# LAMPIRAN-LAMPIRAN

Tabel 4.1: Data Suku Bunga SBI Periode April 2015-April 2016

| No. | Bulan | SBI (%)) |
|---|---|---|
| 1 | 14 April 2015 | $7,5\%$ |
| 2 | 19 Mei 2015 | $7,5\%$ |
| 3 | 18 Juni 2015 | $7,5\%$ |
| 4 | 14 Juli 2015 | $7,5\%$ |
| 5 | 18 Agustus 2015 | $7,5\%$ |
| 6 | 17 September 2015 | $7,5\%$ |
| 7 | 15 Oktober 2015 | $7,5\%$ |
| 8 | 17 November 2015 | $7,5\%$ |
| 9 | 17 Desember 2015 | $7,5\%$ |
| 10 | 14 Januari 2016 | $7,25\%$ |
| 11 | 18 Februari 2016 | $7,00\%$ |
| 12 | 17 Maret 2016 | $6,75\%$ |
| 13 | 21 April 2016 | $6,75\%$ |

Sumber: Situs Bank Indonesia April 2015-April 2016

## Algoritma Pembentukan Portofolio Saham Optimal CAPM dan Perhitungan Bobot atau Proporsi Dana

```
# Uji Normalitas Univariat
# x diganti nama saham yang akan diuji
x <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/x.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
mean(t(x))
sd(t(x))
var(x)
ks.test((t(x)),"pnorm",mean(t(x)),sd(t(x)))

# Perhitungan Expected Return CAPM
#Rm (IHSG)
IHSG <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/IHSG.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
E.Rm = mean(t(IHSG))
E.Rm
#Rf (SBI)
SBI <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/SBI.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
Rf = mean(t(SBI))
Rf
# Expected Return x
# x diganti nama saham yang akan diuji
```

```
x <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/x.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
#Beta x
Betax = (var(x,IHSG)/var(IHSG))
Betax
E.R.x = (Rf + Betax * (E.Rm - Rf))
E.R.x

# Pemberian Bobot atau Proporsi Dana Portofolio Saham Optimal CAPM
#Uji Normalitas Multivariat
ks.test((t(TLKM)),(t(WSKT)))
ATLKM = E.R.TLKM - Rf
ATLKM
AWSKT= E.R.WSKT - Rf
AWSKT
#Koefisien Risiko Averter
KoefisienRisiko = 2.5
KoefisienRisiko
#Matriks Kovarians
TLKMWSKT <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/TLKMWSKT.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
MatriksKovarians = (var(TLKMWSKT))
MatriksKovarians
#Perhitungan Bobot atau Proporsi Dana
Bobot1 = 2.5 * MatriksKovarians
```

```
Bobot1

InverseBobot1 = solve(Bobot1)

InverseBobot1

Vektor1N  = matrix(c(1,1),ncol=1)

Vektor1N

TransposeVektor1N = t(Vektor1N)

TransposeVektor1N

Bobot2 = InverseBobot1 %*% Vektor1N

Bobot2

Bobot3 = TransposeVektor1N %*% InverseBobot1 %*% Vektor1N

Bobot3

Bobot4 = solve(Bobot3)

Bobot4

W = Bobot2 %*% Bobot4

W

TransposeW = t(W)

TransposeW
```

