DCC GARCH

Amath 546/Econ 589
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Rolling Covariances and Correlations

20-day rolling covariances

20-day rolling correlations

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EWMA Covariances and Correlations

\[ \lambda = 0.94 \]
Specify DCC Model

# univariate normal GARCH(1,1) for each series
> garch11.spec = ugarchspec(mean.model = list(armaOrder = c(0,0)),
+ variance.model = list(garchOrder = c(1,1),
+ model = "sGARCH"),
+ distribution.model = "norm")

# dcc specification - GARCH(1,1) for conditional correlations
> dcc.garch11.spec = dccspec(uspec = multispec( replicate(2, garch11.spec) ),
+ dccOrder = c(1,1),
+ distribution = "mvnorm")

> dcc.garch11.spec

*-----------------------------*
*       DCC GARCH Spec       *
*-----------------------------*
Model : DCC(1,1)
Estimation : 2-step
Distribution : mvnorm
No. of Parameters : 11
No. of Series : 2

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Estimate DCC Model

```r
> dcc.fit = dccfit(dcc.garch11.spec, data = MSFT.GSPC.ret)

Iter: 1 fn: 2261.1651  Pars:  0.02425  0.96193
Iter: 2 fn: 2261.1651  Pars:  0.02425  0.96192
solnp--> Completed in 2 iterations

> class(dcc.fit)
[1] "DCCfit"
attr(,"package")
[1] "rmgarch"

> slotNames(dcc.fit)
[1] "mfit"  "model"

> names(dcc.fit@mfit)
[1] "coef" "matcoef" "garchnames"
[4] "dccnames" "cvar" "scores"
[7] "R" "H" "Q"
[10] "stdresid" "llh" "log.likelihoods"
[13] "timer" "convergence" "Nbar"
[16] "Qbar"
```

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> names(dcc.fit@model)
[1] "modelinc" "modeldesc" "modeldata" "varmodel"
[5] "pars" "start.pars" "fixed.pars" "maxgarchOrder"
[9] "maxdccOrder" "pos.matrix" "pidx" "mu"
[13] "residuals" "sigma" "mpars" "ipars"
[17] "midx" "eidx" "umodel"

# many extractor functions - see help on DCCfit object
# coef, likelihood, rshape, rskew, fitted, sigma,
# residuals, plot, infocriteria, rcor, rcov
# show, nisurface
Estimate DCC Model

*---------------------------------*
* DCC GARCH Fit *
*---------------------------------*

Distribution : mvnorm
DCC Order : 1 1
Asymmetric : FALSE
No. of Parameters : 11
[VAR GARCH DCC UncQ] : [0+8+2+1]
No. of Series : 2
No. of Observations : 3082
Log-Likelihood : 18417
Av.Log-Likelihood : 5.98

Optimal Parameters

|                | Estimate | Std. Error | t value | Pr(>|t|) |
|----------------|----------|------------|---------|----------|
| [MSFT].mu      | 0.000343 | 0.000289   | 1.1881  | 0.234808 |
| [MSFT].omega   | 0.000005 | 0.000002   | 2.4441  | 0.014522 |
| [MSFT].alpha1  | 0.069238 | 0.029389   | 2.3559  | 0.018478 |
| [MSFT].beta1   | 0.920378 | 0.029791   | 30.8943 | 0.000000 |
| [GSPC].mu      | 0.000434 | 0.000168   | 2.5894  | 0.009613 |
| [GSPC].omega   | 0.000001 | 0.000000   | 3.3236  | 0.000889 |
| [GSPC].alpha1  | 0.088147 | 0.014425   | 6.1109  | 0.000000 |
| [GSPC].beta1   | 0.903222 | 0.016831   | 53.6630 | 0.000000 |
| [Joint]dcca1   | 0.024249 | 0.011018   | 2.2008  | 0.027749 |
| [Joint]dccb1   | 0.961925 | 0.022314   | 43.1090 | 0.000000 |

Conditional correlation parameters (with covariance targeting)
DCCfit Plot Method

> plot(dcc.fit)

Make a plot selection (or 0 to exit):

1: Conditional Mean (vs Realized Returns)
2: Conditional Sigma (vs Realized Absolute Returns)
3: Conditional Covariance
4: Conditional Correlation
5: EW Portfolio Plot with conditional density VaR limits

Selection:
GARCH(1,1) Conditional Variances

DCC Conditional Sigma

GSPC
Conditional Correlations

DCC Conditional Correlation
GSPC-MSFT

Year: 2000 to 2012
DCC Forecasts

# 100-step ahead forecasts of conditional covariances
# and conditional correlations
>
def t
(d fit
hd 100)
t =
defc
horacast(dcc.fit, n.ahead=100)
class(dcc.fcst)
[1] "DCCforecast"
attr("package")
[1] "rmgarch"
>
slotNames(dcc.fcst)
[1] "mforecast" "model"
>
class(dcc.fcst@mforecast)
[1] "list"
>
names(dcc.fcst@mforecast)
[1] "H" "R" "Q" "Rbar" "mu"

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DCC Forecasts

```plaintext
Distribution : 
Horizon : 
Roll Steps : 

0-roll forecast:

First 2 Correlation Forecasts
   [,1]   [,2]
[1,] 1.0000  0.6324
[2,] 0.6324  1.0000

Last 2 Correlation Forecasts
   [,1]   [,2]
[1,] 1.0000  0.6298
[2,] 0.6298  1.0000
```

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DCC Forecasts

> plot(dcc.fcst)

Make a plot selection (or 0 to exit):

1: Conditional Mean Forecast (vs Realized Returns)
2: Conditional Sigma Forecast (vs Realized Absolute Returns)
3: Conditional Covariance Forecast
4: Conditional Correlation Forecast
5: EW Portfolio Plot with forecast conditional density VaR limits

Selection:
Conditional Variance Forecasts
Conditional Covariance Forecasts

DCC Unconditional Covariance Forecast
GSPC-MSFT

Time

Feb Mar Apr May Jun Jul Aug
Conditional Correlation Forecast

DCC Unconditional Correlation Forecast
GSPC-MSFT

Time