GAL Buckle 95

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Chapitre 1

Initialisation

1.1 Chargement des paquets

```
> setwd("~/git/GAL-Buckle95/")
> library(actuar)
> library(MASS)
> library(xtable)
> library(multicore)
> library(moments)
> library(TTR)
> library(FourierStuff)
> library(GeneralizedAsymmetricLaplace)
> library(GMMStuff)
> library(OptionPricingStuff)
> library(QuadraticEstimatingEquations)
```

1.2 Constantes et données

```
> #Nombre de décimales affichées
> options(digits=6)
> #Marge pour intervalles de confiance
> alpha.confint <- 0.05
> #Marge pour test d'hypothèses
> alpha.test <- 0.05
> #Chargement des données
> RETURNS <- head(read.csv("abbeyn.csv",sep="\t",header=TRUE)[,1],-1)
> #Taille de l'échantillon
> n <- length(RETURNS)
```

1.3 Test de normalité

```
> EppsPulley.test(RETURNS)

Epps-Pulley Normality test

 T: 0.626033
 T*: 0.635568
p-value: 0.007178

$Tstat
[1] 0.626033

$Tmod
[1] 0.635568

$Zscore
[1] 2.44824

$Pvalue
[1] 0.00717788

$Reject
[1] TRUE
```

Chapitre 2

Estimation

2.1 Données mises à l'échelle

```
> sRET <- as.vector(scale(RETURNS))
```

2.2 Première estimation par QEE

```
> ## Point de départ
> pt.depart <- startparamGAL(sRET)
> ## Fonctions pour les moments
> meanQEE <- function(param) mGAL(param,1)
> varianceQEE <- function(param) cmGAL(param,2)
> sdQEE <- function(param) sqrt(cmGAL(param,2))
> skewnessQEE <- function(param) cmGAL(param,3)
> kurtosisQEE <- function(param) cmGAL(param,4)
> ## Fonctions pour les dérivées
> dmeanQEE <- function(param) dmGAL(param,1)
> dsdQEE <- function(param) dmGAL(param,2)
> ## Estimation gaussienne
> optim1 <- optim(pt.depart,obj.gauss,gr=NULL,sRET,
+                 meanQEE,varianceQEE,dmeanQEE,dsdQEE)
> pt.optim1 <- optim1$par
> ## Estimation de crowder
> optim2 <- optim(pt.depart,obj.Crowder,gr=NULL,sRET,
+                 meanQEE,varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE)
> pt.optim2 <- optim2$par
> ## Estimation de crowder modifiée
> optim3 <- optim(pt.depart,obj.Crowder.Mod,gr=NULL,sRET,
+                 meanQEE,varianceQEE,dmeanQEE,dsdQEE)
> pt.optim3 <- optim3$par
```

2.3 Résultats de la première estimation par QEE

```
> cov.optim1 <- covariance.QEE(M.gauss(pt.optim1,sRET,
+                                 meanQEE,varianceQEE,dmeanQEE,dsdQEE),
+                 V.gauss(pt.optim1,sRET,meanQEE,varianceQEE,
+                                 skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),n)
> cov.optim2 <- covariance.QEE(M.Crowder(pt.optim2,sRET,
+                                 varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),
+                 V.Crowder(pt.optim2,sRET,varianceQEE,
+                                 skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),n)
> cov.optim3 <- covariance.QEE(M.Crowder.Mod(pt.optim3,sRET,
+                                 varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),
+                 V.Crowder.Mod(pt.optim3,sRET,varianceQEE,dmeanQEE,dsdQEE),n)
> confidence.interval.QEE(pt.optim1,cov.optim1,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.780018 -0.726048 -0.672077
[2,]  0.436002  0.596316  0.756630
[3,]  0.262650  0.359186  0.455722
[4,]  1.994757  2.021370  2.047982

> confidence.interval.QEE(pt.optim2,cov.optim2,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.694457 -0.627404 -0.560351
[2,]  0.413764  0.640292  0.866820
[3,]  0.232650  0.334028  0.435405
[4,]  1.839966  1.878296  1.916626

> confidence.interval.QEE(pt.optim3,cov.optim3,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.765288 -0.711439 -0.657589
[2,]  0.455485  0.606642  0.757798
[3,]  0.264669  0.362932  0.461195
[4,]  1.932691  1.960299  1.987906
```

