

LAMPIRAN

Lampiran 1. Statistika Deskriptif

Descriptive Statistics: Inflasi

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Inflasi	20	0	0.05995	0.00308	0.01376	0.03350	0.04605	0.06335	0.07102

Variable	Maximum	Range
Inflasi	0.08360	0.05010

Descriptive Statistics: MinyakMentah

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
MinyakMentah	20	0	28.567	0.283	1.265	25.210	28.308	28.970	29.338

Variable	Maximum	Range
MinyakMentah	29.960	4.750

Descriptive Statistics: M2

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
M2	15	0	1953054	290582	1125419	747028	955692	1649662	2877220

Variable	Maximum	Range
M2	4173327	3426299

Descriptive Statistics: Kurs

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Kurs	20	0	13583	28.0	125	13400	13471	13545	13713	13826

Variable	Range
Kurs	426

Welcome to Minitab, press F1 for help.

Retrieving project from file: 'C:\USERS\REZZY\DESKTOP\PENELITIAN
2016\REBERKASBIPS\MINITAB.MPJ'

Lampiran 2. Regresi Parametrik

3/4/2016 7:47:08 AM

Welcome to Minitab, press F1 for help.

Regression Analysis: y versus x1, x2, x3

The regression equation is

$$y = 0.928 + 0.00206 x1 + 0.000000 x2 - 0.000096 x3$$

Predictor	Coef	SE Coef	T	P
Constant	0.9280	0.2860	3.24	0.273
x1	0.002058	0.001785	1.15	0.008
x2	0.00000000	0.00000000	2.22	0.048
x3	-0.00009627	0.00003144	-3.06	0.011

S = 0.00838689 R-Sq = 65.1% R-Sq(adj) = 55.6%

PRESS = 0.00128914 R-Sq(pred) = 41.91%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	0.00144560	0.00048187	6.85	0.007
Residual Error	11	0.00077374	0.00007034		
Total	14	0.00221934			

Source	DF	Seq SS
x1	1	0.00002337
x2	1	0.00076257
x3	1	0.00065966

Unusual Observations

Obs	x1	y	Fit	SE Fit	Residual	St Resid
3	28.4	0.03990	0.05584	0.00304	-0.01594	-2.04R

R denotes an observation with a large standardized residual.

Durbin-Watson statistic = 1.88138

Lampiran 3. Estimasi Parameter Spline Multivariabel

```
MPL<-function(x,eps=1e-009)
{
  x<-as.matrix(x)
  xsvd<-svd(x)
  diago<-xsvd$d[xsvd$d>eps]
  if(length(diago)==1)
  {
    xplus<-as.matrix(xsvd$v[,1])%*%t(as.matrix(xsvd$u[,1])/diago)
  }
  else {
    xplus<-xsvd$v[,1:length(diago)]%*%diag(1/diago)%*%t(xsvd$u[,1:length(diago)])
  }
  return(xplus)}
trun <- function(gdp,a,power)
{ gdp[gdp<a] <- a
  (gdp-a)^power}
spline.knots<-function(respon,x1,x2,x3,orde,knots=c(...)){
  y<-respon
  n <- length(y)
  r <- length(knots)
  k<-r/3
  m<-orde
  v<- matrix(0,n,1+3*(m+k))
  v[,1]<-1
  for (i in 2:(m+1))
  {v[,i] <- x1^(i-1)
    v[,i+m] <- x2^(i-1)
    v[,2*m+i] <- x3^(i-1)
  }
  for (i in 1:k)
  {v[,3*m+2*i+i-1] <- trun(x1,knots[1+3*(i-1)],m)
    v[,3*m+2*i+i] <- trun(x2,knots[2+3*(i-1)],m)
    v[,3*m+2*i+i+1] <- trun(x3,knots[3+3*(i-1)],m)}
  vtv <- t(v) %*% v
  C <- MPL(vtv)
  beta <- MPL(vtv)%*% t(v) %*% y
  for (i in 1:(3*(m+k)+1))
  {
    cat("Beta ke-",i,"=",beta[i],"\n")
  }
  h <- v %*% MPL(vtv) %*% t(v)
  ytopi <- v%*% beta
  error<-y-ytopi
  MSE<-sum((error)^2)/n
  cat("
=====")
  cat("\n\\t\\tytopi\\t\\terror")
}
```

```

cat("\n
=====")
for(i in 1:n)
{
  cat("\n",y[i],"t",ytopi[i],"t",error[i])
}
cat("\n=====
====\n")
cat("\n MSE=",MSE,"\n")

yb<-as.vector(ytopi)
n<-length(y)
B<-0
for(i in 1:n)
{
  b<-(y[i]-mean(y))*(yb[i]-mean(yb))
  B<-B+b
}
jkr<-B^2
C<-0
for(i in 1:n)
{
  c<-(y[i]-mean(y))^2
  C<-C+c
}
D<-0
for(i in 1:n)
{
  d<-(yb[i]-mean(yb))^2
  D<-D+d
}
jkt <- C*D
R<-jkr/jkt
cat("Nilai Koefisien Determinasi = ", R, "\n")
}

