LAMPIRAN

Lampiran 1. Data Harga Bawang Merah, Luas Panen Harga Bawang, Hari Besar Nasional dan Hari Raya Keagamaan di Provinsi Bali Periode Januari 2016 hingga Desember 2021.

Periode	Harga Bawang Merah	Produksi Bawang Merah (Ton)	Luas Panen Bawang Merah (Ha)	Hari Besar Nasional	Hari Raya Keagamaan di Bali
Jan-16	31480	136,4	11	1	0
Feb-16	25165	4395	378	1	1
Mar-16	35683	4278,4	387	1	1
Apr-16	37714	523,9	36	0	0
May-16	36948	1195,3	89	0	0
Jun-16	29253	1587,9	110	0	1
Jul-16	33042	607,3	57	1	0
Aug-16	35727	492,8	35	0	0
Sep-16	33800	3285,3	225	1	0
Oct-16	25768	791,6	68	0	0
Nov-16	39386	319,5	35	0	0
Dec-16	35558	410,9	39	1	0
Jan-17	23756	472,1	39	1	0
Feb-17	29718	5691,5	43	0	0
Mar-17	33035	2629,2	49	1	1
Apr-17	30542	527,4	239	0	1
May-17	26143	593,8	49	0	0
Jun-17	24461	702,4	65	1	0
Jul-17	26680	3844	207	0	0
Aug-17	20484	681,9	90	0	0
Sep-17	15896	736,5	46	1	0
Oct-17	13201	3058,5	36	0	0
Nov-17	16391	999	121	0	1
Dec-17	18286	369,3	328	1	0
Jan-18	22050	407,3	49	1	0
Feb-18	20650	4852,9	326	1	0
Mar-18	25250	1470	98	1	1
Apr-18	31800	572,8	40	0	0
May-18	25650	2001,3	134	0	1
Jun-18	29750	2975,3	200	1	1
Jul-18	22450	2235	150	0	0

Aug-18	22200	2044,1	147	1	0
Sep-18	19250	2390,6	167	0	0
Oct-18	19750	2328,1	165	0	1
Nov-18	19050	1749,6	159	0	0
Dec-18	26550	1240	83	1	1
Jan-19	27550	1340,7	79	1	1
Feb-19	20150	2475,2	100	1	0
Mar-19	25250	2595	173	1	1
Apr-19	38150	2222,7	102	0	0
May-19	29650	931,4	54	0	1
Jun-19	26750	1052	217	1	0
Jul-19	25150	661	84	0	1
Aug-19	21750	1157	50	1	1
Sep-19	16950	3439,7	153	0	0
Oct-19	18050	2553,9	123	0	0
Nov-19	21900	315,3	128	0	0
Dec-19	32300	942,9	52	1	1
Jan-20	31300	525,46	25	1	0
Feb-20	27650	620,632	40	0	1
Mar-20	28550	2290,3	142,62	1	1
Apr-20	40300	2777,2	117	0	0
May-20	44050	1161,4	51	1	0
Jun-20	38000	2495,835	120,93	0	0
Jul-20	25350	70,021	82,1	1	1
Aug-20	23950	43	60	0	0
Sep-20	22500	349,15	89	0	1
Oct-20	21450	2143,278	107,02	0	0
Nov-20	26850	223,302	80,35	0	0
Dec-20	30300	1507,847	74,8	1	0
Jan-21	26500	890,096	46	1	0
Feb-21	22800	934,4	51,5	1	1
Mar-21	26850	4280,596	265,5	1	1
Apr-21	27150	2019,704	135	0	1
May-21	23250	2295,16	129,5	1	0
Jun-21	20550	1464,436	86	0	0
Jul-21	24400	1798,775	91,1	1	0
Aug-21	29250	1433,735	75,75	0	0
Sep-21	18850	2685,518	153,2	0	1
Oct-21	19000	3486,216	214	0	0
Nov-21	18500	948,524	70,1	0	1
Dec-21	20250	977,988	64	1	0

Lampiran 2. *Package* yang dibutuhkan untuk analisis metode SARIMA

```
> #Packages
> library(readxl)
> library(stats)
> library(forecast)
> library(EnvStats)
> library(tseries)
> library(MASS)
> library(lmtest)
> library(MLmetrics)
>
```

