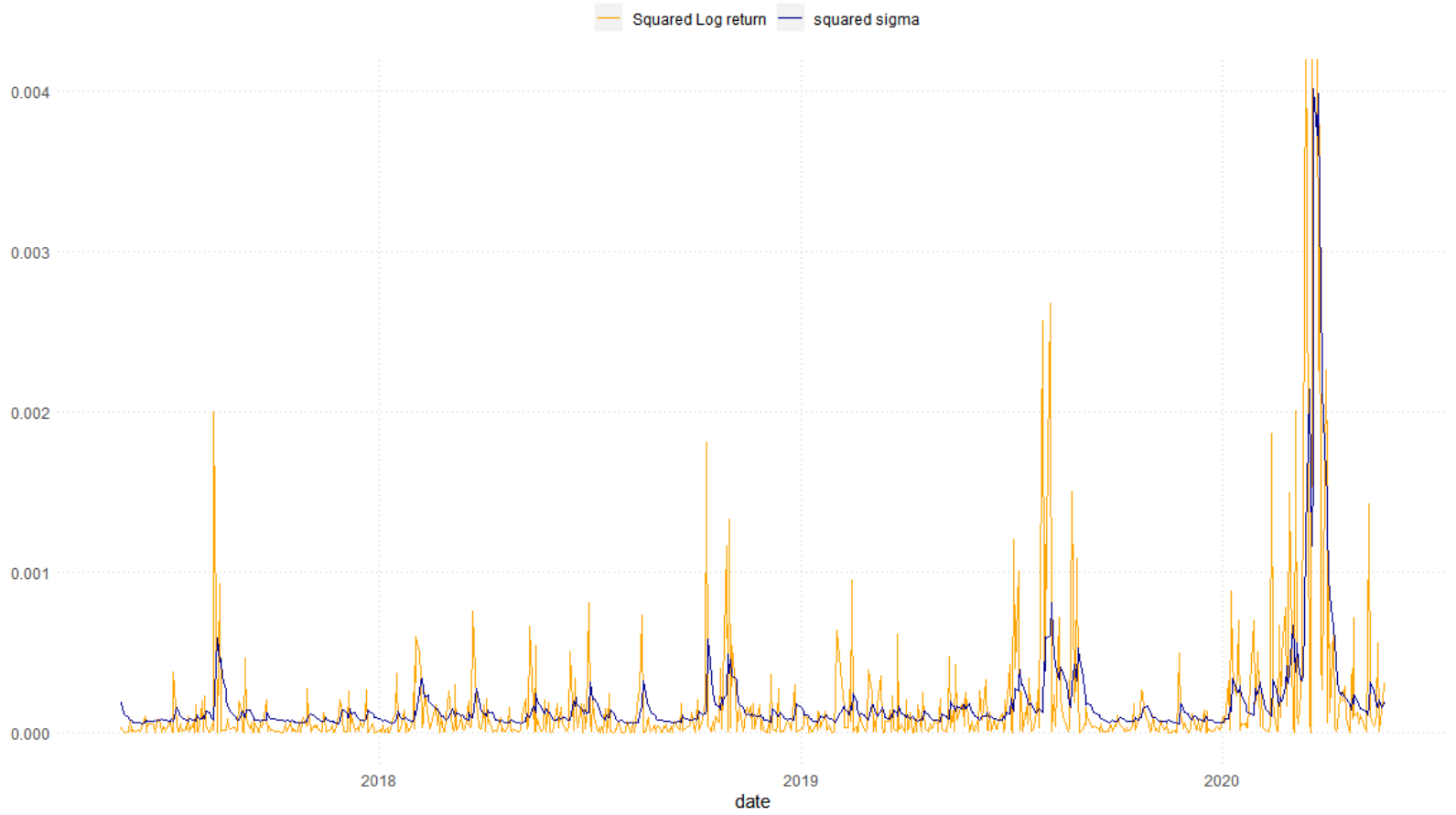
Lag	Statistic	p-value
5	1.323	0.922
10	5.870	0.826
15	12.064	0.674
20	15.646	0.738
25	19.383	0.778
30	21.945	0.856

* Ljung - Box test : 자기상관계수가 0인지(독립적으로 분포되어 있는지) 검정한다.

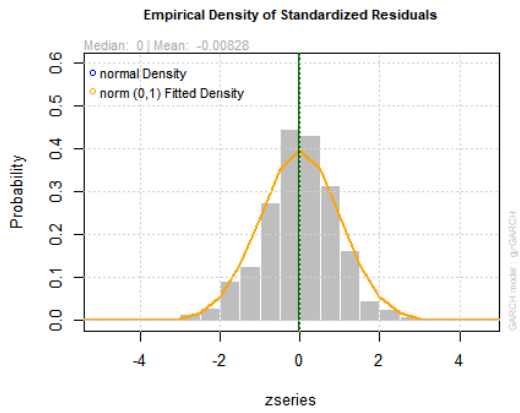
GJR−Garch(1, 1) : standard normal distribution