## Algoritma Perhitungan Risiko VaR Portofolio Saham Optimal dengan Metode Simulasi Monte Carlo

```
TLKM <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/WSKT.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
WSKT <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/WSKT.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
TLKMWSKT <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/TLKMWSKT.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
x <- t(TLKM)
x
y <- t(WSKT)
y
p <- t(TLKMWSKT)
p
Wo <- 1000000000
Wo
n <- 25
n
T <- 252
T
alpha <- c(0.01,0.025,0.05,0.1)
alpha
k <- 1
k
```

```
wx <- 0.6307128
wx
wy <- 0.3692872
wy

VaR.MC = function(x,Wo,w,T,alpha,k)
{
x=as.matrix(x)
Mean.Rtx=mean(x)
Sigma.Rtx=sd(x)
return.simx=rnorm(T,Mean.Rtx,Sigma.Rtx)
y=as.matrix(y)
Mean.Rty=mean(y)
Sigma.Rty=sd(y)
return.simy=rnorm(T,Mean.Rty,Sigma.Rty)
Rp=(return.simx*wx)+(return.simy*wy)
Rbintang=quantile(Rp,alpha)
VaR=Wo*Rbintang*sqrt(k)
tampilan=as.matrix(t(VaR))
colnames(tampilan)=paste(((1-alpha)*100),"%",sep="")
rownames(tampilan)=""
return(tampilan)
}
VaR.MC(x,Wo,w,T,alpha,k)

VaR_MC=function(p,n,w)
{
```

```
VaR.MC=matrix(p,n,4)
for(i in 1:n)
{
VaR.MC[i,1]=VaR.MC(x,Wo,w,T,alpha,k)[1]
VaR.MC[i,2]=VaR.MC(x,Wo,w,T,alpha,k)[2]
VaR.MC[i,3]=VaR.MC(x,Wo,w,T,alpha,k)[3]
VaR.MC[i,4]=VaR.MC(x,Wo,w,T,alpha,k)[4]
}
VaR.MC
z=colMeans(VaR.MC)
ratarata=as.matrix(t(z))
cat("Nilai Value at Risk dengan Simulasi Monte Carlo
untuk tingkat kepercayaan: \n")
cat(" 99% 97.5% 95% 90% \n")
print(VaR.MC)
colnames(ratarata)=paste(((1-c(0.01,0.025,0.05,0.1))*100),"%",sep="")
rownames(ratarata)=""
cat("Rata-rata nilai Value at Risk dengan",n,"kali ulangan
untuk tingkat kepercayaan: \n")
return(ratarata)
}
VaR_MC(p,n,w)
```

**Algoritma Perhitungan Risiko C-VaR Portofolio Saham Optimal dengan Metode Simulasi Monte Carlo**

```
#Perhitungan C-VaR saham TLKM
TLKM <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/TLKM.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
x <- t(TLKM)
x
Wo <- 1000000000
Wo
T <- 252
T
n <- 25
n
alpha <- c(0.01,0.025,0.05,0.1)
alpha
k <- 1
k
w <- 0.6307128
w

VaR.MC = function(x,Wo,w,T,alpha,k)
{
x=as.matrix(x)
Mean.Rt=mean(x)
Sigma.Rt=sd(x)
return.sim=rnorm(T,Mean.Rt,Sigma.Rt)
```

