LAMPIRAN

Lampiran 1 : Data Nilai Ekspor Provinsi Bali (US$) Periode Januari 2015 sampai Desember 2021

Ekspor Bulanan Provinsi Bali (US$)							
Bulan	Tahun						
	2015	2016	2017	2018	2019	2020	2021
Januari	38080345	36191105	39154169	49728570	50057354	46595578	35279255
Februari	40932454	40331684	45168869	45280317	48637402	50764165	39746244
Maret	50671386	47447483	51927333	59233497	57308658	44160861	47599877
April	48421540	42654421	40105818	49153691	51590035	26350478	44393681
Mei	36646841	41660760	50841196	49513054	59146140	25756676	38188098
Juni	39936064	48050453	39467843	33350549	32569033	32257489	39173657
Juli	34208932	28158523	41112256	46423640	44757639	33994467	31395387
Agustus	38041330	40664715	43072264	44122707	46434743	33807208	39364228
September	40037757	40512116	44958201	47782934	45231781	38465302	40850026
Oktober	48570874	53778427	47692769	53983146	59068047	40458024	49413807
November	40966429	44205729	45807570	61315101	51016660	41772255	48822983
Desember	42167747	41410436	47239632	55956089	45859480	41996560	51790489

Lampiran 2 : *Package* yang dibutuhkan

```
> #PACKAGE YANG DIBUTUHKAN
> library(readxl)
> library(EnvStats)
> library(forecast)
> library(MASS)
> library(tsoutliers)
> library(lmtest)
> library(FitAR)
> library(stats)
> library(stargazer)
> library(TSA)
> library(ggplot2)
> library(astsa)
> library(fUnitRoots)
> library(strucchange)
> library(reshape)
> library(Rmisc)
> library(fBasics)
> library(tseries)
> library(car)
> library(nortest)
> library(portes)
> library(knitr)
> library(AID)
> library(fGarch)
> library(rugarch)
> library('fpp2')
> library(TTR)
> library(TSA)
> library(graphics)
>
```

Lampiran 3 : *Input* data pada aplikasi R Studio

```
> setwd("D:/DATA C/Desktop/Skripsi/Data")
> #INPUT DATA
> ekspor.real <- read_excel('Data Skripsi.xlsx', sheet = "Lembar1")
> ekspor.real<- ekspor.real[,c(-1)]
> ekspor.real<-ts(ekspor.real,start=c(2015,1),freq=12)
> ekspor.real
          Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
2015 38080345 40932454 50671386 48421540 36646841 39936064 34208932 38041330
2016 36191105 40331684 47447483 42654421 41660760 48050453 28158523 40664715
2017 39154169 45168869 51927333 40105818 50841196 39467843 41112256 43072264
2018 49728570 45280317 59233497 49153691 49513054 33350549 46423640 44122707
2019 50057354 48637402 57308658 51590035 59146140 32569033 44757639 46434743
2020 46595578 50764165 44160861 26350478 25756676 32257489 33994467 33807208
2021 35279255 39746244 47599877 44393681 38188098 39173657 31395387 39364228
          Sep      Oct      Nov      Dec
2015 40037757 48570874 40966429 42167747
2016 40512116 53778427 44205729 41410436
2017 44958201 47692769 45807570 47239632
2018 47782934 53983146 61315101 55956089
2019 45231781 59068047 51016660 45859480
2020 38465302 40458024 41772255 41996560
2021 40850026 49413807 48822983 51790489
>
> |
```

Lampiran 4 : R *Code* plot *time series* data keseluruhan

```
> #PLOT DATA REAL NILAI EKSPOR
> plot(ekspor.real, col="black", main="Nilai Ekspor Provinsi Bali", xlab="Waktu",
+      type="o", ylab="Nilai ekspor",lty=1, lwd = 1.5)
> |
```

Lampiran 5 : R *Code input* data *training*

```
> #Data Training
> ekspor <- read_excel('Data Nilai Ekspor Skripsi.xlsx', sheet = "Lembar1")
> ekspor<- ekspor[,c(-1)]
> ekspor<-ts(ekspor,start=c(2015,1),freq=12)
> ekspor
          Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
2015 38080345 40932454 50671386 48421540 36646841 39936064 34208932 38041330
2016 36191105 40331684 47447483 42654421 41660760 48050453 28158523 40664715
2017 39154169 45168869 51927333 40105818 50841196 39467843 41112256 43072264
2018 49728570 45280317 59233497 49153691 49513054 33350549 46423640 44122707
2019 50057354 48637402 57308658 51590035 59146140 32569033 44757639 46434743
2020 46595578 50764165 44160861 26350478 25756676 32257489 33994467 33807208
          Sep      Oct      Nov      Dec
2015 40037757 48570874 40966429 42167747
2016 40512116 53778427 44205729 41410436
2017 44958201 47692769 45807570 47239632
2018 47782934 53983146 61315101 55956089
2019 45231781 59068047 51016660 45859480
2020 38465302 40458024 41772255 41996560
> |
```