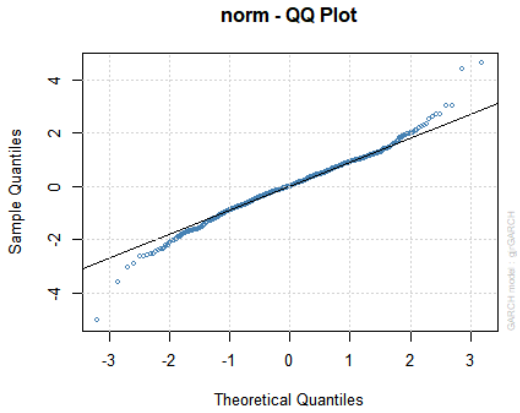
$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ N(0,1)$

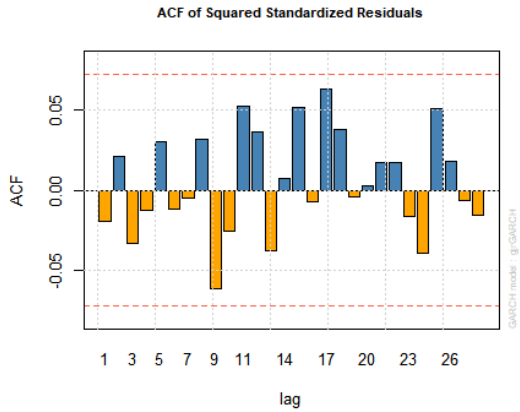
$\sigma_t{}^2 = 1.249 \times 10^{-5} + 0.133(1 + 0.127 I_{t-1}) R_{t-1} + 0.727 \sigma_{t-1}{}^2$



GJR-Garch(1, 1) : standard normal distribution







* Normality tests on the residuals

Normality test	Statistic	p-value
Kolmogorov-Smirnov	$D = 0.040$	0.007
Shapiro-Wilk	$W = 0.982$	7.605×10^{-8}
Jarque-Bera	$JB = 123.84$	$< 2.2 \times 10^{-16}$
Anderson-Darling	$A = 2.070$	2.88×10^{-5}

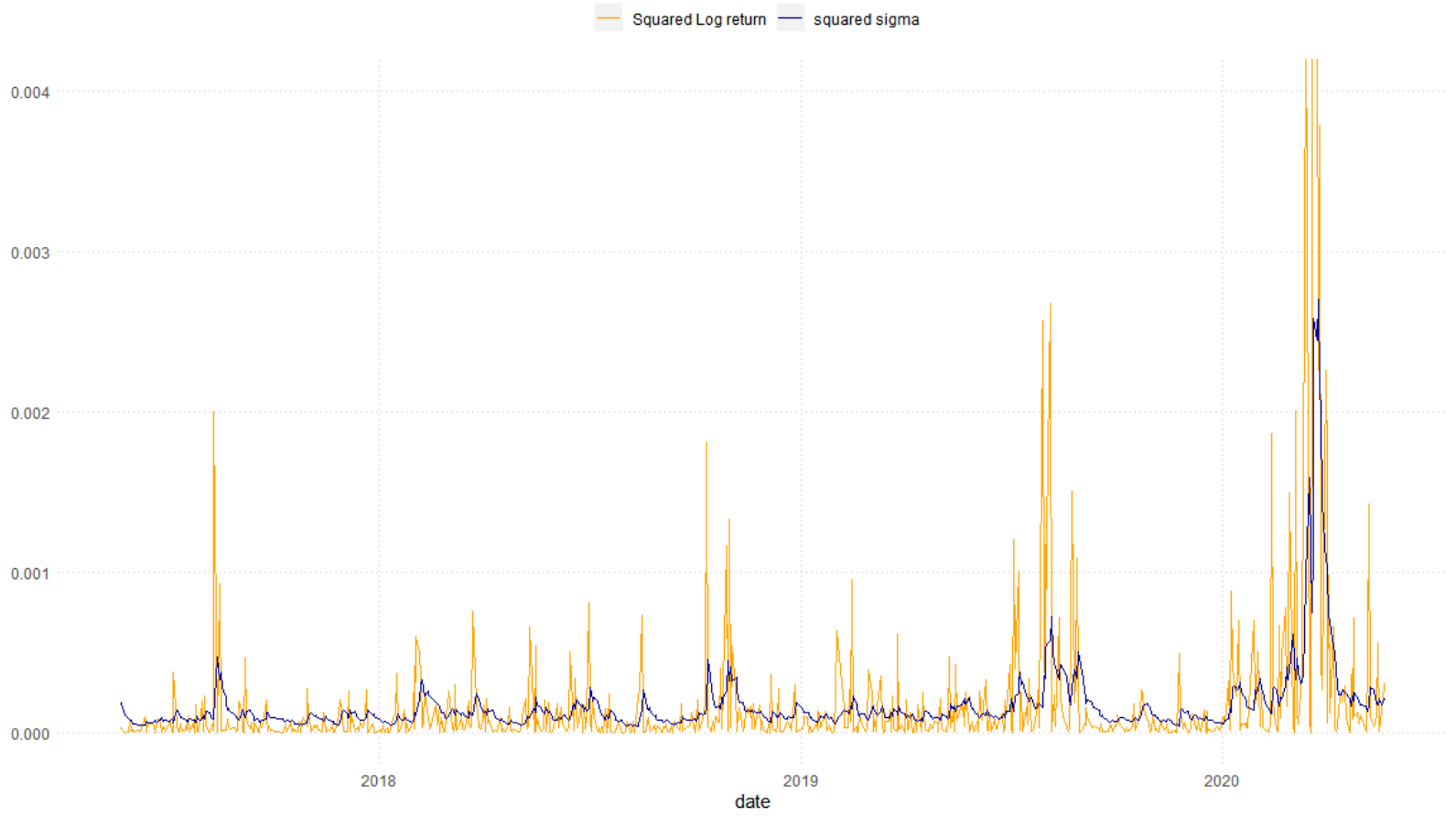
* Ljung - Box test on the squared residuals