```

Lampiran 4. Menentukan Titik Knot Spline Multivariabel

```
MPL<-function(x,eps=1e-009)
{
  x<-as.matrix(x)
  xsvd<-svd(x)
  diago<-xsvd$d[xsvd$d>eps]
  if(length(diago)==1)
  {
    xplus<-as.matrix(xsvd$v[,1])%*%t(as.matrix(xsvd$u[,1])/diago)
  }
  else
  {
    xplus<-xsvd$v[,1:length(diago)]%*%diag(1/diago)%*%t(xsvd$u[,1:length(diago)])
  }
  return(xplus)
}
```

```
trun <- function(gdp,a,power)
{
  gdp[gdp<a] <- a
  (gdp-a)^power
}
```

```
gcv.knots<-function(respon,x1,x2,x3,orde,knots=c(...))
{
  h<-length(knots)
  m<-orde
  kn<-rep(0,h)
  print(h)
  if (h==3)
  {

    y <- respon
    n <- length(y)
    cat ("\norde : ",format (m))
    cat ("\n Titik knots GCV")
    for(j in 1:h)
    {
      for(i in 1:h)
      {kn[i]<-knots[i]}

      g<- kn[j]+0.1
      while(kn[j]<=g)
      {
```

```

k1<-kn[1]
k2<-kn[2]
k3<-kn[3]
  w <- matrix(0,n,3*m+4)
  w[,1]<-1
  for (i in 2:(m+1))
  {
w[,i] <- x1 ^ (i-1)
  w[,m+i]<-x2^(i-1)
  w[,2*m+i]<-x3^(i-1)
}
  w[, (3*m+2)] <- trun(x1, k1,m)
  w[, (3*m+3)] <- trun(x2, k2,m)
w[, (3*m+4)] <- trun(x3, k3,m)

  wtw <- t(w) %*% w
  C <- MPL(wtw)
  beta <- C %*% t(w) %*% y
  H <- w %*% MPL(wtw) %*% t(w)
  mu <- w %*% beta
  MSE <- t(y-mu) %*% (y-mu)/n
  I <- matrix (0, ncol = n, nrow = n)
  for (i in 1:n)
  { I[i, i] <- 1 }
  GCV <- (n^2 * MSE)/(sum(diag(I-H)))^2
  cat ("\n ", k1, " ", k2, " ", k3, " ", format (GCV))
  kn[j]<-kn[j]+0.01
kn[1]<-kn[1]+0.01
  }
  cat("\n")
}
}
else if (h==9)
{
  y <- respon
  n <- length(y)
kn<-rep(0,h)
  cat ("\nOrde Polinomial : ",format(m))
  cat ("\n Titik knots GCV")
  for(j in 1:h)
  {
for(i in 1:h)
{kn[i]<-knots[i]}

g<- kn[j]+0.1