Lampiran 6 : R *Code input* data *testing*

```
> #Data Testing
> data.test  = ts(ekspor.real[73:84], start=73, end=84)
> data.test
Time Series:
Start = 73
End = 84
Frequency = 1
 [1] 35279255 39746244 47599877 44393681 38188098 39173657 31395387 39364228
 [9] 40850026 49413807 48822983 51790489
> |
```

Lampiran 7 : R *Code* uji kestasioneran dalam ragam

```
> #stasioneritas Dalam Ragam
> #Syarat stasioner dalam ragam adalah lamda=1
> BoxCox(ekspor)# Hasil menunjukkan bahwa lamda=0.996 artinya data belum stasioner dalam ragam
```

Lampiran 8 : R *Code* dan *output* uji kestasioneran dalam rata- rata

```
> #Stasioneritas Dalam Rataan
> #Note: data dapat dikatakan stastioner apabila p-value < alpha
> #sebelum diferencing
> par(mfrow=c(1,2))
> plot(ekspor, col="black", main="Data In Sample ", xlab="Waktu",
+      type="o", ylab="Nilai ekspor",lty=1, lwd = 1.5)
> Acf(ekspor,lag.max = 48)
> adf.test(ekspor)

        Augmented Dickey-Fuller Test

data:  ekspor
Dickey-Fuller = -2.2622, Lag order = 4, p-value = 0.4686
alternative hypothesis: stationary
```

Lampiran 9 : *Output* uji kestasioneran rata – rata setelah *differencing*

```
> #setelah diferencing
> par(mfrow=c(1,2))
> plot(diff(ekspor), col="black", main="Data In Sample ", xlab="Waktu",
+      type="o", ylab="Nilai ekspor",lty=1, lwd = 1.5)
> Acf(diff(ekspor),lag.max = 48)
> adf.test(diff(ekspor))

        Augmented Dickey-Fuller Test

data:  diff(ekspor)
Dickey-Fuller = -5.235, Lag order = 4, p-value = 0.01
alternative hypothesis: stationary
```

Lampiran 10 : R *Code* menampilkan plot ACF dan PACF

```
> #ACF DAN PACF UNTUK DATA YANG STASIONER
> par(mfrow=c(1,2))
> Acf(diff(ekspor),lag.max = 48)
> Pacf(diff(ekspor),lag.max = 48)
```

Lampiran 11 : R *Code input* model SARIMA$(0,1,1)(1,0,0)^{12}$ dan hasil uji koefisien

```
> #Model Dugaan
> Arima.1<-Arima(ekspor, order = c(0,1,1), seasonal=list(order=c(1,0,0), periode=12), method = "ML")
> summary(Arima.1)
Series: ekspor
ARIMA(0,1,1)(1,0,0)[12]

Coefficients:
          ma1    sar1
      -0.7158  0.4428
s.e.   0.0981  0.1127

sigma^2 = 4.096e+13:  log likelihood = -1214.09
AIC=2434.17   AICc=2434.53   BIC=2440.96

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE       ACF1
Training set -191250.6 6265099 4590814 -2.484089 11.42157 0.7382987 0.09927466
> coeftest(Arima.1)

z test of coefficients:

      Estimate Std. Error z value  Pr(>|z|)
ma1  -0.715753   0.098123 -7.2945 2.999e-13 ***
sar1  0.442768   0.112721  3.9280 8.566e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
```

Lampiran 12 : R *Code* penamaan model hasil *overfitting*

```
> # Model hasil overfitting
> Arima.2<-Arima(ekspor, order = c(1,1,1), seasonal=list(order=c(1,0,0), periode=12), method = "ML")
> Arima.3<-Arima(ekspor, order = c(0,1,2), seasonal=list(order=c(1,0,0), periode=12), method = "ML")
> Arima.4<-Arima(ekspor, order = c(0,1,1), seasonal=list(order=c(2,0,0), periode=12), method = "ML")
> Arima.5<-Arima(ekspor, order = c(0,1,1), seasonal=list(order=c(1,0,1), periode=12), method = "ML")
>
```