Lag	Statistic	p-value
5	2.211	0.819
10	6.042	0.781
15	12.61	0.632
20	16.792	0.666
25	20.615	0.714
30	23.049	0.813

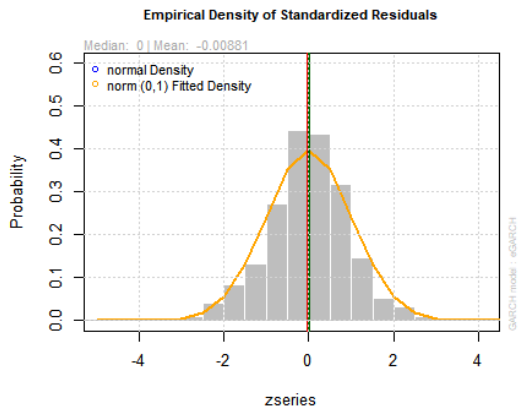
E-Garch(1, 1) : standard normal distribution

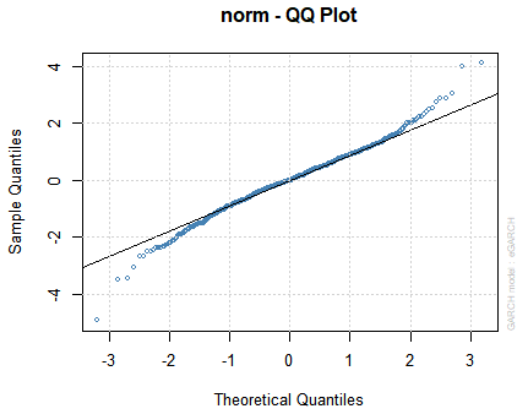
$$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ N(0,1)$$

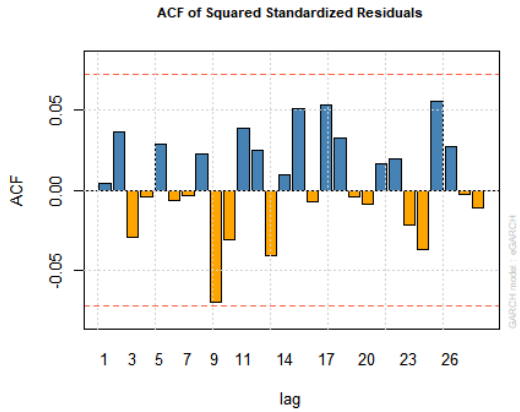
$$\log {\sigma_t}^2 = -0.618 - 0.063\epsilon_{t-1} + 0.334(|\epsilon_{t-1}| - E[|\epsilon_{t-1}|]) + 0.930 \log {\sigma_{t-1}}^2$$



E-Garch(1, 1) : standard normal distribution







* Normality tests on the residuals

Normality test	Statistic	p-value
Kolmogorov-Smirnov	$D = 0.044$	0.002
Shapiro-Wilk	$W = 0.985$	5.76×10^{-7}
Jarque-Bera	$JB = 90.586$	$< 2.2 \times 10^{-16}$
Anderson-Darling	$A = 2.071$	2.86×10^{-5}

* Ljung - Box test on the squared residuals

Lag	Statistic	p-value
5	1.753	0.882
10	6.559	0.766
15	11.408	0.723
20	14.444	0.807
25	18.885	0.803
30	21.622	0.867

모형 적합

- Ljung-Box test를 진행한 결과 세 모형 모두에서 귀무가설을 채택한다.
  따라서 각각의 모형에서 $\{(R_t/\hat{\sigma}_t)^2\}$은 independent sequence이다.