2.4 Seconde estimation par QEE

```
> ## Estimation gaussienne
> optim4 <- optim(pt.optim1,obj.gauss,gr=NULL,sRET,
+                 meanQEE,varianceQEE,dmeanQEE,dsdQEE,
+                 ginv(V.gauss(pt.optim1,sRET,meanQEE,
+                                                 varianceQEE,skewnessQEE,kurtosisQEE,
+                                                 dmeanQEE,dsdQEE)))
> pt.optim4 <- optim4$par
```

```
> ## Estimation de crowder
> optim5 <- optim(pt.optim2,obj.Crowder,gr=NULL,sRET,
+                 meanQEE,varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE,
+                 ginv(V.Crowder(pt.optim2,sRET,varianceQEE,skewnessQEE,
+                                                 kurtosisQEE,dmeanQEE,dsdQEE)))
> pt.optim5 <- optim5$par
> ## Estimation de crowder modifiée
> optim6 <- optim(pt.optim3,obj.Crowder.Mod,gr=NULL,sRET,
+                 meanQEE,varianceQEE,dmeanQEE,dsdQEE,
+                 ginv(V.Crowder.Mod(pt.optim3,sRET,varianceQEE,
+                                                 dmeanQEE,dsdQEE)))
> pt.optim6 <- optim6$par
```

2.5 Résultats de la seconde estimation par QEE

```
> cov.optim4 <- covariance.QEE(M.gauss(pt.optim4,sRET,
+                                 meanQEE,varianceQEE,dmeanQEE,dsdQEE),
+                 V.gauss(pt.optim4,sRET,meanQEE,varianceQEE,
+                                 skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),n)
> cov.optim5 <- covariance.QEE(M.Crowder(pt.optim5,sRET,
+                                 varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),
+                 V.Crowder(pt.optim5,sRET,varianceQEE,skewnessQEE,
+                                 kurtosisQEE,dmeanQEE,dsdQEE),n)
> cov.optim6 <- covariance.QEE(M.Crowder.Mod(pt.optim6,sRET,
+                                 varianceQEE,skewnessQEE,kurtosisQEE,dmeanQEE,dsdQEE),
+                 V.Crowder.Mod(pt.optim6,sRET,varianceQEE,dmeanQEE,dsdQEE),n)
> confidence.interval.QEE(pt.optim4,cov.optim4,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.779792 -0.725853 -0.671914
[2,]  0.436017  0.596319  0.756622
[3,]  0.262456  0.358969  0.455482
[4,]  1.995452  2.022048  2.048644

> confidence.interval.QEE(pt.optim5,cov.optim5,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.692712 -0.625874 -0.559036
[2,]  0.414139  0.640445  0.866750
[3,]  0.231568  0.332845  0.434122
[4,]  1.842116  1.880376  1.918636

> confidence.interval.QEE(pt.optim6,cov.optim6,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.766288 -0.712450 -0.658612
```

```
[2,]  0.455051  0.606193  0.757334
[3,]  0.264972  0.363196  0.461419
[4,]  1.934050  1.961614  1.989178
```

2.6 Estimation par GMM

```
> ## GMM régulier
> optim7 <- optim.GMM(pt.depart,
+                  conditions.vector=meanvariance.gmm.vector,
+                  data=sRET,W=diag(2),
+                  meanf=meanQEE,variancef=varianceQEE)
> pt.optim7 <- optim7$par
> cov.optim7 <- mean.variance.GMM.gradient.GAL(pt.optim7,sRET) %*%
+                  covariance.GMM(meanvariance.gmm.vector,pt.optim7,sRET,
+                                 meanf=meanQEE,variancef=varianceQEE) %*%
+                  t(mean.variance.GMM.gradient.GAL(pt.optim7,sRET)) / n
> ## GMM itératif
> optim8 <- iterative.GMM(pt.depart,
+                  conditions.vector=meanvariance.gmm.vector,
+                  data=sRET,W=diag(2),
+                  meanf=meanQEE,variancef=varianceQEE)
> pt.optim8 <- optim8$par
> cov.optim8 <-  mean.variance.GMM.gradient.GAL(pt.optim8,sRET) %*%
+                  optim8$cov %*%
+                  t(mean.variance.GMM.gradient.GAL(pt.optim8,sRET)) / n
> confidence.interval.QEE(pt.optim7,cov.optim7,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.878702 -0.641646 -0.404589
[2,] -0.469225  0.625908  1.721040
[3,] -0.192234  0.326366  0.844965
[4,]  1.696121  1.965995  2.235869

> confidence.interval.QEE(pt.optim8,cov.optim8,n)

         LOWER  ESTIMATE     UPPER
[1,] -0.874031 -0.636980 -0.399929
[2,] -0.473292  0.626346  1.725984
[3,] -0.193600  0.322895  0.839390
[4,]  1.704166  1.972716  2.241265
```

