summary(fit.mle.gjrGARCH.norm)

[1] "Specification Type: Markov-Switching"

[1] "Specification Name: gjrGARCH\_normal\_sym gjrGARCH\_normal\_sym"

[1] "Number of parameters in each variance model: 4 4"

[1] "Number of parameters in each distribution: 0 0"

[1] "Default parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1 alpha0\_2 alpha1\_2

[1,] 0.1 0.05 0.1 0.8 0.1 0.05

alpha2\_2 beta\_2 P P

[1,] 0.1 0.8 0.5 0.5

[1] "DEoptim initialization: FALSE"

[1] "Fitted Parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1 alpha0\_2

[1,] 1e-04 0.02139502 0.004828757 0.8569296 0.01555149

alpha1\_2 alpha2\_2 beta\_2 P P

[1,] 1e-06 0.1324616 0.9301987 6.411673e-08 0.1788964

[1] "Transition matrix:"

t = 1 t = 2

t + 1 = 1 6.411673e-08 0.1788964

t + 1 = 2 9.999999e-01 0.8211036

[1] "Stable probabilities:"

Stable probabilities

State 1 0.1517491

State 2 0.8482509

[1] "Unconditional volatility:"

State 1 State 2

[1,] 0.02895681 2.087288

Log-kernel: -6738.332

AIC: 13611.66

BIC: 13674.79

> summary(fit.bayes.gjrGARCH.norm)

[1] "Specification Type: Markov-Switching"

[1] "Specification Name: gjrGARCH\_normal\_sym gjrGARCH\_normal\_sym"

[1] "Number of parameters in each variance model: 4 4"

[1] "Number of parameters in each distribution: 0 0"

[1] "Default parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1 alpha0\_2 alpha1\_2

[1,] 0.1 0.05 0.1 0.8 0.1 0.05

alpha2\_2 beta\_2 P P

[1,] 0.1 0.8 0.5 0.5

[1] "Bayesian posterior mean:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1

0.002779999 0.027114116 0.042023822 0.841456637

alpha0\_2 alpha1\_2 alpha2\_2 beta\_2

0.025635835 0.007074763 0.131085414 0.923204800

P P

0.075724170 0.336127235

[1] "Posterior variance-covariance matrix"