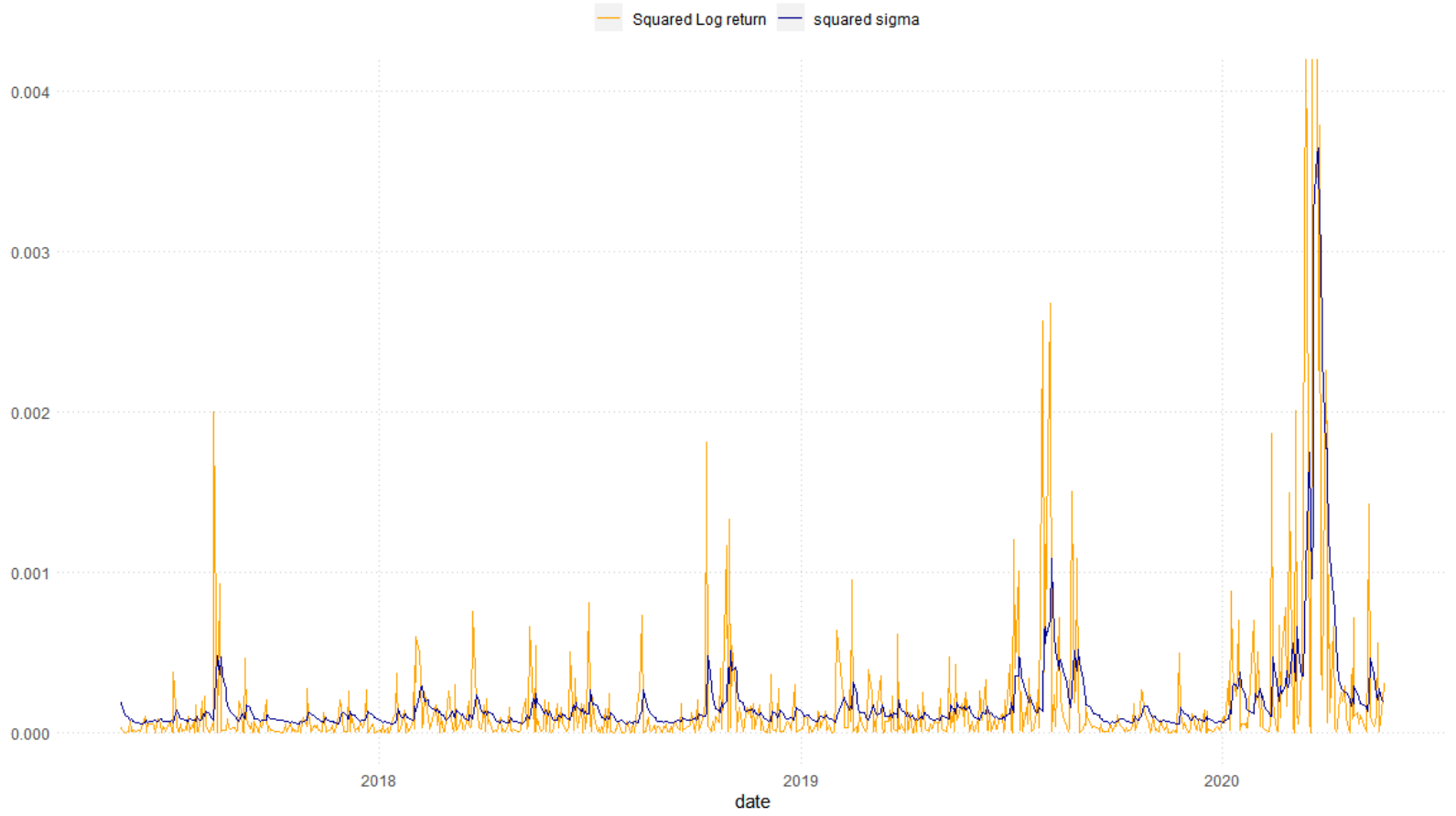
- 정규성 검정을 진행한 결과, 세 모형 모두 $(R_t/\hat{\sigma}_t)$가 표준정규분포를 따르지 않는다. 따라서 Noise가 표준정규분포를 따른다는 가정은 잘못되었다.

- Noise(ϵ_t)가 i.i.d.하게 standardized t분포를 따른다고 가정, 모형을 적합한다.

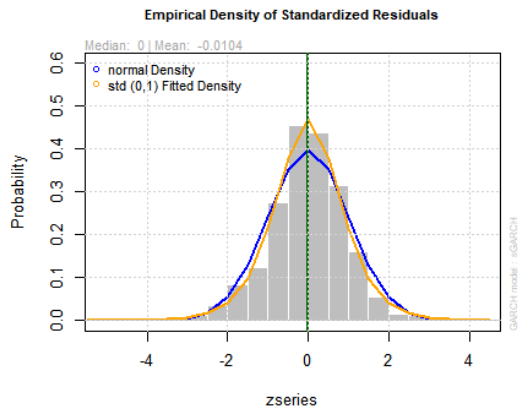
Garch(1, 1) : standardized t distribution

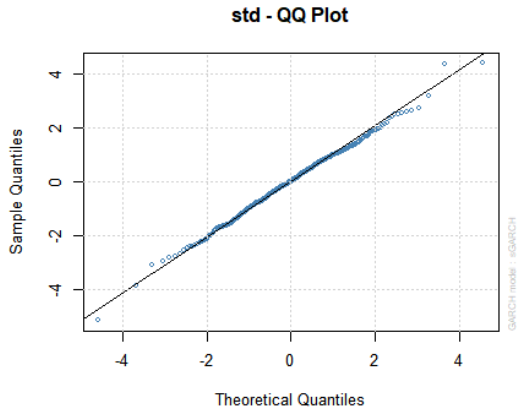
$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ standardized\ t_{6.020}$