Lampiran 3. *Input* data pada RStudio

```
> #Input Data
> harga = read_excel("~/Shintya/Data Harga Bawang.xlsx")
New names:
• `` -> `...1`
> harga = harga[,c(-1)]
> harga = ts(harga, start=c(2016,1), freq=12)
> harga
       Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct
2016 31480 25165 35683 37714 36948 29253 33042 35727 33800 25768
2017 23756 29718 33035 30542 26143 24461 26680 20484 15896 13201
2018 22050 20650 25250 31800 25650 29750 22450 22200 19250 19750
2019 27550 20150 25250 38150 29650 26750 25150 21750 16950 18050
2020 31300 27650 28550 40300 44050 38000 25350 23950 22500 21450
2021 26500 22800 26850 27150 23250 20550 24400 29250 18850 19000
       Nov   Dec
2016 39386 35558
2017 16391 18286
2018 19050 26550
2019 21900 32300
2020 26850 30300
2021 18500 20250
>
```

Lampiran 4. Input data *training* dan data *testing*

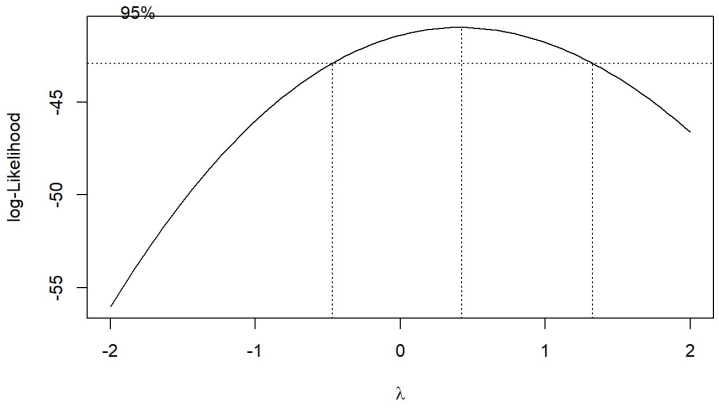
```
> #Input Data Training
> training = ts(harga, start=c(2016,1),end=c(2020,12), freq=12)
> training
       Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct
2016 31480 25165 35683 37714 36948 29253 33042 35727 33800 25768
2017 23756 29718 33035 30542 26143 24461 26680 20484 15896 13201
2018 22050 20650 25250 31800 25650 29750 22450 22200 19250 19750
2019 27550 20150 25250 38150 29650 26750 25150 21750 16950 18050
2020 31300 27650 28550 40300 44050 38000 25350 23950 22500 21450
       Nov   Dec
2016 39386 35558
2017 16391 18286
2018 19050 26550
2019 21900 32300
2020 26850 30300
>
> #Input Data Testing
> testing = ts(harga, start=c(2021,1), end=c(2021,12), freq=12)
> testing
       Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct
2021 31480 25165 35683 37714 36948 29253 33042 35727 33800 25768
       Nov   Dec
2021 30386 35558
```

Lampiran 5. R. *Code* untuk *plot time series* data *training*

```
> #Plot Data Training Harga Bawang Merah
> plot(training, col="black", main="Harga Bawang Merah Prov. Bali",
 xlab="time", type="o", ylab="Harga", lty=1, lwd=1.5)
>
```

Lampiran 6. R. *Code* dan hasil stasioneritas dalam ragam

```
> #Stasioneritas Dalam Ragam
> boxcox(lm(training~1))
> #nilai lambda = 0,5
>
```



Lampiran 7. R. *Code* transformasi data training

```
> #Transformasi Data Training
> tr.training=sqrt(training)
> tr.training
          Jan      Feb      Mar      Apr      May      Jun
2016 177.4260 158.6348 188.8994 194.2009 192.2186 171.0351
2017 154.1298 172.3891 181.7553 174.7627 161.6880 156.4001
2018 148.4924 143.7011 158.9025 178.3255 160.1562 172.4819
2019 165.9819 141.9507 158.9025 195.3202 172.1918 163.5543
2020 176.9181 166.2829 168.9675 200.7486 209.8809 194.9359
          Jul      Aug      Sep      Oct      Nov      Dec
2016 181.7746 189.0159 183.8478 160.5241 198.4591 188.5683
2017 163.3401 143.1223 126.0793 114.8956 128.0273 135.2257
2018 149.8332 148.9966 138.7444 140.5347 138.0217 162.9417
2019 158.5875 147.4788 130.1922 134.3503 147.9865 179.7220
2020 159.2168 154.7579 150.0000 146.4582 163.8597 174.0690
> ts.plot(tr.training)
> boxcox(lm(tr.training~1))
> #nilai lambda = 1
>
```

Lampiran 8. R. *Code* untuk *plot* data setelah transformasi 1 kali

```
> #Plot Data Setelah Ditransformasikan sebanyak 1 kali
> plot(tr.training, col="black", main="Transformasi Data", type="o",
 lty=1, lwd=1.5)
>
```