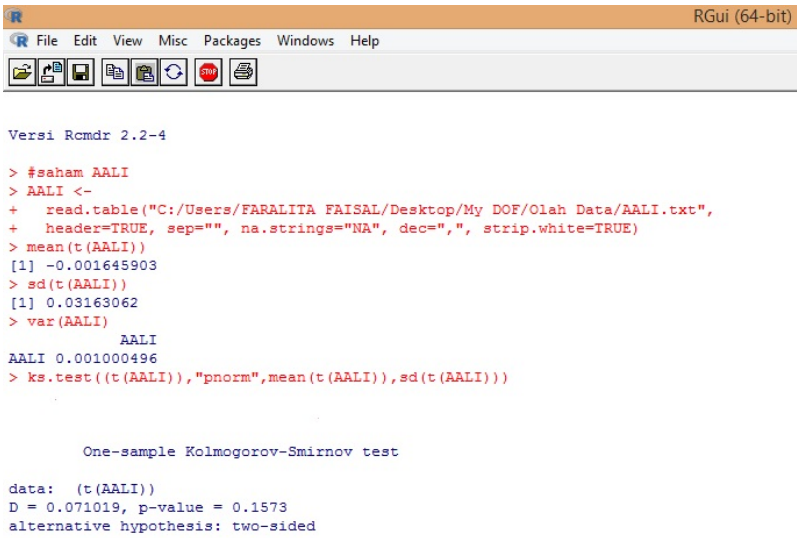
```
Rbintang=quantile(return.sim,alpha)
VaR=Wo*Rbintang*sqrt(k)
tampilan=as.matrix(t(VaR))
colnames(tampilan)=paste(((1-alpha)*100),"%",sep="")
rownames(tampilan)=""
return(tampilan)
}

VaR.MC(x,Wo,w,T,alpha,k)

VaR_MC=function(x,n,w)
{
VaR.MC=matrix(x,n,4)
for(i in 1:n)
{
VaR.MC[i,1]=VaR.MC(x,Wo,w,T,alpha,k)[1]
VaR.MC[i,2]=VaR.MC(x,Wo,w,T,alpha,k)[2]
VaR.MC[i,3]=VaR.MC(x,Wo,w,T,alpha,k)[3]
VaR.MC[i,4]=VaR.MC(x,Wo,w,T,alpha,k)[4]
}
VaR.MC
z=colMeans(VaR.MC)
ratarata=as.matrix(t(z))
cat("Nilai Value at Risk dengan Simulasi Monte Carlo
untuk tingkat kepercayaan: \n")
cat(" 99% 97.5% 95% 90% \n")
print(VaR.MC)
```

```
colnames(ratarata)=paste(((1-c(0.01,0.025,0.05,0.1))*100),"%",sep="")
rownames(ratarata)=""
cat("Rata-rata nilai Value at Risk dengan",n,"kali ulangan
 untuk tingkat kepercayaan: \n")
return(ratarata)
}
VaR_MC(x,n,w)

#Perhitungan C-VaR saham WSKT
WSKT <-
read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/WSKT.txt",
header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
y <- t(WSKT)
y
Wo <- 1000000000
Wo
T <- 252
T
n <- 25
n
alpha <- c(0.01,0.025,0.05,0.1)
alpha
k <- 1
k
w <- 0.3692872
w
```

```
VaR.MC = function(y,Wo,w,T,alpha,k)
{
y=as.matrix(y)
Mean.Rt=mean(y)
Sigma.Rt=sd(y)
return.sim=rnorm(T,Mean.Rt,Sigma.Rt)
Rbintang=quantile(return.sim,alpha)
VaR=Wo*Rbintang*sqrt(k)
tampilan=as.matrix(t(VaR))
colnames(tampilan)=paste(((1-alpha)*100),"%",sep="")
rownames(tampilan)=""
return(tampilan)
}

VaR.MC(y,Wo,w,T,alpha,k)

VaR_MC=function(y,n,w)
{
VaR.MC=matrix(y,n,4)
for(i in 1:n)
{
VaR.MC[i,1]=VaR.MC(y,Wo,w,T,alpha,k)[1]
VaR.MC[i,2]=VaR.MC(y,Wo,w,T,alpha,k)[2]
VaR.MC[i,3]=VaR.MC(y,Wo,w,T,alpha,k)[3]
VaR.MC[i,4]=VaR.MC(y,Wo,w,T,alpha,k)[4]
}
VaR.MC
```

```
z=colMeans(VaR.MC)
ratarata=as.matrix(t(z))
cat("Nilai Value at Risk dengan Simulasi Monte Carlo
untuk tingkat kepercayaan: \n")
cat(" 99% 97.5% 95% 90% \n")
print(VaR.MC)
colnames(ratarata)=paste(((1-c(0.01,0.025,0.05,0.1))*100),"%",sep="")
rownames(ratarata)=""
cat("Rata-rata nilai Value at Risk dengan",n,"kali ulangan
 untuk tingkat kepercayaan: \n")
return(ratarata)
}
VaR_MC(y,n,w)
```