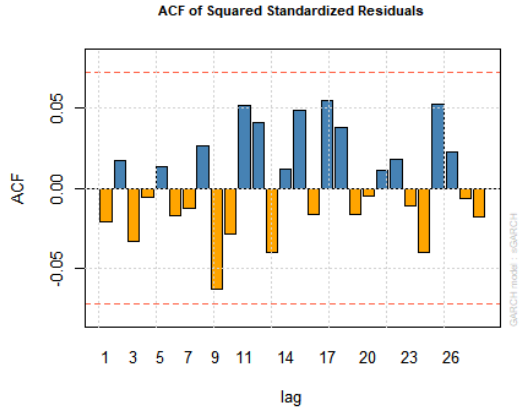
$\sigma_t{}^2 = 1.175 \times 10^{-5} + 0.207 R_{t-1} + 0.728 \sigma^2{}_{t-1}$



Garch(1, 1) : standardized t distribution







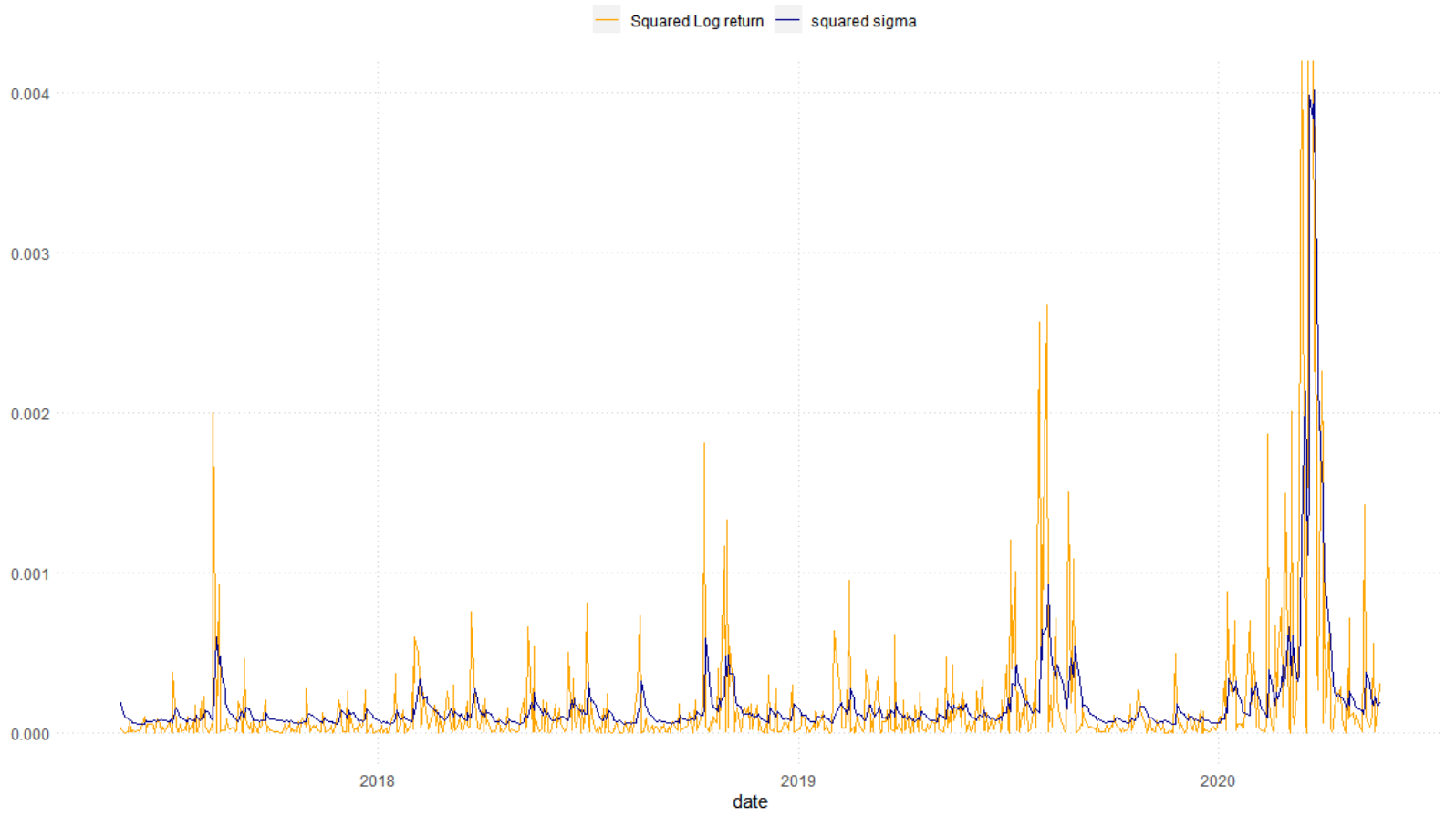
* Ljung - Box test on the squared residuals