Lampiran 9. R. *Code* stasioneritas dalam rata-rata

```
> #Stasioneritas Dalam Rata-Rata
> #stasioner dalam rata-rata untuk non musiman
> acf(tr.training, lag.max=60)
> adf.test(tr.training)

        Augmented Dickey-Fuller Test

data:  tr.training
Dickey-Fuller = -2.6582, Lag order = 3, p-value = 0.3087
alternative hypothesis: stationary

> #belum stasioner dalam rata-rata non musiman
> #differencing non musiman
> diff.tr.training=diff(tr.training)
> diff.tr.training
             Jan          Feb          Mar          Apr          May
2016             -18.7912402  30.2646434   5.3014827  -1.9823013
2017 -34.4384746  18.2592794   9.3662353  -6.9926338 -13.0747251
2018  13.2666869  -4.7913454  15.2014072  19.4230592 -18.1693712
2019   3.0402194 -24.0312311  16.9517902  36.4177640 -23.1284963
2020  -2.8039474 -10.6351686   2.6845610  31.7811465   9.1323196
             Jun          Jul          Aug          Sep          Oct
2016  21.1835414  10.7395016   7.2412867   5.1681092  23.3236216
> par(mfrow=c(1,2))
> plot(diff.tr.training, col="black", main="differencing tr.trainin
g", xlab="time", type="o", ylab="diff.trtraining", lty=1, lwd=1.5)
> acf(diff.tr.training, lag.max=60)
> adf.test(diff.tr.training)

        Augmented Dickey-Fuller Test

data:  diff.tr.training
Dickey-Fuller = -3.9262, Lag order = 3, p-value = 0.019
alternative hypothesis: stationary

> #sudah stasioner dalam rata-rata non musiman (d=1)
>
> par(mfrow=c(1,1))
>
> #stasioner untuk musiman 12
> diff.mus12 = diff(diff.tr.training, lag=12)
> diff.mus12
            Jan         Feb         Mar         Apr         May
2017             37.050520 -20.898408 -12.294117 -11.092424
2018  47.705161 -23.050625   5.835172  26.415693  -5.094646


> acf(diff.mus12, lag.max = 60)
> #stasioner untuk musiman 12 (D=1)
>
```

Lampiran 10. R. *Code plot* ACF dan PACF data yang sudah stasioner

```
> #plot ACF dan PACF
> par(mfrow=c(1,2))
> acf(diff.mus12, lag.max = 60)
> pacf(diff.mus12, lag.max = 60)
>
```