```

```

while (kn[j]<=g)
{
k1<-kn[1]
k2<-kn[2]
k3<-kn[3]
k4<-kn[4]
k5<-kn[5]
k6<-kn[6]
k7<-kn[7]
k8<-kn[8]
k9<-kn[9]

w <- matrix(0,n,3*m+10)
w[,1]<-1
for (i in 2:(m+1))
{
w[,i] <- x1 ^ (i-1)
w[,m+i] <- x2 ^ (i-1)
w[,2*m+i] <- x3 ^ (i-1)
}
w[, (3*m+2)] <- trun(x1, k1, m)
w[, (3*m+3)] <- trun(x2, k2, m)
w[, (3*m+4)] <- trun(x3, k3, m)
w[, 3*m+5] <- trun(x1, k4, m)
w[, 3*m+6] <- trun(x2, k5, m)
w[, 3*m+7] <- trun(x3, k6, m)
w[, 3*m+8] <- trun(x1, k7, m)
w[, 3*m+9] <- trun(x2, k8, m)
w[, 3*m+10] <- trun(x3, k9, m)

wtw <- t(w) %*% w
beta <- MPL(wtw) %*% t(w) %*% y
H <- w %*% MPL(wtw) %*% t(w)
mu <- w %*% beta
MSE <- t(y - mu) %*% (y - mu)/n
I <- matrix(0, ncol = n, nrow = n)
for(i in 1:n)
{ I[i, i] <- 1}
GCV <- (n^2 * MSE)/(sum(diag(I-H)))^2
cat ("\n ", k1, " ", k2, " ", k3, " ", k4, " ", k5, " ", k6, " ", k7, " ", k8, " ", k9, " ", format (GCV))
kn[j]<-kn[j]+0.01
kn[1]<-kn[1]+0.01
}
kn[2]<-kn[2]+0.01
kn[3]<-kn[3]+0.01

```

```

kn[4]<-kn[4]+0.01
kn[5]<-kn[5]+0.01
}
cat("\n")
}
else if (h==6)
{
  y <- respon
  n <- length(y)
kn<-rep(0,h)
  cat ("\nOrde Polinomial : ",format(m))
  cat ("\n Titik knots GCV")
  for(j in 1:h)
  {
for(i in 1:h)
{kn[i]<-knots[i]}

g<- kn[j]+0.1

  while (kn[j]<=g)
  {
k1<-kn[1]
k2<-kn[2]
k3<-kn[3]
k4<-kn[4]
k5<-kn[5]
k6<-kn[6]

      w <- matrix(0,n,3*m+7)
      w[,1]<-1
for (i in 2:(m+1))
  {
w[,i] <- x1 ^(i-1)
      w[,m+i]<-x2^(i-1)
      w[,2*m+i]<-x3^(i-1)
  }
w[, (3*m+2)] <- trun(x1, k1,m)
      w[, (3*m+3)] <- trun(x2, k2,m)
w[, (3*m+4)] <- trun(x3,k3,m)
      w[,3*m+5] <- trun(x1, k4, m)
w[,3*m+6] <- trun(x2, k5, m)
w[,3*m+7] <- trun(x3, k6, m)

      wtw <- t(w) %*% w
      beta <- MPL(wtw) %*% t(w) %*% y
      H <- w %*% MPL(wtw) %*% t(w)

```



```

mu <- w %*% beta
MSE <- t(y - mu) %*% (y - mu)/n
I <- matrix(0, ncol = n, nrow = n)
for(i in 1:n)
  { I[i, i] <- 1}
GCV <- (n^2 * MSE)/(sum(diag(I-H)))^2
cat ("\n ", k1, " ", k2, " ", k3, " ", k4, " ", k5, " ", k6, " ", format (GCV))
kn[j]<-kn[j]+0.01
kn[1]<-kn[1]+0.01
  }
  kn[2]<-kn[2]+0.01
kn[3]<-kn[3]+0.01

}

cat("\n")
}

}