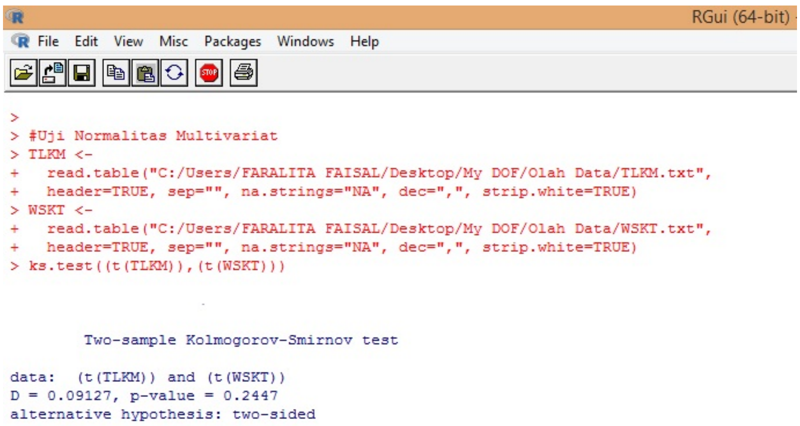
**Tampilan Hasil Uji Normalitas Univariat pada *Software R.3.30* pada Saham AALI periode April 2015-April 2016**




```
Versi Rcmdr 2.2-4

> #saham AALI
> AALI <-
+   read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/AALI.txt",
+   header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
> mean(t(AALI))
[1] -0.001645903
> sd(t(AALI))
[1] 0.03163062
> var(AALI)
            AALI
AALI 0.001000496
> ks.test((t(AALI)),"pnorm",mean(t(AALI)),sd(t(AALI)))


        One-sample Kolmogorov-Smirnov test

data:  (t(AALI))
D = 0.071019, p-value = 0.1573
alternative hypothesis: two-sided
```

Gambar 4.1: Hasil Uji Normalitas Univariat Saham AALI

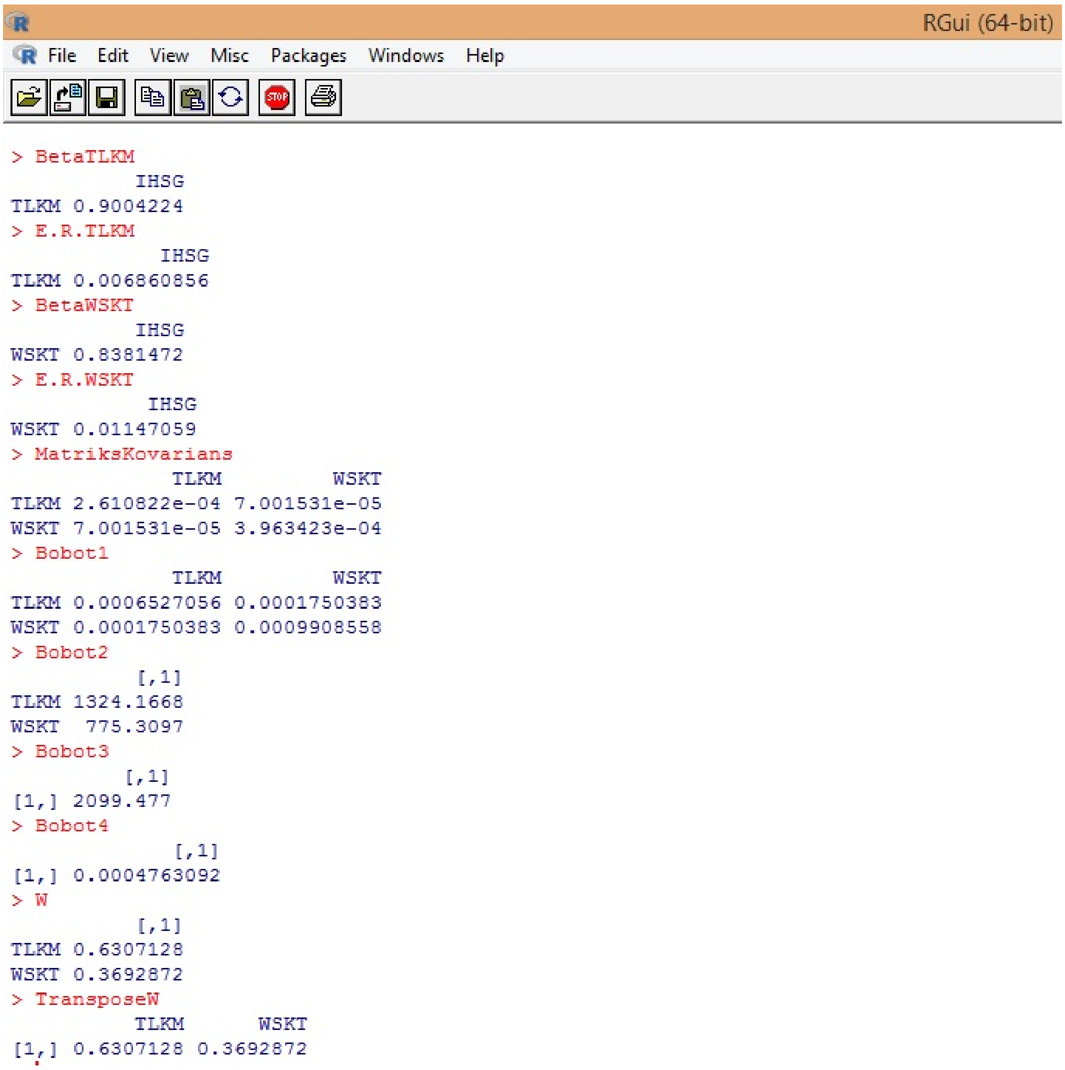
**Tampilan Hasil Uji Normalitas Multivariat pada *Software R.3.30* pada Saham TLKM dan WSKT periode April 2015-April 2016**




```
>
> #Uji Normalitas Multivariat
> TLKM <-
+   read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/TLKM.txt",
+   header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
> WSKT <-
+   read.table("C:/Users/FARALITA FAISAL/Desktop/My DOF/Olah Data/WSKT.txt",
+   header=TRUE, sep="", na.strings="NA", dec=",", strip.white=TRUE)
> ks.test((t(TLKM)),(t(WSKT)))


        Two-sample Kolmogorov-Smirnov test

data:  (t(TLKM)) and (t(WSKT))
D = 0.09127, p-value = 0.2447
alternative hypothesis: two-sided
```