Lampiran 11. R. *Code* dan hasil auto.arima pada RStudio

```
> auto.arima(tr.training, d = 1, D = 1, stepwise = FALSE, approximation =
 FALSE, trace = TRUE)

 ARIMA(0,1,0)(0,1,0)[12]                    : 407.7348
 ARIMA(0,1,0)(0,1,1)[12]                    : 406.3011
 ARIMA(0,1,0)(1,1,0)[12]                    : 407.7828
 ARIMA(0,1,0)(1,1,1)[12]                    : Inf
 ARIMA(0,1,1)(0,1,0)[12]                    : 402.9092
 ARIMA(0,1,1)(0,1,1)[12]                    : 400.6335
 ARIMA(0,1,1)(1,1,0)[12]                    : 401.2604
 ARIMA(0,1,1)(1,1,1)[12]                    : 402.9947
 ARIMA(0,1,2)(0,1,0)[12]                    : 404.5015
 ARIMA(0,1,2)(0,1,1)[12]                    : 402.3445
 ARIMA(0,1,2)(1,1,0)[12]                    : 403.3476
 ARIMA(0,1,2)(1,1,1)[12]                    : 404.6337
 ARIMA(0,1,3)(0,1,0)[12]                    : 404.355
 ARIMA(0,1,3)(0,1,1)[12]                    : 403.356
 ARIMA(0,1,3)(1,1,0)[12]                    : 403.8737
 ARIMA(0,1,3)(1,1,1)[12]                    : 405.9085
 ARIMA(0,1,4)(0,1,0)[12]                    : 406.7677
 ARIMA(0,1,4)(0,1,1)[12]                    : 405.8146
 ARIMA(0,1,4)(1,1,0)[12]                    : 406.4153

 ARIMA(0,1,5)(0,1,0)[12]                    : 408.0198
 ARIMA(1,1,0)(0,1,0)[12]                    : 406.3678
 ARIMA(1,1,0)(0,1,1)[12]                    : 404.5887
 ARIMA(1,1,0)(1,1,0)[12]                    : 405.5697
 ARIMA(1,1,0)(1,1,1)[12]                    : Inf
 ARIMA(1,1,1)(0,1,0)[12]                    : 404.9823
 ARIMA(1,1,1)(0,1,1)[12]                    : 402.7424
 ARIMA(1,1,1)(1,1,0)[12]                    : 403.5412
 ARIMA(1,1,1)(1,1,1)[12]                    : 405.1526
 ARIMA(1,1,2)(0,1,0)[12]                    : 406.1463
 ARIMA(1,1,2)(0,1,1)[12]                    : 404.4237
 ARIMA(1,1,2)(1,1,0)[12]                    : 405.3361
 ARIMA(1,1,2)(1,1,1)[12]                    : 406.8767
 ARIMA(1,1,3)(0,1,0)[12]                    : 406.8254
 ARIMA(1,1,3)(0,1,1)[12]                    : 405.9401
 ARIMA(1,1,3)(1,1,0)[12]                    : 406.4794
 ARIMA(1,1,4)(0,1,0)[12]                    : 409.0276
 ARIMA(2,1,0)(0,1,0)[12]                    : 401.8785
 ARIMA(2,1,0)(0,1,1)[12]                    : 400.4254
 ARIMA(2,1,0)(1,1,0)[12]                    : 401.0118
```

```
ARIMA(2,1,0)(1,1,1)[12]                    : 402.8034
ARIMA(2,1,1)(0,1,0)[12]                    : 404.264
ARIMA(2,1,1)(0,1,1)[12]                    : 402.8038
ARIMA(2,1,1)(1,1,0)[12]                    : 403.4113
ARIMA(2,1,1)(1,1,1)[12]                    : 405.3317
ARIMA(2,1,2)(0,1,0)[12]                    : 406.2369
ARIMA(2,1,2)(0,1,1)[12]                    : 405.0944
ARIMA(2,1,2)(1,1,0)[12]                    : 405.6293
ARIMA(2,1,3)(0,1,0)[12]                    : 408.7586
ARIMA(3,1,0)(0,1,0)[12]                    : 404.2589
ARIMA(3,1,0)(0,1,1)[12]                    : 402.7227
ARIMA(3,1,0)(1,1,0)[12]                    : 403.3369
ARIMA(3,1,0)(1,1,1)[12]                    : 405.2632
ARIMA(3,1,1)(0,1,0)[12]                    : Inf
ARIMA(3,1,1)(0,1,1)[12]                    : Inf
ARIMA(3,1,1)(1,1,0)[12]                    : Inf
ARIMA(3,1,2)(0,1,0)[12]                    : 408.7637
ARIMA(4,1,0)(0,1,0)[12]                    : 406.2014
ARIMA(4,1,0)(0,1,1)[12]                    : 404.7997
ARIMA(4,1,0)(1,1,0)[12]                    : 405.2823
ARIMA(4,1,1)(0,1,0)[12]                    : 408.8096
ARIMA(5,1,0)(0,1,0)[12]                    : 408.8041

 Best model: ARIMA(2,1,0)(0,1,1)[12]

Series: tr.training
ARIMA(2,1,0)(0,1,1)[12]

Coefficients:
          ar1      ar2     sma1
      -0.3891  -0.3674  -0.3923
s.e.   0.1388   0.1375   0.1979

sigma^2 = 246.3:  log likelihood = -195.74
AIC=399.47   AICc=400.43   BIC=406.87
> |
```

Lampiran 12. R. *Code* untuk *input* model SARIMA(2,1,0)(0,1,1)[12] dan *output* uji koefisien

```
> #model arima yaitu (2,1,0)(0,1,1)[12]
> Arima.model = Arima(tr.training, order = c(2,1,0), seasonal = list
(order=c(0,1,1), periode=12), method = "ML")
> Arima.model
Series: tr.training
ARIMA(2,1,0)(0,1,1)[12]

Coefficients:
          ar1      ar2     sma1
      -0.3891  -0.3674  -0.3923
s.e.   0.1388   0.1375   0.1979

sigma^2 = 246.3:  log likelihood = -195.74
AIC=399.47   AICc=400.43   BIC=406.87
```

```
> summary(Arima.model)
Series: tr.training
ARIMA(2,1,0)(0,1,1)[12]

Coefficients:
          ar1      ar2     sma1
      -0.3891  -0.3674  -0.3923
s.e.   0.1388   0.1375   0.1979

sigma^2 = 246.3:  log likelihood = -195.74
AIC=399.47   AICc=400.43   BIC=406.87

Training set error measures:
                    ME     RMSE      MAE       MPE     MAPE
Training set 0.9416995 13.44041 9.463304 0.2846437 6.032559
                   MASE         ACF1
Training set 0.5256281 -0.004185247
```

```
> coeftest(Arima.model)

z test of coefficients:

     Estimate Std. Error z value Pr(>|z|)
ar1  -0.38912    0.13876 -2.8042 0.005044 **
ar2  -0.36736    0.13747 -2.6722 0.007534 **
sma1 -0.39230    0.19792 -1.9821 0.047469 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

>
```