Chapitre 3

Comparaison des résultats

```
> # Aggrégation des estimateurs (pour simplifier les calculs)
> pts.estim <- cbind(pt.optim1,pt.optim2,pt.optim3,pt.optim4,
+                 pt.optim5,pt.optim6,pt.optim7,pt.optim8)
> l.pts.estim <- as.list(data.frame(pts.estim))
```

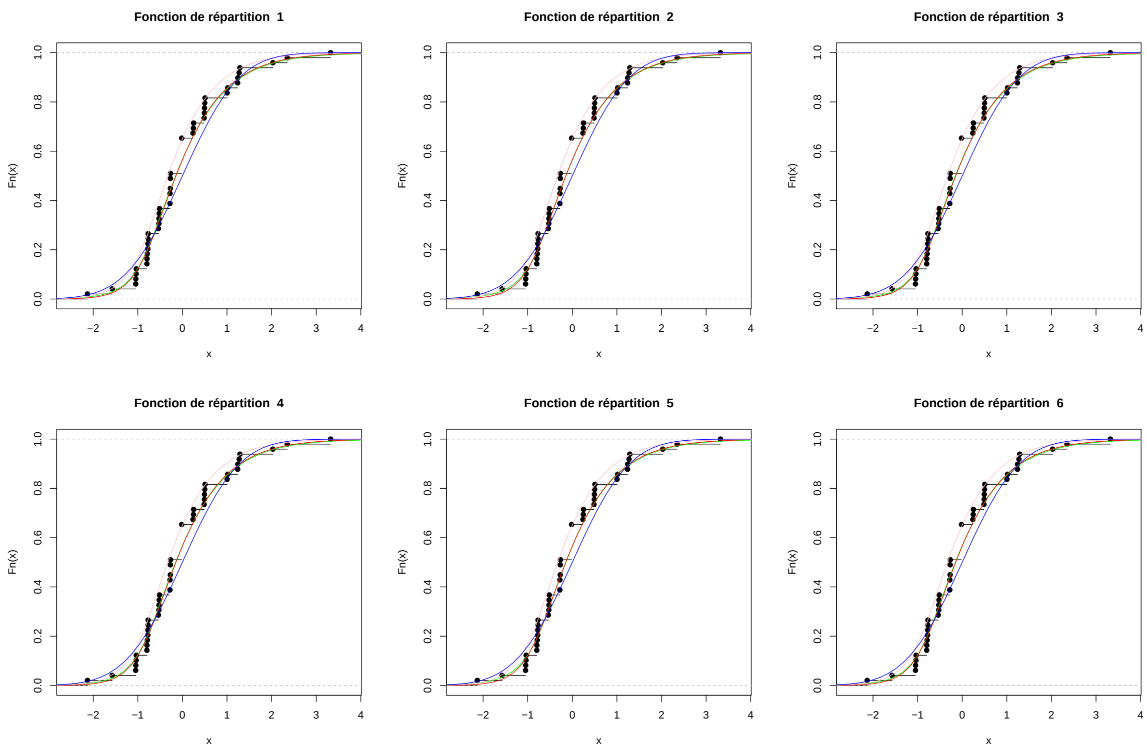
3.1 Fonction de répartition

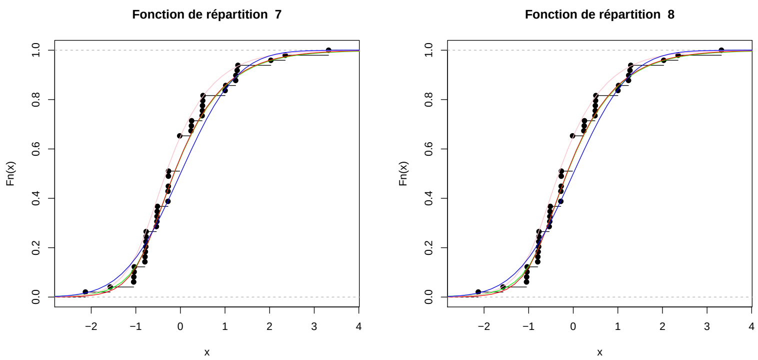
```
> # Points d'évaluation
> xi <- seq(2*min(sRET),2*max(sRET),length.out=2^6)
> # Fonction de répartition par intégration de la fonction caractéristique
> dist1 <- cbind(cftocdf(xi,cfGAL,param=pt.optim1),
+                 cftocdf(xi,cfGAL,param=pt.optim2),
+                 cftocdf(xi,cfGAL,param=pt.optim3),
+                 cftocdf(xi,cfGAL,param=pt.optim4),
+                 cftocdf(xi,cfGAL,param=pt.optim5),
+                 cftocdf(xi,cfGAL,param=pt.optim6),
+                 cftocdf(xi,cfGAL,param=pt.optim7),
+                 cftocdf(xi,cfGAL,param=pt.optim8))
> # Fonction de répartition par point de selle
> dist2 <- cbind(psaddleapproxGAL(xi,pt.optim1),
+                 psaddleapproxGAL(xi,pt.optim2),
+                 psaddleapproxGAL(xi,pt.optim3),
+                 psaddleapproxGAL(xi,pt.optim4),
+                 psaddleapproxGAL(xi,pt.optim5),
+                 psaddleapproxGAL(xi,pt.optim6),
+                 psaddleapproxGAL(xi,pt.optim7),
+                 psaddleapproxGAL(xi,pt.optim8))
> # Fonction de répartition par intégration de la fonction de densité
> dist3 <- cbind(pGAL(xi,pt.optim1),
+                 pGAL(xi,pt.optim2),
```

```
+                   pGAL(xi,pt.optim3),
+                   pGAL(xi,pt.optim4),
+                   pGAL(xi,pt.optim5),
+                   pGAL(xi,pt.optim6),
+                   pGAL(xi,pt.optim7),
+                   pGAL(xi,pt.optim8))
```