```

Lampiran 5. Estimasi Parameter Regresi Estimasi Parameter Spline Multivariabel

spline.knots(data[,1], data[,2], data[,3],data[,4],1,knots=c(1,0,0.01))

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],1,knots=c(1,0,0.01))
```

```
Beta ke- 1 = 0.3048391  
Beta ke- 2 = 0.301002  
Beta ke- 3 = 0.8278483  
Beta ke- 4 = -0.7289002  
Beta ke- 5 = -3.828437  
Beta ke- 6 = -0.4888307  
Beta ke- 7 = 0.4630524
```

```
=====
```

y	ytopi	error
0.51236	-0.6115482	1.123908
-1.0647	-0.3820219	-0.6826781
-1.45715	-0.5918205	-0.8653295
-1.0647	-0.9432584	-0.1214416
-0.84667	-0.9169912	0.07032123
0.17079	0.05574405	0.1150459
1.71878	0.9244436	0.7943364
0.70132	1.200234	-0.4989142
0.21439	0.3003275	-0.08593746
0.2798	-0.106379	0.386179
0.57777	0.8547825	-0.2770125
0.83941	0.9061913	-0.06678126
0.91935	0.8339945	0.08535554
0.91935	0.8425381	0.0768119
0.86121	0.9150737	-0.05386366

```
=====
```

```
MSE= 0.2429754
```

```
Nilai Koefisien Determinasi = 0.6890781
```

2 titik knot untuk orde 1.spline.knots(data[,1],Data[,2],data[,3],data[,4],1,knots=c(0,0,0,0,0,0))

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],1,knots=c(0,0,0,0,0,0))
```

```
Beta ke- 1 = 0.3067216  
Beta ke- 2 = 0.2666067  
Beta ke- 3 = 0.7852018  
Beta ke- 4 = -0.709561  
Beta ke- 5 = 0.004039447  
Beta ke- 6 = -0.2642043  
Beta ke- 7 = 0.1799646  
Beta ke- 8 = 0.004039447  
Beta ke- 9 = -0.2642043  
Beta ke- 10 = 0.1799646
```

```
=====
```

y	ytopi	error
0.51236	-0.6191152	1.131475
-1.0647	-0.4028196	-0.6618804
-1.45715	-0.5609995	-0.8961505
-1.0647	-1.067577	0.002877179
-0.84667	-0.7859405	-0.06072953
0.17079	0.06740128	0.1033887
1.71878	0.9140971	0.8046829
0.70132	1.188884	-0.4875639
0.21439	0.3584397	-0.1440497
0.2798	-0.03574899	0.315549
0.57777	0.8465046	-0.2687346
0.83941	0.8346357	0.004774276
0.91935	0.7061735	0.2131765
0.91935	0.7225976	0.1967524
0.86121	1.114778	-0.2535675

```
=====
```

```
MSE= 0.2508027
```

```
Nilai Koefisien Determinasi = 0.6790619
```

1 titik knot untuk orde 2 `spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(0,0,0))`

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(0,0,0))
Beta ke- 1 = -1.335041
Beta ke- 2 = 2.51888
Beta ke- 3 = 1.000301
Beta ke- 4 = 2.279831
Beta ke- 5 = 3.801342
Beta ke- 6 = -2.930567
Beta ke- 7 = -0.683102
Beta ke- 8 = -3.394922
Beta ke- 9 = -4.313299
Beta ke- 10 = 1.992743
```

y	ytopi	error
0.51236	-0.03006536	0.5424254
-1.0647	-0.7975231	-0.2671769
-1.45715	-1.030688	-0.4264615
-1.0647	-0.8559486	-0.2087514
-0.84667	-1.008624	0.1619537
0.17079	-0.01491072	0.1857007
1.71878	1.705071	0.01370885
0.70132	0.8387558	-0.1374358
0.21439	-0.2393976	0.4537876
0.2798	0.5827284	-0.3029284
0.57777	0.5034848	0.07428517
0.83941	1.208643	-0.3692334
0.91935	0.7092667	0.2100833
0.91935	0.6796849	0.2396651
0.86121	1.030832	-0.1696224