Gambar 4.2: Hasil Uji Normalitas Multivariat Saham TLKM dan WSKT

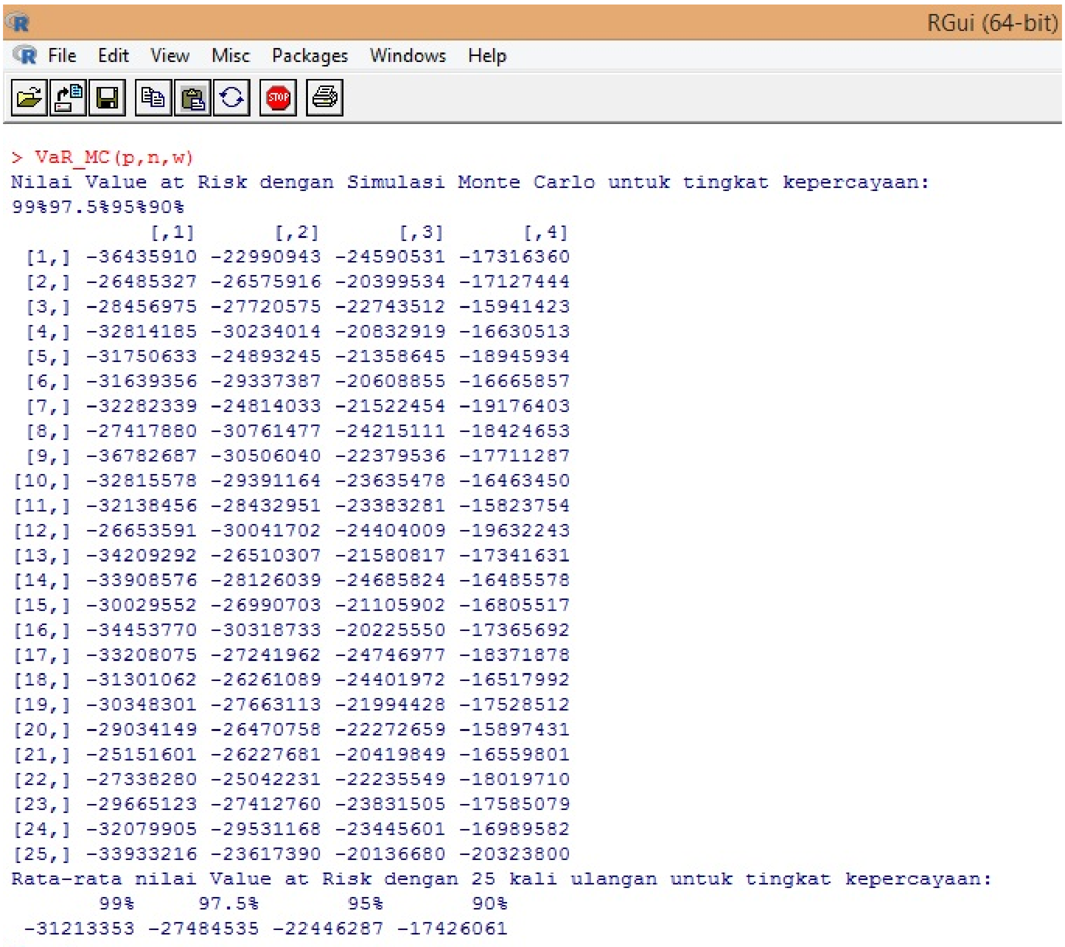
## Tampilan Hasil Pemberian Bobot atau Proporsi Dana Portofolio TLKM-WSKT pada *Software R.3.30*




```
> BetaTLKM
          IHSG
TLKM 0.9004224
> E.R.TLKM
            IHSG
TLKM 0.006860856
> BetaWSKT
          IHSG
WSKT 0.8381472
> E.R.WSKT
           IHSG
WSKT 0.01147059
> MatriksKovarians
             TLKM         WSKT
TLKM 2.610822e-04 7.001531e-05
WSKT 7.001531e-05 3.963423e-04
> Bobot1
             TLKM         WSKT
TLKM 0.0006527056 0.0001750383
WSKT 0.0001750383 0.0009908558
> Bobot2
          [,1]
TLKM 1324.1668
WSKT  775.3097
> Bobot3
         [,1]
[1,] 2099.477
> Bobot4
             [,1]
[1,] 0.0004763092
> W
          [,1]
TLKM 0.6307128
WSKT 0.3692872
> TransposeW
          TLKM      WSKT
[1,] 0.6307128 0.3692872
```

Gambar 4.3: Hasil Pemberian Bobot Portofolio TLKM-WSKT

## Tampilan Hasil Perhitungan VaR Portofolio TLKM-WSKT pada *Software R.3.30*




```
> VaR_MC(p,n,w)
Nilai Value at Risk dengan Simulasi Monte Carlo untuk tingkat kepercayaan:
99%97.5%95%90%
          [,1]      [,2]      [,3]      [,4]
 [1,] -36435910 -22990943 -24590531 -17316360
 [2,] -26485327 -26575916 -20399534 -17127444