3.1.1 Graphiques

```
>       for (i in 1:8)
+       {
+               file<-paste("dist-GAL-",i,".pdf",sep="")
+               pdf(file=file,paper="special",width=6,height=6)
+               plot.ecdf(sRET,main=paste("Fonction de répartition ",i))
+               lines(xi,dist1[,i],col="green")
+               lines(xi,dist2[,1],col="red")
+               lines(xi,dist3[,1],col="pink")
+               lines(xi,pnorm(xi),type="l",col="blue")
+               dev.off()
+               cat("\\includegraphics[height=2in,width=2in]{",
+                               file,"}\n",sep="")
+       }
```





3.1.2 Statistiques

Test du χ^2, Méthode avec intégration

```
> chisquare.test1 <- function(param,DATA.hist,FUN,method)
+ {
+         chisquare.test(DATA.hist,FUN,param,method=method)
+ }
> xtable(do.call(rbind,lapply(l.pts.estim,chisquare.test1,hist(sRET),cfGAL,"integral")),digi
```

	chisquare.stat	df	p.value
pt.optim1	5.473824	6.000000	0.484626
pt.optim2	5.329673	6.000000	0.502277
pt.optim3	5.388158	6.000000	0.495076
pt.optim4	5.474310	6.000000	0.484567
pt.optim5	5.337004	6.000000	0.501372
pt.optim6	5.390662	6.000000	0.494769
pt.optim7	5.454256	6.000000	0.487003
pt.optim8	5.476963	6.000000	0.484245

Test du χ^2, Méthode avec point de selle

```
> xtable(do.call(rbind,lapply(l.pts.estim,chisquare.test1,hist(sRET),pGAL,"saddlepoint")),di
```

Statistique de Kolmogorov-Smirnov

```
>         ks.test1 <- function(param,x,y) ks.test(x,y,param)
>         xtable(do.call(rbind,mclapply(l.pts.estim,ks.test1,sRET,"pGAL")),digits=6)
```

Statistique de distance minimale

```
>         tvariate1 <- seq(-.1,.1,by=0.01)
>         xtable(do.call(rbind,mclapply(l.pts.estim,md.test,sRET,tvariate1,cfGAL,empCF)),dig
```

	chisquare.stat	df	p.value
pt.optim1	9.293574	6.000000	0.157728
pt.optim2	8.345592	6.000000	0.213862
pt.optim3	9.050625	6.000000	0.170751
pt.optim4	9.292836	6.000000	0.157767
pt.optim5	8.344140	6.000000	0.213959
pt.optim6	9.062381	6.000000	0.170100
pt.optim7	8.616379	6.000000	0.196330
pt.optim8	8.610490	6.000000	0.196698

	statistic	p.value	alternative	method	data.name
pt.optim1	0.158220	0.171912	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim2	0.140346	0.289345	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim3	0.156772	0.179751	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim4	0.158159	0.172235	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim5	0.139916	0.292753	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim6	0.156960	0.178718	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim7	0.141230	0.282437	two-sided	One-sample Kolmogorov-Smirnov test	x
pt.optim8	0.140016	0.291954	two-sided	One-sample Kolmogorov-Smirnov test	x

	md.stat	df	p.value
pt.optim1	0.000422	21.000000	0.000000
pt.optim2	0.120174	21.000000	0.000000
pt.optim3	0.001384	21.000000	0.000000
pt.optim4	0.000388	21.000000	0.000000
pt.optim5	0.123295	21.000000	0.000000
pt.optim6	0.001451	21.000000	0.000000
pt.optim7	0.007980	21.000000	0.000000
pt.optim8	0.010416	21.000000	0.000000