Lag	Statistic	p-value
5	1.508	0.912
10	5.898	0.824
15	12.264	0.659
20	16.05	0.714
25	19.838	0.755
30	22.393	0.839

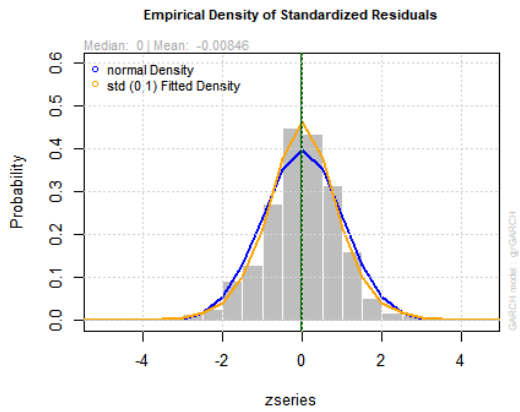
GJR−Garch(1, 1) : standardized t distribution

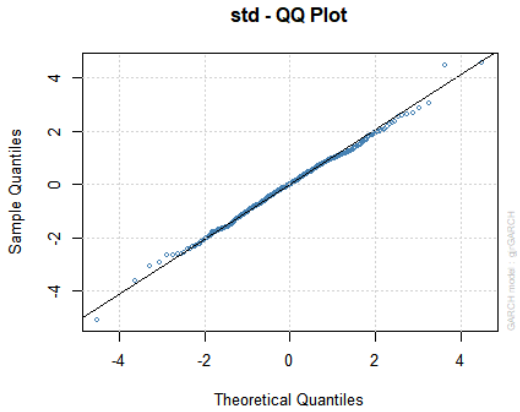
$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ standardized\ t_{6.300}$

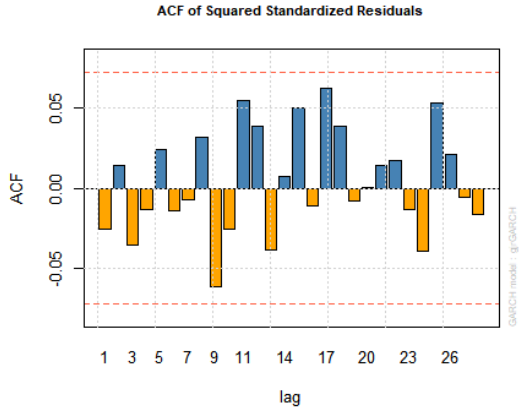
$\sigma_t{}^2 = 1.309 \times 10^{-5} + 0.168(1 + 0.095 I_{t-1}) R_{t-1} + 0.709 \sigma_{t-1}{}^2$



GJR-Garch(1, 1) : standardized t distribution







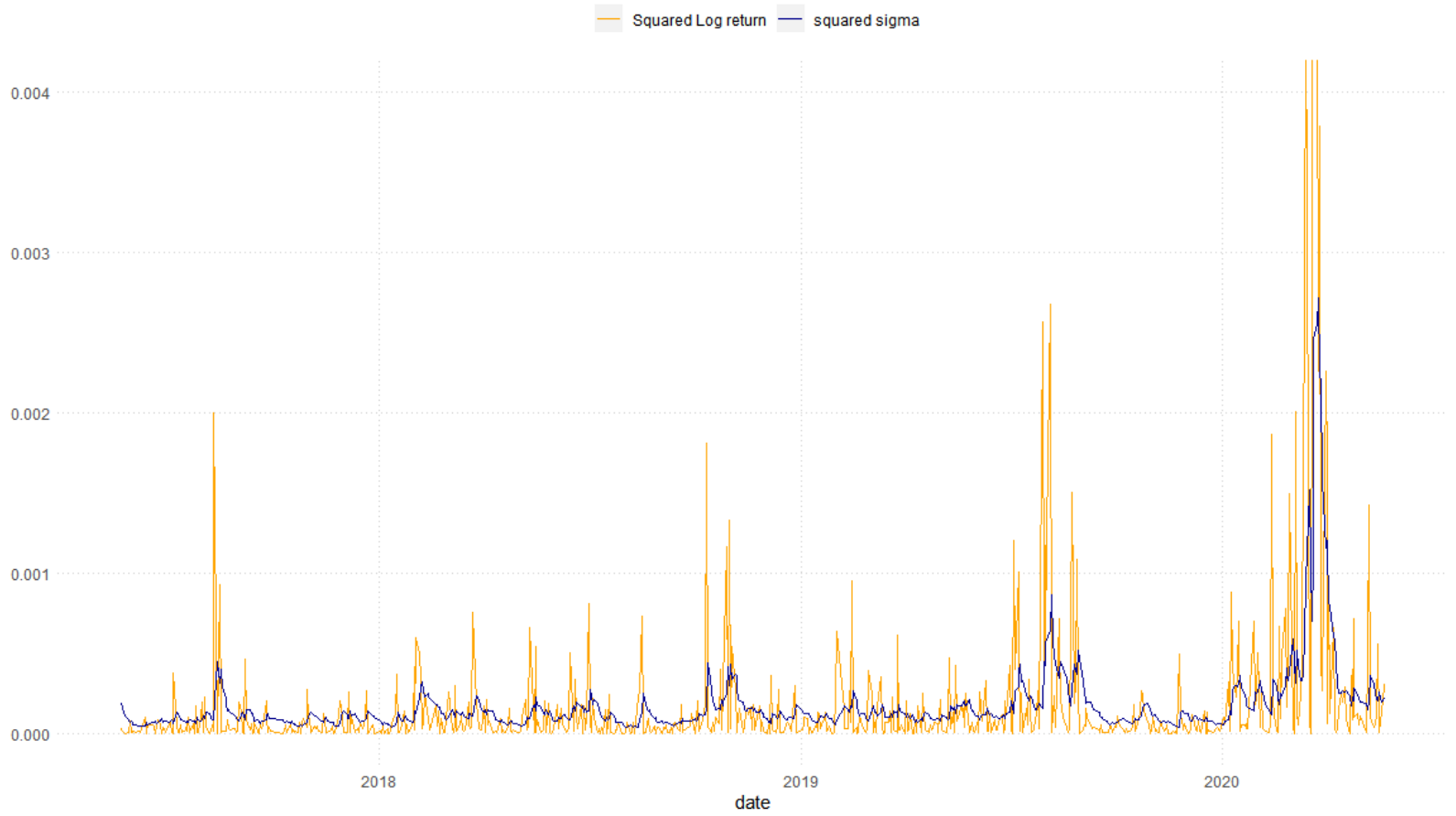
* Ljung - Box test on the squared residuals