 [3,] -28456975 -27720575 -22743512 -15941423
 [4,] -32814185 -30234014 -20832919 -16630513
 [5,] -31750633 -24893245 -21358645 -18945934
 [6,] -31639356 -29337387 -20608855 -16665857
 [7,] -32282339 -24814033 -21522454 -19176403
 [8,] -27417880 -30761477 -24215111 -18424653
 [9,] -36782687 -30506040 -22379536 -17711287
[10,] -32815578 -29391164 -23635478 -16463450
[11,] -32138456 -28432951 -23383281 -15823754
[12,] -26653591 -30041702 -24404009 -19632243
[13,] -34209292 -26510307 -21580817 -17341631
[14,] -33908576 -28126039 -24685824 -16485578
[15,] -30029552 -26990703 -21105902 -16805517
[16,] -34453770 -30318733 -20225550 -17365692
[17,] -33208075 -27241962 -24746977 -18371878
[18,] -31301062 -26261089 -24401972 -16517992
[19,] -30348301 -27663113 -21994428 -17528512
[20,] -29034149 -26470758 -22272659 -15897431
[21,] -25151601 -26227681 -20419849 -16559801
[22,] -27338280 -25042231 -22235549 -18019710
[23,] -29665123 -27412760 -23831505 -17585079
[24,] -32079905 -29531168 -23445601 -16989582
[25,] -33933216 -23617390 -20136680 -20323800
Rata-rata nilai Value at Risk dengan 25 kali ulangan untuk tingkat kepercayaan:
      99%     97.5%       95%       90%
 -31213353 -27484535 -22446287 -17426061
```