Lampiran 13 : R *Code* untuk *input* model SARIMA$(1,1,1)(1,0,0)^{12}$ dan *output* uji koefisien

```
> Arima.2<-Arima(ekspor, order = c(1,1,1), seasonal=list(order=c(1,0,0), periode=12), method = "ML")
> summary(Arima.2)
Series: ekspor
ARIMA(1,1,1)(1,0,0)[12]

Coefficients:
         ar1      ma1    sar1
      0.1974  -0.8085  0.4181
s.e.  0.1633   0.0970  0.1146

sigma^2 = 4.09e+13:  log likelihood = -1213.36
AIC=2434.71   AICc=2435.32   BIC=2443.76

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE          ACF1
Training set -233290.3 6215282 4608734 -2.597165 11.47413 0.7411805 -0.007515458
> coeftest(Arima.2)

z test of coefficients:

      Estimate Std. Error z value  Pr(>|z|)
ar1   0.197362   0.163349  1.2082 0.2269606
ma1  -0.808501   0.096958 -8.3387 < 2.2e-16 ***
sar1  0.418126   0.114635  3.6474 0.0002649 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
```

Lampiran 14 : R *Code* untuk *input* model SARIMA $(0,1,2)(1,0,0)^{12}$ dan *output* uji koefisien

```
> Arima.3<-Arima(ekspor, order = c(0,1,2), seasonal=list(order=c(1,0,0), periode=12), method = "ML")
> summary(Arima.3)
Series: ekspor
ARIMA(0,1,2)(1,0,0)[12]

Coefficients:
          ma1      ma2    sar1
      -0.6276  -0.1229  0.4279
s.e.   0.1112   0.1064  0.1125

sigma^2 = 4.093e+13:  log likelihood = -1213.45
AIC=2434.89   AICc=2435.5   BIC=2443.94

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE        ACF1
Training set -232705.4 6217195 4615697 -2.589603 11.48853 0.7423003 0.005479637
> coeftest(Arima.3)

z test of coefficients:

     Estimate Std. Error z value  Pr(>|z|)
ma1  -0.62762    0.11121 -5.6435 1.666e-08 ***
ma2  -0.12293    0.10639 -1.1554  0.247908
sar1  0.42786    0.11251  3.8030  0.000143 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Lampiran 15 : R *Code* untuk *input* model SARIMA$(0,1,1)(2,0,0)^{12}$ dan *output* uji koefisien

```
> Arima.4<-Arima(ekspor, order = c(0,1,1), seasonal=list(order=c(2,0,0), periode=12), method = "M
L")
> summary(Arima.4)
Series: ekspor
ARIMA(0,1,1)(2,0,0)[12]

Coefficients:
          ma1    sar1    sar2
      -0.7152  0.4171  0.0524
s.e.   0.0958  0.1363  0.1592

sigma^2 = 4.148e+13:  log likelihood = -1214.03
AIC=2436.07   AICc=2436.67   BIC=2445.12

Training set error measures:
                   ME    RMSE     MAE       MPE     MAPE      MASE       ACF1
Training set -209612.9 6258960 4578171 -2.523221 11.40448 0.7362654 0.09033676
> coeftest(Arima.4)

z test of coefficients:

      Estimate Std. Error z value  Pr(>|z|)
ma1  -0.715207   0.095782 -7.4670 8.203e-14 ***
sar1  0.417066   0.136254  3.0610  0.002206 **
sar2  0.052438   0.159232  0.3293  0.741916
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
```

Lampiran 16 : R *Code* untuk *input* model SARIMA $(0,1,1)(1,0,1)^{12}$ dan *output* uji koefisien

```
> Arima.5<-Arima(ekspor, order = c(0,1,1), seasonal=list(order=c(1,0,1), periode=12), method = "M
L")
> summary(Arima.5)
Series: ekspor
ARIMA(0,1,1)(1,0,1)[12]

Coefficients:
          ma1    sar1     sma1
      -0.7135  0.6211  -0.2328
s.e.   0.0943  0.3500   0.4680

sigma^2 = 4.135e+13:  log likelihood = -1213.98
AIC=2435.96   AICc=2436.56   BIC=2445.01

Training set error measures:
                    ME    RMSE     MAE       MPE  MAPE      MASE       ACF1
Training set -222378.8 6249056 4543480 -2.549591 11.34 0.7306863 0.07951149
> coeftest(Arima.5)

z test of coefficients:

      Estimate Std. Error z value  Pr(>|z|)
ma1  -0.713521   0.094303 -7.5662 3.842e-14 ***
sar1  0.621076   0.350029  1.7744    0.0760 .
sma1 -0.232824   0.467975 -0.4975    0.6188
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Lampiran 17 : R *Code* dan *output* uji Ljung – Box model SARIMA $(0,1,1)(1,0,1)^{12}$

```
> #Diagnosis Cacking Model Arima 1
> # Uji Ljung-Box
> print(Box.test(Arima.1$residuals, type = "Ljung-Box"))

        Box-Ljung test

data:  Arima.1$residuals
X-squared = 0.73958, df = 1, p-value = 0.3898
```