Lag	Statistic	p-value
5	2.107	0.834
10	6.343	0.786
15	12.746	0.622
20	16.993	0.653
25	20.87	0.700
30	23.33	0.802

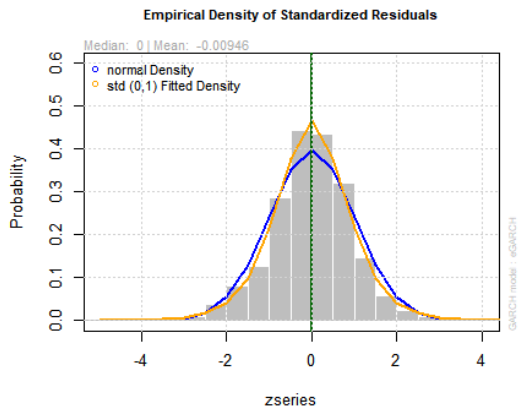
E-Garch(1, 1) : standardized t distribution

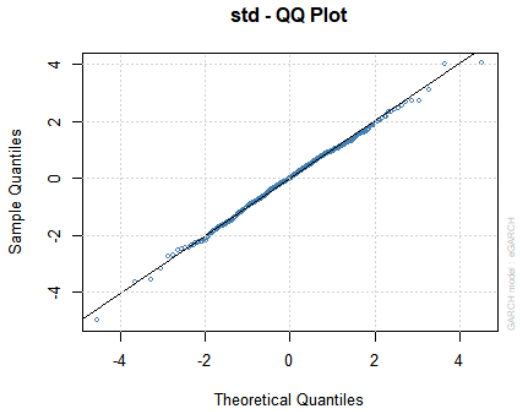
$R_t = \sigma_t \epsilon_t,\ \epsilon_t \sim i.i.d.\ standardized\ t_{6.144}$

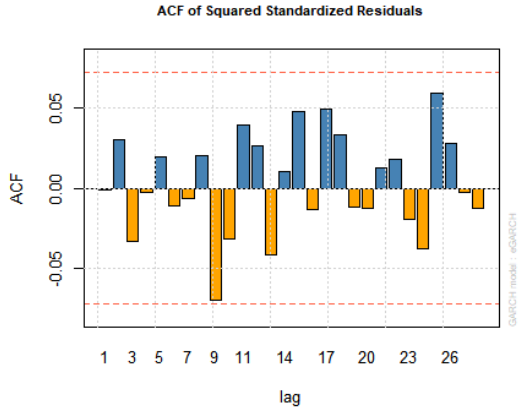
$$\log {\sigma_t}^2 = -0.624 - 0.031\epsilon_{t-1} + 0.361(|\epsilon_{t-1}| - E[|\epsilon_{t-1}|]) + 0.930 \log {\sigma_{t-1}}^2$$



E-Garch(1, 1) : standardized t distribution







* Ljung - Box test on the squared residuals

Lag	Statistic	p-value
5	1.753	0.882
10	6.599	0.766
15	11.408	0.723
20	14.444	0.807
25	18.885	0.803
30	21.622	0.867