alpha0\_1 alpha1\_1 alpha2\_1

alpha0\_1 1.400494e-05 1.247706e-07 -1.747007e-05

alpha1\_1 1.247706e-07 2.340615e-04 -2.375663e-04

alpha2\_1 -1.747007e-05 -2.375663e-04 1.157550e-03

beta\_1 -6.210891e-05 -4.154677e-04 6.676547e-04

alpha0\_2 -1.001496e-05 -1.958221e-05 1.412751e-04

alpha1\_2 -2.100674e-06 -2.448414e-05 6.940847e-05

alpha2\_2 -1.436289e-06 2.159672e-05 -1.237341e-04

beta\_2 3.280738e-06 1.506941e-05 -9.603116e-06

P -4.254366e-05 -6.937372e-05 9.759708e-04

P -1.738517e-04 -3.859470e-04 3.731957e-03

beta\_1 alpha0\_2 alpha1\_2

alpha0\_1 -6.210891e-05 -1.001496e-05 -2.100674e-06

alpha1\_1 -4.154677e-04 -1.958221e-05 -2.448414e-05

alpha2\_1 6.676547e-04 1.412751e-04 6.940847e-05

beta\_1 2.654941e-03 2.345495e-04 7.613500e-05

alpha0\_2 2.345495e-04 7.614245e-05 2.733163e-05

alpha1\_2 7.613500e-05 2.733163e-05 4.921534e-05

alpha2\_2 1.154170e-05 2.776441e-05 -3.756498e-05

beta\_2 -8.551857e-05 -4.470124e-05 -3.143480e-05

P 1.271686e-03 2.425168e-04 5.576665e-05

P 4.722128e-03 9.653494e-04 3.419917e-04

alpha2\_2 beta\_2 P

alpha0\_1 -1.436289e-06 3.280738e-06 -4.254366e-05

alpha1\_1 2.159672e-05 1.506941e-05 -6.937372e-05

alpha2\_1 -1.237341e-04 -9.603116e-06 9.759708e-04

beta\_1 1.154170e-05 -8.551857e-05 1.271686e-03

alpha0\_2 2.776441e-05 -4.470124e-05 2.425168e-04

alpha1\_2 -3.756498e-05 -3.143480e-05 5.576665e-05

alpha2\_2 2.072098e-04 -6.449856e-05 -7.266982e-05

beta\_2 -6.449856e-05 6.594856e-05 -1.941386e-05

P -7.266982e-05 -1.941386e-05 4.284652e-03

P -1.941962e-04 -2.494817e-04 4.434318e-03

P

alpha0\_1 -0.0001738517

alpha1\_1 -0.0003859470

alpha2\_1 0.0037319569

beta\_1 0.0047221285

alpha0\_2 0.0009653494

alpha1\_2 0.0003419917

alpha2\_2 -0.0001941962

beta\_2 -0.0002494817

P 0.0044343176

P 0.0218675676

[1] "Posterior mean transition matrix:"

t = 1 t = 2

t + 1 = 1 0.07572417 0.3361272

t + 1 = 2 0.92427583 0.6638728

[1] "Posterior mean stable probabilities:"

Stable probabilities

State 1 0.2666823

State 2 0.7333177

[1] "Posterior mean unconditional volatility:"

State 1 State 2

[1,] 0.1586732 2.477157

Acceptance rate: 1

AIC: 13589.66

BIC: 13652.79

DIC: 14149.04

> summary(fit.mle.gjrGARCH.t)

[1] "Specification Type: Markov-Switching"

[1] "Specification Name: gjrGARCH\_student\_sym gjrGARCH\_student\_sym"

[1] "Number of parameters in each variance model: 4 4"

[1] "Number of parameters in each distribution: 1 1"

[1] "Default parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1 nu\_1 alpha0\_2

[1,] 0.1 0.05 0.1 0.8 10 0.1

alpha1\_2 alpha2\_2 beta\_2 nu\_2 P P

[1,] 0.05 0.1 0.8 10 0.5 0.5

[1] "DEoptim initialization: FALSE"

[1] "Fitted Parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1

[1,] 0.0003728445 0.09088906 0.0001190302 0.0004915556

nu\_1 alpha0\_2 alpha1\_2 alpha2\_2 beta\_2

[1,] 2.1 0.0001000048 1.000131e-05 0.124606 0.9372613

nu\_2 P P

[1,] 11.77403 1.363103e-09 1.110223e-16

[1] "Transition matrix:"

t = 1 t = 2

t + 1 = 1 1.363103e-09 1.110223e-16

t + 1 = 2 1.000000e+00 1.000000e+00

[1] "Stable probabilities:"

Stable probabilities

State 1 1.110223e-16

State 2 1.000000e+00

[1] "Unconditional volatility:"

State 1 State 2

[1,] 0.02025756 0.4846565

Log-kernel: -6743.185

AIC: 13446.38

BIC: 13522.14

> summary(fit.bayes.gjrGARCH.t)

[1] "Specification Type: Markov-Switching"

[1] "Specification Name: gjrGARCH\_student\_sym gjrGARCH\_student\_sym"

[1] "Number of parameters in each variance model: 4 4"

[1] "Number of parameters in each distribution: 1 1"

[1] "Default parameters:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1 nu\_1 alpha0\_2

[1,] 0.1 0.05 0.1 0.8 10 0.1

alpha1\_2 alpha2\_2 beta\_2 nu\_2 P P

[1,] 0.05 0.1 0.8 10 0.5 0.5

[1] "Bayesian posterior mean:"

alpha0\_1 alpha1\_1 alpha2\_1 beta\_1

0.001157012 0.005442591 0.122940428 0.929996690

nu\_1 alpha0\_2 alpha1\_2 alpha2\_2

9.465496099 0.147127680 0.049868691 0.182413383

beta\_2 nu\_2 P P

0.827091832 9.841238542 0.879978298 0.741655937

[1] "Posterior variance-covariance matrix"