Gambar 4.4: Hasil Perhitungan VaR Portofolio TLKM-WSKT

## Tampilan Hasil Perhitungan C-VaR TLKM pada *Software R.3.30*

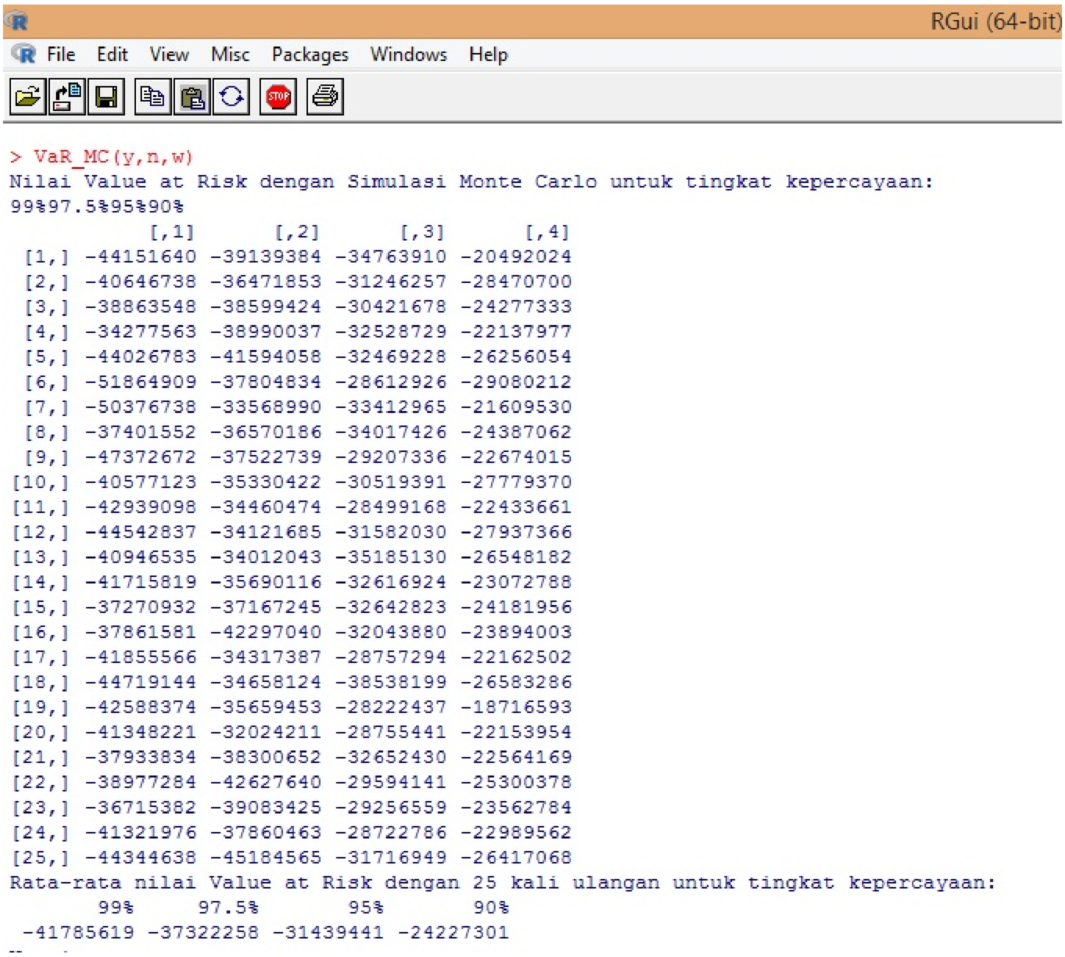
RGui (64-bit)