Lampiran 13. R *Code* dan *output* uji Ljung – Box model SARIMA (2,1,0)(0,1,1)[12]

```
> #diagnosis checking model ARIMA
> #uji Ljung-Box
> print(Box.test(Arima.model$residuals, type = "Ljung-Box"))

        Box-Ljung test

data:  Arima.model$residuals
X-squared = 0.0011044, df = 1, p-value = 0.9735

>
```

Lampiran 14. R Code dan output uji Kolmogorov-Smirnov model SARIMA (2,1,0)(0,1,1)[12]

```
> #uji Kolmogorov-Smirnov
> print(ks.test(Arima.model$residuals, "pnorm", mean=mean(Arima.mode
l$residuals),sd=sd(Arima.model$residuals)))

        Exact one-sample Kolmogorov-Smirnov test

data:  Arima.model$residuals
D = 0.12979, p-value = 0.2425
alternative hypothesis: two-sided

>
```

Lampiran 15. R *Code* dan *output* hasil peramalan tahun 2021

```
> #peramalan tahun2021
> forecast = forecast(training, model = Arima.model, h = 12)
> forecast
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
Jan 2021       30740.17 30720.05 30760.29 30709.40 30770.94
Feb 2021       28070.77 28047.19 28094.34 28034.71 28106.82
Mar 2021       29712.42 29687.54 29737.29 29674.37 29750.46
Apr 2021       40352.55 40324.71 40380.40 40309.97 40395.14
May 2021       40221.57 40191.11 40252.02 40174.99 40268.14
Jun 2021       35922.66 35890.37 35954.94 35873.28 35972.03
Jul 2021       27218.34 27184.10 27252.59 27165.98 27270.71
Aug 2021       25419.99 25383.80 25456.19 25364.63 25475.35
Sep 2021       22911.08 22873.14 22949.01 22853.06 22969.10
Oct 2021       22281.64 22242.03 22321.25 22221.06 22342.21
Nov 2021       26812.20 26770.95 26853.45 26749.12 26875.28
Dec 2021       32128.02 32085.22 32170.83 32062.55 32193.49
> 
```

Lampiran 16. R *Code plot* perbandingan hasil permalan tahun 2021

```
> #Plot Perbandingan Hasil Peramalan Tahun 2021
> par(mfrow=c(1,1))
> plot(forecast, main = "Perbandingan Hasil Peramalan", ylab = 'Harg
a', xlab = 'Waktu')
> par(col = 'Red')
> lines(fitted(forecast))
> par(col = 'Black')
> lines(harga)
> abline(v = 73, lty = 4, col = 'Red')
> legend('bottomleft', c("Data Aktual","Fitting", "Hasil Peramala
n"), col = c("black","red","blue"),lty = 1, cex = 0.25, text.font =
 4)
> 
```

Lampiran 17. R *Code* dan *output* peramalan untuk periode mendatang

```
> #Peramalan Periode Mendatang
> forecast2022 = forecast(harga, model = Arima.model, h=6)
> forecast2022
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
Jan 2022       20941.55 20921.44 20961.67 20910.79 20972.31
Feb 2022       17169.53 17145.96 17193.10 17133.48 17205.57
Mar 2022       19421.01 19396.13 19445.88 19382.97 19459.05
Apr 2022       24284.34 24256.50 24312.19 24241.76 24326.92
May 2022       21979.10 21948.65 22009.55 21932.53 22025.67
Jun 2022       18420.32 18388.04 18452.60 18370.95 18469.69
> 
```

Lampiran 18. R *Code plot* hasil peramalan periode mendatang

```
> #plot peramalan mendatang
> plot(forecast2022, main = "Peramalan Periode Mendatang", ylab = "H
arga", xlab = "Waktu")
> par(col = 'Black')
> lines(harga)
> abline(v=73, lty=4, col='red')
> legend('bottomleft', c('Data Aktual', 'Hasil Peramalan'), col=c('b
lack','blue'), lty=1, cex=0.25, text.font=4)
> 
```