```
MSE= 0.08271547
Nilai Koefisien Determinasi = 0.8941537
```

2 titik knot untuk orde 2 `spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(1,1,1))`

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(1,1,1))
Beta ke- 1 = -0.8007261
Beta ke- 2 = 0.6502481
Beta ke- 3 = 0.2838022
Beta ke- 4 = 0.3100409
Beta ke- 5 = 0.8463839
Beta ke- 6 = -1.376674
Beta ke- 7 = -0.07095927
Beta ke- 8 = -140.6768
Beta ke- 9 = -2.036365
Beta ke- 10 = 2.202088
```

y	ytopi	error
0.51236	-0.6499561	1.162316
-1.0647	-0.2088243	-0.8558757
-1.45715	-0.7575656	-0.6995844
-1.0647	-1.223756	0.1590562
-0.84667	-0.7255631	-0.1211069
0.17079	0.08116888	0.08962112
1.71878	1.16674	0.5520405
0.70132	1.100102	-0.3987823
0.21439	0.260711	-0.04632102
0.2798	0.1585696	0.1212304
0.57777	0.6476542	-0.06988424
0.83941	0.6125847	0.2268253
0.91935	0.9080168	0.01133321
0.91935	1.121272	-0.2019223
0.86121	0.7901561	0.07105386

```
MSE= 0.213588
Nilai Koefisien Determinasi = 0.7266835
```

3 titik knot untuk orde 2. `spline.knots(data[,1], data[,2], data[,3],data[,4],3,knots=c(0,0,0,0,0))`

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],3,knots=c(0,0,0,0,0))
Beta ke- 1 = -2.232367
Beta ke- 2 = 3.148126
Beta ke- 3 = 2.254421
Beta ke- 4 = 0.3615655
Beta ke- 5 = 1.923692
Beta ke- 6 = 0.4345845
Beta ke- 7 = -4.369765
Beta ke- 8 = -3.853199
Beta ke- 9 = -1.671454
Beta ke- 10 = -0.4616478
Beta ke- 11 = -2.828367
Beta ke- 12 = 2.088474
Beta ke- 13 = 1.09003
Beta ke- 14 = -2.828367
Beta ke- 15 = 2.088474
Beta ke- 16 = 1.09003
```

Y	ytopi	error
0.51236	0.4743076	0.0380524
-1.0647	-1.132627	0.06792737
-1.45715	-1.328883	-0.1282673
-1.0647	-1.064627	-7.346482e-05
-0.84667	-0.8451688	-0.001501213
0.17079	0.1534026	0.01738743
1.71878	1.772949	-0.05416933
0.70132	0.6548622	0.04645783
0.21439	0.1057214	0.1086686
0.2798	0.3142057	-0.03440573
0.57777	0.6918737	-0.1141037
0.83941	0.7669971	0.07241288
0.91935	0.9886235	-0.06927349
0.91935	0.8394806	0.07986938
0.86121	0.8901916	-0.02898163

MSE= 0.004745706

MSE= 0.004745706

Nilai Koefisien Determinasi = 0.9939272

1 titik knot untuk orde 3. `spline.knots(data[,1], data[,2], data[,3],data[,4],1,knots=c(0,0,0,0,0))`

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],1,knots=c(0,0,0,0,0))
Beta ke- 1 = 0.3067216
Beta ke- 2 = 0.2666067
Beta ke- 3 = 0.7852018
Beta ke- 4 = -0.709561
Beta ke- 5 = 0.008078895
Beta ke- 6 = -0.5284086
Beta ke- 7 = 0.3599293
Beta ke- 8 = 0
Beta ke- 9 = 0
```