File Edit View Misc Packages Windows Help

```
> VaR_MC(x,n,w)
Nilai Value at Risk dengan Simulasi Monte Carlo untuk tingkat kepercayaan:
99%97.5%95%90%
          [,1]      [,2]      [,3]      [,4]
 [1,] -34501662 -30031631 -24928437 -21234857
 [2,] -34995900 -27404223 -26420716 -17988702
 [3,] -39416171 -29070400 -24608340 -20536189
 [4,] -39187705 -32710214 -26461227 -21657117
 [5,] -34820333 -31335166 -26744240 -20450432
 [6,] -37789101 -32374348 -26101489 -20057154
 [7,] -37151915 -28946639 -24109239 -21856086
 [8,] -40200580 -27014504 -26130825 -20761646
 [9,] -38334285 -29400252 -26893693 -21580945
[10,] -40639191 -31230657 -30069968 -20554989
[11,] -33501077 -32998233 -26929170 -21101549
[12,] -34398998 -33425917 -25833229 -21437993
[13,] -41012651 -32920428 -25392032 -19401992
[14,] -40554652 -31220296 -23023741 -17456499
[15,] -36477002 -28758792 -23341755 -21050896
[16,] -34928296 -30623787 -26067093 -17167519
[17,] -39897961 -29648400 -26156691 -20902850
[18,] -34260407 -23728183 -26265418 -19730863
[19,] -33947629 -32514875 -26948368 -20733988
[20,] -38841242 -29090512 -25715252 -21419308
[21,] -31020242 -31079471 -25251606 -21644598
[22,] -29954345 -30834811 -24221326 -19414138
[23,] -35793711 -28317671 -27633199 -20963547
[24,] -43881288 -36596929 -27432419 -18950929
[25,] -30741211 -35540369 -26080083 -19293923
Rata-rata nilai Value at Risk dengan 25 kali ulangan untuk tingkat kepercayaan:
      99%     97.5%       95%       90% 
 -36649902 -30672668 -25950382 -20293948
```

Gambar 4.5: Hasil Perhitungan C-VaR TLKM

### Tampilan Hasil Perhitungan C-VaR WSKT pada *Software R.3.30*




```
> VaR_MC(y,n,w)
Nilai Value at Risk dengan Simulasi Monte Carlo untuk tingkat kepercayaan:
99%97.5%95%90%
          [,1]      [,2]      [,3]      [,4]
 [1,] -44151640 -39139384 -34763910 -20492024
 [2,] -40646738 -36471853 -31246257 -28470700
 [3,] -38863548 -38599424 -30421678 -24277333
 [4,] -34277563 -38990037 -32528729 -22137977
 [5,] -44026783 -41594058 -32469228 -26256054
 [6,] -51864909 -37804834 -28612926 -29080212
 [7,] -50376738 -33568990 -33412965 -21609530
 [8,] -37401552 -36570186 -34017426 -24387062
 [9,] -47372672 -37522739 -29207336 -22674015
[10,] -40577123 -35330422 -30519391 -27779370
[11,] -42939098 -34460474 -28499168 -22433661
[12,] -44542837 -34121685 -31582030 -27937366
[13,] -40946535 -34012043 -35185130 -26548182
[14,] -41715819 -35690116 -32616924 -23072788
[15,] -37270932 -37167245 -32642823 -24181956
[16,] -37861581 -42297040 -32043880 -23894003
[17,] -41855566 -34317387 -28757294 -22162502
[18,] -44719144 -34658124 -38538199 -26583286
[19,] -42588374 -35659453 -28222437 -18716593
[20,] -41348221 -32024211 -28755441 -22153954
[21,] -37933834 -38300652 -32652430 -22564169
[22,] -38977284 -42627640 -29594141 -25300378
[23,] -36715382 -39083425 -29256559 -23562784
[24,] -41321976 -37860463 -28722786 -22989562
[25,] -44344638 -45184565 -31716949 -26417068
Rata-rata nilai Value at Risk dengan 25 kali ulangan untuk tingkat kepercayaan:
      99%     97.5%       95%       90%
 -41785619 -37322258 -31439441 -24227301
```

Gambar 4.6: Hasil Perhitungan C-VaR WSKT