Lampiran 19. Data yang digunakan untuk metode *Quantile Regression*

Periode	Harga Bawang Merah	Produksi Bawang Merah (Ton)	Luas Panen Bawang Merah (Ha)	Hari Besar Nasional	Hari Raya Keagamaan di Bali	Hasil Peramalan SARIMA
Jan-16	31480	136,4	11	1	0	31461,825
Feb-16	25165	4395	378	1	1	25161,763
Mar-16	35683	4278,4	387	1	1	35671,992
Apr-16	37714	523,9	36	0	0	37704,004
May-16	36948	1195,3	89	0	0	36940,719
Jun-16	29253	1587,9	110	0	1	29254,020
Jul-16	33042	607,3	57	1	0	33039,346
Aug-16	35727	492,8	35	0	0	35722,157
Sep-16	33800	3285,3	225	1	0	33797,520
Oct-16	25768	791,6	68	0	0	25773,408
Nov-16	39386	319,5	35	0	0	39377,903
Dec-16	35558	410,9	39	1	0	35572,287
Jan-17	23756	472,1	39	1	0	23904,553
Feb-17	29718	5691,5	43	0	0	19532,992
Mar-17	33035	2629,2	49	1	1	36249,129
Apr-17	30542	527,4	239	0	1	33142,729
May-17	26143	593,8	49	0	0	33628,852
Jun-17	24461	702,4	65	1	0	21780,624
Jul-17	26680	3844	207	0	0	27142,105
Aug-17	20484	681,9	90	0	0	27185,016
Sep-17	15896	736,5	46	1	0	22385,543
Oct-17	13201	3058,5	36	0	0	12175,173
Nov-17	16391	999	121	0	1	24449,846
Dec-17	18286	369,3	328	1	0	15717,488
Jan-18	22050	407,3	49	1	0	9676,263
Feb-18	20650	4852,9	326	1	0	17150,624
Mar-18	25250	1470	98	1	1	22770,717
Apr-18	31800	572,8	40	0	0	25972,143
May-18	25650	2001,3	134	0	1	26140,416
Jun-18	29750	2975,3	200	1	1	20441,122
Jul-18	22450	2235	150	0	0	30450,096
Aug-18	22200	2044,1	147	1	0	20306,195
Sep-18	19250	2390,6	167	0	0	21137,716
Oct-18	19750	2328,1	165	0	1	13416,487
Nov-18	19050	1749,6	159	0	0	24013,239
Dec-18	26550	1240	83	1	1	20403,754
Jan-19	27550	1340,7	79	1	1	25071,401

Feb-19	20150	2475,2	100	1	0	23868,940
Mar-19	25250	2595	173	1	1	27141,349
Apr-19	38150	2222,7	102	0	0	31556,841
May-19	29650	931,4	54	0	1	29536,165
Jun-19	26750	1052	217	1	0	28712,972
Jul-19	25150	661	84	0	1	26142,731
Aug-19	21750	1157	50	1	1	24515,384
Sep-19	16950	3439,7	153	0	0	18659,361
Oct-19	18050	2553,9	123	0	0	16868,113
Nov-19	21900	315,3	128	0	0	19735,105
Dec-19	32300	942,9	52	1	1	25028,840
Jan-20	31300	525,46	25	1	0	29527,566
Feb-20	27650	620,632	40	0	1	25070,888
Mar-20	28550	2290,3	142,62	1	1	32763,046
Apr-20	40300	2777,2	117	0	0	39124,493
May-20	44050	1161,4	51	1	0	33748,260
Jun-20	38000	2495,835	120,93	0	0	37574,721
Jul-20	25350	70,021	82,1	1	1	33512,474
Aug-20	23950	43	60	0	0	28489,119
Sep-20	22500	349,15	89	0	1	23100,530
Oct-20	21450	2143,278	107,02	0	0	21098,612
Nov-20	26850	223,302	80,35	0	0	2405,873
Dec-20	30300	1507,847	74,8	1	0	34588,509
Jan-21	26500	890,096	46	1	0	30740,170
Feb-21	22800	934,4	51,5	1	1	28070,770
Mar-21	26850	4280,596	265,5	1	1	29712,420
Apr-21	27150	2019,704	135	0	1	40352,550
May-21	23250	2295,16	129,5	1	0	40221,570
Jun-21	20550	1464,436	86	0	0	35922,660
Jul-21	24400	1798,775	91,1	1	0	27218,340
Aug-21	29250	1433,735	75,75	0	0	25419,990
Sep-21	18850	2685,518	153,2	0	1	22911,080
Oct-21	19000	3486,216	214	0	0	22281,640
Nov-21	18500	948,524	70,1	0	1	26812,200
Dec-21	20250	977,988	64	1	0	32128,020

Lampiran 20. *Package* yang diperlukan untuk metode QR

```
> library(SparseM)
> library(quantreg)
> library(readxl)
>
```

Lampiran 21. R *Code* untuk *input* data metode QR pada RStudio

```
> #Input Data
> Data <- read_excel("~/Shintya/Data QR.xlsx")
> attach(Data)
> summary(Data)
 Harga Bawang Merah Produksi Bawang Merah (Ton)
 Min.   :13201      Min.   :  43.0
 1st Qu.:21675      1st Qu.: 617.3
 Median :25709      Median :1290.3
 Mean   :26441      Mean   :1662.6
 3rd Qu.:30361      3rd Qu.:2411.8
 Max.   :44050      Max.   :5691.5
```