y	ytopi	error
0.51236	-0.6191152	1.131475
-1.0647	-0.4028196	-0.6618804
-1.45715	-0.5609995	-0.8961505
-1.0647	-1.067577	0.002877179
-0.84667	-0.7859405	-0.06072953
0.17079	0.06740128	0.1033887
1.71878	0.9140971	0.8046829
0.70132	1.188884	-0.4875639
0.21439	0.3584397	-0.1440497
0.2798	-0.03574899	0.315549
0.57777	0.8465046	-0.2687346
0.83941	0.8346357	0.004774276
0.91935	0.7061735	0.2131765
0.91935	0.7225976	0.1967524
0.86121	1.114778	-0.2535675

MSE= 0.2508027

Nilai Koefisien Determinasi = 0.6790619

2 titik knot untuk orde 3. `spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(0,0,0,0,0))`

```
> spline.knots(data[,1], data[,2], data[,3],data[,4],2,knots=c(0,0,0,0,0))
Beta ke- 1 = -1.335041
Beta ke- 2 = 2.51888
Beta ke- 3 = 1.000301
Beta ke- 4 = 2.279831
Beta ke- 5 = 3.801342
Beta ke- 6 = -2.930567
Beta ke- 7 = -0.683102
Beta ke- 8 = -3.394922
Beta ke- 9 = -4.313299
Beta ke- 10 = 1.992743
Beta ke- 11 = 0
Beta ke- 12 = 0
```

y	ytopi	error
0.51236	-0.03006536	0.5424254
-1.0647	-0.7975231	-0.2671769
-1.45715	-1.030688	-0.4264615
-1.0647	-0.8559486	-0.2087514
-0.84667	-1.008624	0.1619537
0.17079	-0.01491072	0.1857007
1.71878	1.705071	0.01370885
0.70132	0.8387558	-0.1374358
0.21439	-0.2393976	0.4537876
0.2798	0.5827284	-0.3029284
0.57777	0.5034848	0.07428517
0.83941	1.208643	-0.3692334
0.91935	0.7092667	0.2100833
0.91935	0.6796849	0.2396651
0.86121	1.030832	-0.1696224

```
MSE= 0.08271547
Nilai Koefisien Determinasi = 0.8941537
```

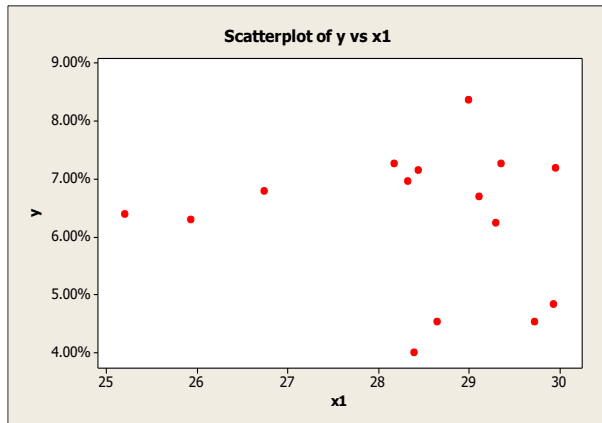
3 titik knot untuk orde 3 `spline.knots(data[,1], data[,2], data[,3],data[,4],3,knots=c(0,0,0,0,0))`

```
Beta ke- 1 = -2.232367
Beta ke- 2 = 3.148126
Beta ke- 3 = 2.254421
Beta ke- 4 = 0.3615655
Beta ke- 5 = 1.923692
Beta ke- 6 = 0.4345845
Beta ke- 7 = -4.369765
Beta ke- 8 = -3.853199
Beta ke- 9 = -1.671454
Beta ke- 10 = -0.4616478
Beta ke- 11 = -5.656733
Beta ke- 12 = 4.176947
Beta ke- 13 = 2.180059
Beta ke- 14 = 0
Beta ke- 15 = 0
```