모형 적합

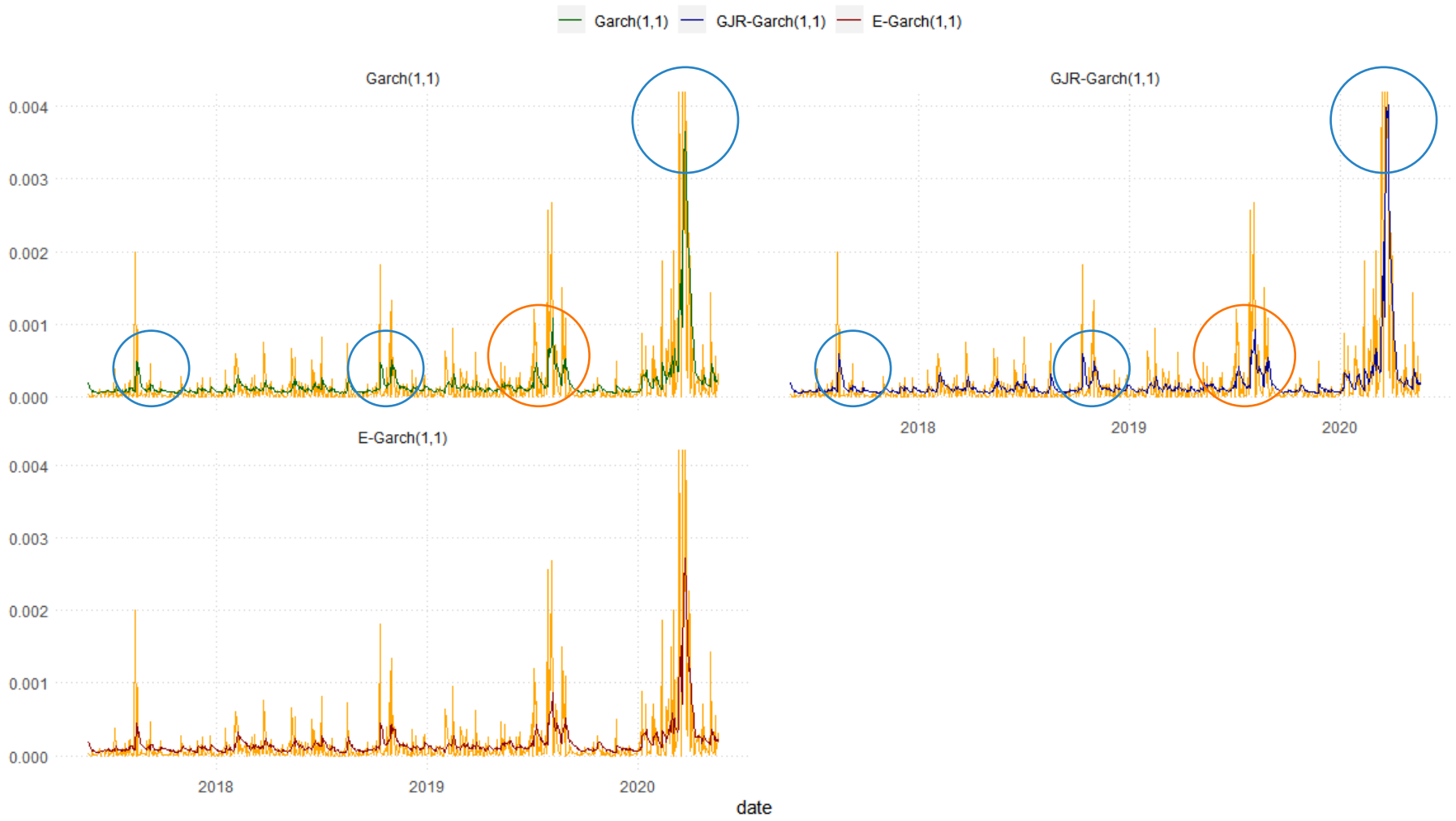
- Noise(ϵ_t)가 i.i.d.하게 standardized t분포를 따른다고 가정했을 때, 세 모형 모두에서 가정이 잘 들어맞는다.

- 따라서 Noise가 i.i.d.하게 standardized t분포를 따른다고 가정한 Garch(1, 1), GJR-Garch(1, 1), E-Garch(1, 1) 중, 모형을 선택한다.

모형 진단

	AIC	BIC	MSE	QLIKE
Garch(1, 1)	−6.199	−6.174	2.70×10^{-7}	1115.501
GJR-Garch(1, 1)	−6.198	−6.167	2.54×10^{-7}	1111.029
E-Garch(1, 1)	−6.189	−6.158	2.77×10^{-7}	1115.296

모형 선택


Garch(1,1)
GJR-Garch(1,1)
E-Garch(1,1)
Garch(1,1)
GJR-Garch(1,1)
E-Garch(1,1)
0.004
0.003
0.002
0.001
0.000
2018
2019
2020
date

모형 선택

- 세 모형 중, AIC, BIC 면에서는 Garch(1, 1)이 가장 적합하다.
- MSE, QLIKE를 비교해보았을 때는, GJR-Garch(1, 1)이 가장 적합하다.
- 그래프와 AIC, BIC, MSE, QLIKE를 모두 고려하였을 때,
  세 모형 중 GJR-Garch(1, 1)이 가장 실제 수익률과정을 잘 설명한다.