Lampiran 22. R *Code* untuk mendefinisikan variabel X dan variable Y

```
> #Define Variabels
> Y <- cbind(`Harga Bawang Merah`)
> X <- cbind(`Produksi Bawang Merah (Ton)`,`Luas Panen Bawang Merah
  (Ha)`,`Hari Besar Nasional`,`Hari Raya Keagamaan di Bali`,`Hasil Pe
ramalan SARIMA`)
>
```

Lampiran 23. R *Code scatter plot* variabel

```
> #Scatter Plot Variabels
> datatable = data.frame(`Harga Bawang Merah`,`Produksi Bawang Merah
  (Ton)`,`Luas Panen Bawang Merah (Ha)`,`Hari Besar Nasional`,`Hari R
aya Keagamaan di Bali`,`Hasil Peramalan SARIMA`)
> cor(datatable)
```

```
> pairs(datatable, col="blue", main="Scatterplots")
>
```

Lampiran 24. R *Code* dan *output* model *qunatile regression*

```
> #Quantile Regression
> quantreg25 <- rq(Y ~ X, data=Data, tau=0.25)
> summary(quantreg25)

Call: rq(formula = Y ~ X, tau = 0.25, data = Data)

tau: [1] 0.25

Coefficients:
                            coefficients lower bd
(Intercept)                  5727.40233  -2826.87868
XProduksi Bawang Merah (Ton)    0.31686     -1.34529
XLuas Panen Bawang Merah (Ha)   1.78356    -40.64852
XHari Besar Nasional         3542.52048   -564.56581
XHari Raya Keagamaan di Bali  -120.80597  -3241.03210
XHasil Peramalan SARIMA          0.52897      0.10929
                            upper bd
(Intercept)                 19605.95336
XProduksi Bawang Merah (Ton)    1.46526
XLuas Panen Bawang Merah (Ha)  18.15741
XHari Besar Nasional         4652.18272
XHari Raya Keagamaan di Bali 3267.51372
XHasil Peramalan SARIMA          0.83461
```

```
> quantreg50 <- rq(Y ~ X, data=Data, tau=0.5)
> summary(quantreg50)

Call: rq(formula = Y ~ X, tau = 0.5, data = Data)

tau: [1] 0.5

Coefficients:
                            coefficients lower bd
(Intercept)                  5242.05211   2558.29669
XProduksi Bawang Merah (Ton)    0.00097     -0.99836
XLuas Panen Bawang Merah (Ha)  -1.33642    -29.80207
XHari Besar Nasional          909.57310  -1217.19634
XHari Raya Keagamaan di Bali -891.91138  -2792.46455
XHasil Peramalan SARIMA          0.79990      0.42063
                            upper bd
(Intercept)                 15332.72109
XProduksi Bawang Merah (Ton)    1.10636
XLuas Panen Bawang Merah (Ha)   7.34944
XHari Besar Nasional         2852.57904
XHari Raya Keagamaan di Bali 2365.91967
XHasil Peramalan SARIMA          0.93107
```

```
> quantreg75 <- rq(Y ~ X, data=Data, tau=0.75)
> summary(quantreg75)

Call: rq(formula = Y ~ X, tau = 0.75, data = Data)

tau: [1] 0.75

Coefficients:
                            coefficients lower bd
(Intercept)                 13275.40852   7351.25900
XProduksi Bawang Merah (Ton)     0.76401     -0.81693
XLuas Panen Bawang Merah (Ha)  -14.74662    -15.63124
XHari Besar Nasional          -676.71290  -1272.58975
XHari Raya Keagamaan di Bali -1613.53505  -3687.65532
XHasil Peramalan SARIMA           0.65163      0.51138
                            upper bd
(Intercept)                 18948.06035
XProduksi Bawang Merah (Ton)     0.94460
XLuas Panen Bawang Merah (Ha)    6.18940
XHari Besar Nasional          2803.66161
XHari Raya Keagamaan di Bali  2490.36510
XHasil Peramalan SARIMA           0.78495
```

Lampiran 25. R *Code* untuk peramalan *quantile regression*

```
> #Peramanalan quantile regression
> quantreg <- rq (Y~X, data=Data, tau = seq(0.25, 0.75, by=0.25))
> summary(quantreg)
```

```
> prediction <- data.frame(predict(quantreg))
> View(prediction)
>
```

olahdataQR.R | Syntax SARIMA.R | prediction

Filter

	X1	X2	X3
1	25975.070	31303.262	33042.29
2	24525.668	24885.597	25165.00
3	30064.352	33280.552	31792.02
4	25901.835	35353.750	37714.00
5	25805.349	34673.019	36948.00
6	21780.376	27604.857	30315.82
7	27040.780	32504.095	33751.68
8	24841.863	33769.784	36413.55
9	28590.013	32888.622	33814.30