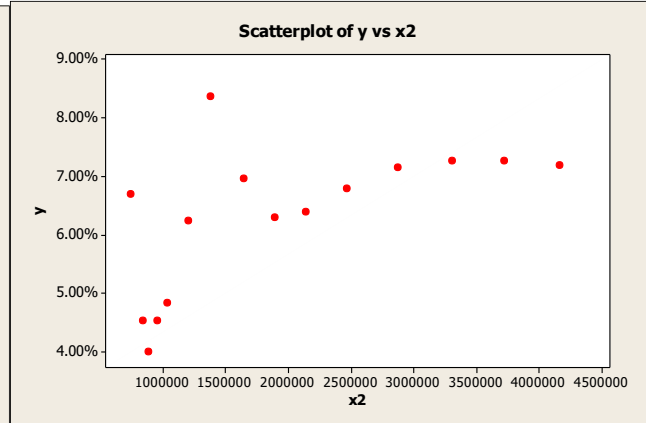
y	ytopi	error
0.51236	0.4743076	0.0380524
-1.0647	-1.132627	0.06792737
-1.45715	-1.328883	-0.1282673
-1.0647	-1.064627	-7.346482e-05
-0.84667	-0.8451688	-0.001501213
0.17079	0.1534026	0.01738743
1.71878	1.772949	-0.05416933
0.70132	0.6548622	0.04645783
0.21439	0.1057214	0.1086686
0.2798	0.3142057	-0.03440573
0.57777	0.6918737	-0.1141037
0.83941	0.7669971	0.07241288
0.91935	0.9886235	-0.06927349
0.91935	0.8394806	0.07986938
0.86121	0.8901916	-0.02898163

```
MSE= 0.004745706
Nilai Koefisien Determinasi = 0.9939272
```