alpha0\_1 alpha1\_1 alpha2\_1

alpha0\_1 2.250481e-06 -3.810124e-07 2.203393e-06

alpha1\_1 -3.810124e-07 2.263442e-05 -1.494311e-05

alpha2\_1 2.203393e-06 -1.494311e-05 1.924637e-04

beta\_1 -1.461505e-06 -1.742118e-05 -8.036766e-05

nu\_1 -2.553004e-04 2.434592e-04 7.925077e-04

alpha0\_2 1.799468e-05 -5.661536e-05 1.433612e-06

alpha1\_2 2.120323e-05 -3.884827e-05 1.057333e-05

alpha2\_2 7.928660e-06 -4.382468e-05 -3.004634e-04

beta\_2 -2.713323e-05 7.582717e-05 1.142563e-04

nu\_2 2.245572e-04 1.893926e-04 -1.152440e-03

P 4.604516e-05 -1.354026e-04 2.981535e-05

P 3.164360e-06 -1.343481e-04 2.154605e-04

beta\_1 nu\_1 alpha0\_2

alpha0\_1 -1.461505e-06 -0.0002553004 1.799468e-05

alpha1\_1 -1.742118e-05 0.0002434592 -5.661536e-05

alpha2\_1 -8.036766e-05 0.0007925077 1.433612e-06

beta\_1 6.285879e-05 -0.0007673588 9.847171e-05

nu\_1 -7.673588e-04 0.5237169647 -2.661649e-02

alpha0\_2 9.847171e-05 -0.0266164858 9.483386e-03

alpha1\_2 4.141171e-05 -0.0102092278 1.107294e-03

alpha2\_2 2.284256e-04 -0.0244494042 6.376366e-03

beta\_2 -1.718047e-04 0.0283312978 -5.938984e-03

nu\_2 3.227787e-04 -0.5321007417 -2.782504e-03

P 1.913183e-04 -0.0199593926 4.168406e-03

P 8.128148e-05 -0.0188964651 7.683610e-03

alpha1\_2 alpha2\_2 beta\_2

alpha0\_1 2.120323e-05 7.928660e-06 -2.713323e-05

alpha1\_1 -3.884827e-05 -4.382468e-05 7.582717e-05

alpha2\_1 1.057333e-05 -3.004634e-04 1.142563e-04

beta\_1 4.141171e-05 2.284256e-04 -1.718047e-04

nu\_1 -1.020923e-02 -2.444940e-02 2.833130e-02

alpha0\_2 1.107294e-03 6.376366e-03 -5.938984e-03

alpha1\_2 2.082705e-03 -2.787555e-04 -1.924241e-03

alpha2\_2 -2.787555e-04 1.894459e-02 -9.866776e-03

beta\_2 -1.924241e-03 -9.866776e-03 7.968496e-03

nu\_2 3.423524e-03 1.753387e-02 -1.314328e-02

P 1.287471e-03 3.118900e-03 -3.602666e-03

P 2.608549e-03 2.029945e-03 -5.058660e-03

nu\_2 P P

alpha0\_1 0.0002245572 4.604516e-05 3.164360e-06

alpha1\_1 0.0001893926 -1.354026e-04 -1.343481e-04

alpha2\_1 -0.0011524397 2.981535e-05 2.154605e-04

beta\_1 0.0003227787 1.913183e-04 8.128148e-05

nu\_1 -0.5321007417 -1.995939e-02 -1.889647e-02

alpha0\_2 -0.0027825040 4.168406e-03 7.683610e-03

alpha1\_2 0.0034235243 1.287471e-03 2.608549e-03

alpha2\_2 0.0175338707 3.118900e-03 2.029945e-03

beta\_2 -0.0131432789 -3.602666e-03 -5.058660e-03

nu\_2 0.7230467156 2.944028e-03 -3.183900e-02

P 0.0029440280 8.001610e-03 3.577481e-03

P -0.0318389955 3.577481e-03 3.089570e-02

[1] "Posterior mean transition matrix:"

t = 1 t = 2

t + 1 = 1 0.8799783 0.7416559

t + 1 = 2 0.1200217 0.2583441

[1] "Posterior mean stable probabilities:"

Stable probabilities

State 1 0.8607116

State 2 0.1392884

[1] "Posterior mean unconditional volatility:"

State 1 State 2

[1,] 0.6118631 2.149858

Acceptance rate: 0.998

AIC: 13457.98

BIC: 13533.73

DIC: 13457.48