Lampiran 18 : R *Code* dan *output* uji *Kolmogorov-Smirnov* model SARIMA $(0,1,1)(1,0,1)^{12}$

```
> # Uji Kolmogorov-Smirnov
> print(ks.test(Arima.1$residuals, "pnorm", mean=mean(Arima.1$residuals), sd=sd(Arima.1$residual
s)))

        One-sample Kolmogorov-Smirnov test

data:  Arima.1$residuals
D = 0.10743, p-value = 0.3517
alternative hypothesis: two-sided
```

Lampiran 19 : R *Code* uji plot model SARIMA $(0,1,1)(1,0,1)^{12}$

```
> # Uji Plot
> par(mfrow=c(2,2))
> plot(residuals(Arima.1), ylab ='Residuals', type='o',col='blue',main="(a) Residual Terhadap Order");
> abline(h=0)
> acf(Arima.1$residuals,main='(b) Plot ACF Residual')
> qqnorm(Arima.1$residuals, col=6, main="(c) Normal Plot Residual")
> qqline(Arima.1$residuals)
> hist(Arima.1$residuals, probability = T, main = "(d) Histogram Residual", xlab = "Sisaan")
> lines(density(Arima.1$residuals), col=6)
>
```

Lampiran 20 : R *Code* dan *output* hasil peramalan tahun 2021

```
> #HASIL PERAMALAN DI TAHUN 2021 DENGAN SELURUH DATA
> forecast2021<-forecast(ekspor,model=Arima.1,h=12)
> forecast2021
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
Jan 2021       38382657 30180922 46584392 25839186 50926128
Feb 2021       40228376 31701741 48755011 27188014 53268738
Mar 2021       37304641 28465040 46144242 23785639 50823644
Apr 2021       29418765 20276906 38560623 15437498 43400031
May 2021       29155848 19721410 38590286 14727120 43584576
Jun 2021       32034203 22315990 41752416 17171479 46896927
Jul 2021       32803282 22809349 42797216 17518880 48087684
Aug 2021       32720370 22458121 42982618 17025615 48415125
Sep 2021       34782827 24259102 45306552 18688179 50877476
Oct 2021       35665142 24886281 46444002 19180297 52149986
Nov 2021       36247042 25218947 47275136 19381026 53113057
Dec 2021       36346357 25074537 47618176 19107597 53585117
>
```

Lampiran 21 : R *Code* plot perbandingan hasil peramalan tahun 2021

```
> #Plot Perbandingan Hasil Prediksi Tahun 2021
> par(mfrow=c(1,1))
> plot(forecast2021,main="Perbandingan Hasil Tahun 2021", ylab="jumlah", xlab="waktu")
> par(col="red")
> lines(fitted(Arima.1))
> par(col="Black")
> lines(ekspor.real)
> abline(v=73, lty=4, col="red")
> legend("topleft",c("Data aktual","Fitting","Hasil Peramalan"),
+        col=c("black","red","Blue"),lty=1, cex=0.6, text.font=1)
>
```

Lampiran 22 : R *Code* dan *output* hasil peramalan tahun 2022

```
> #HASIL PERAMALAN DI TAHUN 2022 DENGAN SELURUH DATA
> forecast2022<-forecast(ekspor.real,model=Arima.fit,h=12)
> forecast2022
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
Jan 2022       45331974 37103187 53560761 32747130 57916818
Feb 2022       47017591 38333375 55701807 33736228 60298954
Mar 2022       49981157 40864234 59098080 36038027 63924288
Apr 2022       48771300 39241297 58301303 34196418 63346182
May 2022       46429625 36503718 56355532 31249260 61609990
Jun 2022       46801525 36494911 57108140 31038918 62564132
Jul 2022       43866397 33192645 54540149 27542302 60190492
Aug 2022       46873437 35844763 57902112 30006536 63740339
Sep 2022       47434103 36061578 58806628 30041327 64826879
Oct 2022       50665643 38959363 62371924 32762432 68568854
Nov 2022       50442696 38411916 62473476 32043205 68842187
Dec 2022       51562484 39215729 63909238 32679752 70445215
```

Lampiran 23 : R *Code* plot perbandingan hasil peramalan tahun 2021

```
> par(mfrow=c(1,1))
> plot(forecast2022,main="Prediksi Tahun 2022", ylab="jumlah", xlab="waktu")
> par(col="Black")
> lines(ekspor.real)
> abline(v=73, lty=4, col="red")
> legend("topleft",c("Data aktual","Hasil Peramalan"),
+        col=c("black","Blue"),lty=1, cex=0.8, text.font=1)
```