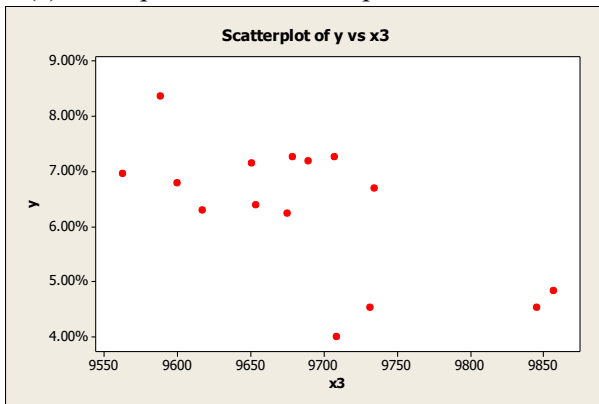
Lampiran 6. Plot Data



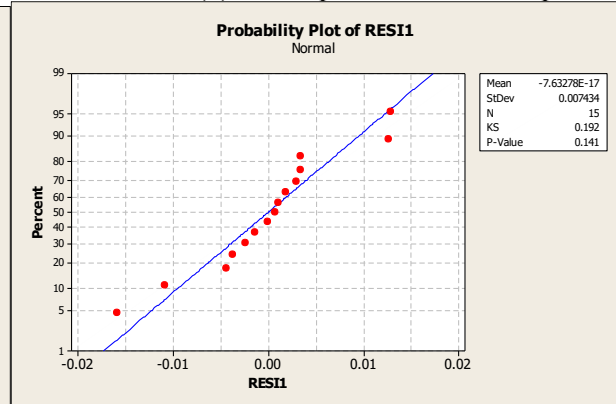
(a) Scatterplot Plot Y terhadap X1



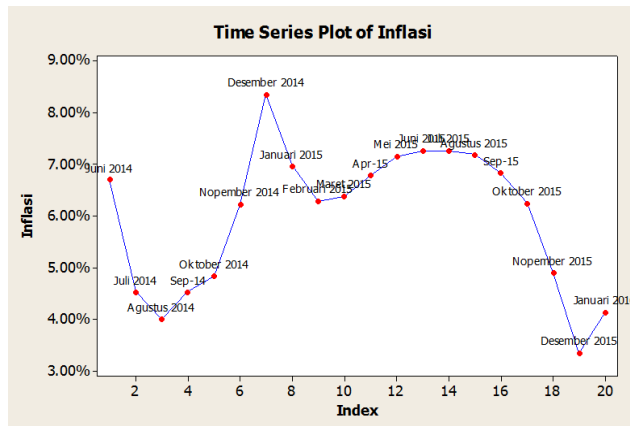
(b) Scatterplot Plot Y terhadap X2



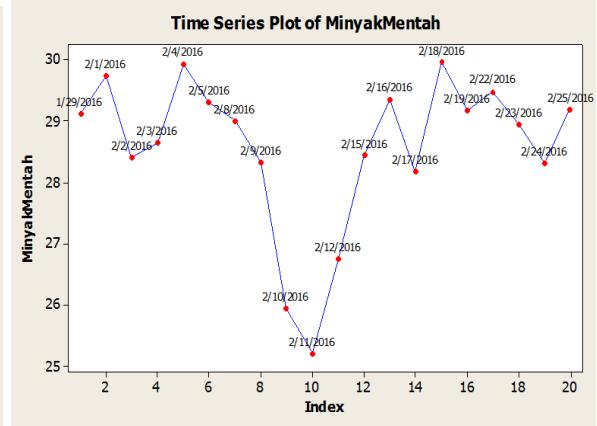
(c) Scatterplot Plot Y terhadap X3



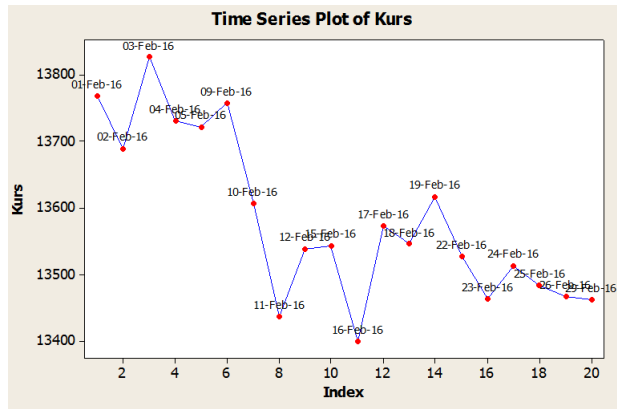
(d) Residual Regresi Parametrik



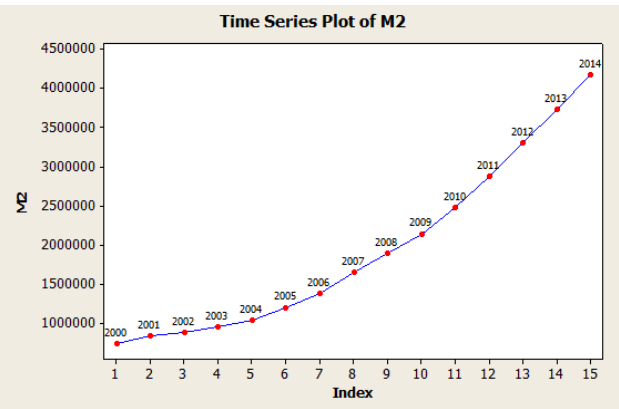
(e) Plot Inflasi



(f) Plot Harga Minyak Mentah



(g) Plot Kurs Rupiah Terhadap Dollar



(f) Plot Jumlah Uang Beredar (M2)