Showing 1 to 10 of 72 entries, 3 total columns

Console | Terminal | Jobs

R 4.2.1 · ~/Shintya/Proposal/

```
> prediction <- data.frame(predict(quantreg))
> View(prediction)
>
```

Lampiran 26. Hasil Peramalan SARIMA-QR (*Seasonal* ARIMA-*Quantile Regression*)

Periode	Data Aktual Harga Bawang Merah	Hasil Peramalan SARIMA-QR		
		Q 0,25	Q 0,5	Q 0,75
Jan-16	31480	25975,07	31303,262	33042,29
Feb-16	25165	24525,668	24885,597	25165
Mar-16	35683	30064,352	33280,552	31792,02
Apr-16	37714	25901,835	35353,75	37714
May-16	36948	25805,349	34673,019	36948
Jun-16	29253	21780,376	27604,857	30315,82
Jul-16	33042	27040,78	32504,095	33751,68
Aug-16	35727	24841,863	33769,784	36413,55
Sep-16	33800	28590,013	32888,622	33814,3
Oct-16	25768	19732,825	25768	29672,25
Nov-16	39386	26720,726	36693,835	38663,35
Dec-16	35558	28286,291	34554,051	35517,62
Jan-17	23756	22133,821	25221,13	27961,28
Feb-17	29718	17939,824	20814,453	29718
Mar-17	33035	29244,234	34192,321	35892,46
Apr-17	30542	23731,432	30542	30137,29
May-17	26143	23791,544	32076,744	34920,19
Jun-17	24461	21129,675	23487,682	26369,8
Jul-17	26680	21671,914	26680	30846,41
Aug-17	20484	20484	26867,633	30183,87
Sep-17	15896	21426,575	23996,98	27070,22
Oct-17	13201	13201	14935,772	23015
Nov-17	16391	19072,142	23746,746	26573,12
Dec-17	18286	18286	18286	18286
Jan-18	22050	14604,81	13826,543	18492,67
Feb-18	20650	20461,179	19439,362	22674,87
Mar-18	25250	21834,674	23344,382	25501,25
Apr-18	31800	19718,681	25964,176	30047,49
May-18	25650	20307,172	25082,621	28248,81
Jun-18	29750	21261,281	21346,085	23629,11
Jul-18	22450	22810,249	29400,673	32613,28
Aug-18	22200	20921,129	22200	25224,85
Sep-18	19250	17963,919	21929,164	26413,21
Oct-18	19750	13735,457	14863,68	19750
Nov-18	19050	19267,605	24239,357	27915,24

Dec-18	26550	20482,995	21470,88	24004,34
Jan-19	27550	22976,806	25209,958	27181,85
Feb-19	20150	22858,478	25113,055	28568,91
Mar-19	25250	24636,832	26741,29	28102,81
Apr-19	38150	23306,174	30350,091	34032,92
May-19	29650	21621,725	27904,75	30823,92
Jun-19	26750	25178,542	28830,045	28912,76
Jul-19	25150	19794,535	25150	27963,65
Aug-19	21750	22572,76	24803,781	27106,84
Sep-19	16950	16960,393	19966,459	25806,2
Oct-19	18050	15678,7	18572,883	24404,6
Nov-19	21900	16494,849	20857,337	24488,8
Dec-19	32300	22780,09	25211,613	27248,36
Jan-20	31300	25100,154	29737,72	31872,65
Feb-20	27650	19136,296	24351,4	27883,22
Mar-20	28550	27459,8	31278,372	31981,31
Apr-20	40300	27511,673	36383,919	39166,7
May-20	44050	27580,643	33079,706	34725,44
Jun-20	38000	26609,749	35138,738	37883,89
Jul-20	25350	27044,771	31956,574	31665,82
Aug-20	23950	20917,882	27950,257	30987,94
Sep-20	22500	18095,412	22709,571	25669,27
Oct-20	21450	17757,89	21977,804	27083,27
Nov-20	26850	7214,097	7059,336	13828,87
Dec-20	30300	28177,331	33720,346	35186,7
Jan-21	26500	25894,576	30679,965	32631,73
Feb-21	22800	24385,59	27645,502	29231,46
Mar-21	26850	26695,92	28675,889	29701,95
Apr-21	27150	27832,556	36449,539	29701,95
May-21	23250	31504,069	38153,87	38652,26
Jun-21	20550	25346,755	33862,946	36534,46
Jul-21	24400	24400	27803,47	30365,95
Aug-21	29250	19763,166	25475,565	29818,26
Sep-21	18850	18850	22474,487	26384,08
Oct-21	19000	19000	22782,43	27302,59
Nov-21	18500	20214,975	25704,36	28824,55
Dec-21	20250	26688,658	31766,131	33337,81