```
R version 3.6.1 (2019-07-05) -- "Action of the Toes"
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Platform: x86_64-w64-mingw32/x64 (64-bit)

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  Natural language support but running in an English locale

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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Previously saved workspace restored]

> #1 Preprocessing data dan Identifikasi model
> #Memangggil data asli dan plot grafik
> penarikan=read.delim("clipboard")
> penarikan
    PERIODE     NASIONAL
1    Jan-03 1.063949e+13
2    Feb-03 1.386427e+13
3    Mar-03 1.078713e+13
4    Apr-03 1.653761e+13
5    May-03 1.765481e+13
6    Jun-03 1.777099e+13
7    Jul-03 1.495606e+13
8    Aug-03 1.860203e+13
9    Sep-03 1.925665e+13
10   Oct-03 1.836467e+13
11   Nov-03 3.464181e+13
12   Dec-03 2.319530e+13
13   Jan-04 1.748276e+13
14   Feb-04 1.514898e+13
15   Mar-04 1.627010e+13
16   Apr-04 2.288022e+13
17   May-04 1.485091e+13
18   Jun-04 2.657411e+13
19   Jul-04 2.154767e+13
20   Aug-04 1.652193e+13
21   Sep-04 2.292159e+13
22   Oct-04 2.711937e+13
23   Nov-04 3.120725e+13
24   Dec-04 2.641769e+13
25   Jan-05 1.418633e+13
26   Feb-05 1.957418e+13
27   Mar-05 1.738889e+13
28   Apr-05 2.251303e+13
29   May-05 2.012169e+13
30   Jun-05 2.563028e+13
31   Jul-05 2.750047e+13
32   Aug-05 1.962557e+13
33   Sep-05 2.974841e+13
34   Oct-05 5.024923e+13
35   Nov-05 1.508410e+13
36   Dec-05 3.406435e+13
37   Jan-06 2.140424e+13
38   Feb-06 2.119080e+13
39   Mar-06 2.301984e+13
40   Apr-06 2.337205e+13
41   May-06 2.109938e+13
42   Jun-06 2.803959e+13
43   Jul-06 2.164494e+13
```

44	Aug-06	1.728710e+13
45	Sep-06	2.850770e+13
46	Oct-06	3.911643e+13
47	Nov-06	1.764658e+13
48	Dec-06	3.140219e+13
49	Jan-07	4.108486e+12
50	Feb-07	6.748068e+12
51	Mar-07	8.942374e+12
52	Apr-07	1.101155e+13
53	May-07	1.253952e+13
54	Jun-07	1.527544e+13
55	Jul-07	8.976616e+12
56	Aug-07	1.105826e+13
57	Sep-07	1.756490e+13
58	Oct-07	2.825908e+13
59	Nov-07	9.928709e+12
60	Dec-07	3.396930e+13
61	Jan-08	4.913317e+12
62	Feb-08	8.498029e+12
63	Mar-08	9.444774e+12
64	Apr-08	1.298753e+13
65	May-08	1.446796e+13
66	Jun-08	2.048466e+13
67	Jul-08	1.182261e+13
68	Aug-08	1.076517e+13
69	Sep-08	5.057300e+13
70	Oct-08	2.533512e+12
71	Nov-08	8.113499e+12
72	Dec-08	3.784541e+13
73	Jan-09	3.484692e+12
74	Feb-09	4.682820e+12
75	Mar-09	1.101214e+13
76	Apr-09	1.366493e+13
77	May-09	9.245561e+12
78	Jun-09	1.845486e+13
79	Jul-09	1.072653e+13
80	Aug-09	9.559560e+12
81	Sep-09	3.794631e+13
82	Oct-09	4.242680e+12
83	Nov-09	1.240306e+13
84	Dec-09	1.994904e+13
85	Jan-10	1.952119e+12
86	Feb-10	3.569295e+12
87	Mar-10	5.071173e+12
88	Apr-10	1.365221e+13
89	May-10	1.566029e+13
90	Jun-10	1.574879e+13
91	Jul-10	1.870920e+13
92	Aug-10	3.077439e+13
93	Sep-10	3.104076e+13
94	Oct-10	1.184979e+13
95	Nov-10	4.103530e+13
96	Dec-10	7.842955e+13
97	Jan-11	8.055254e+12
98	Feb-11	9.385204e+12
99	Mar-11	1.785850e+13
100	Apr-11	2.571476e+13
101	May-11	2.412833e+13
102	Jun-11	2.748675e+13
103	Jul-11	3.111010e+13
104	Aug-11	7.899806e+13
105	Sep-11	1.020726e+13
106	Oct-11	2.433580e+13
107	Nov-11	2.447620e+13
108	Dec-11	5.549305e+13
109	Jan-12	1.219429e+13
110	Feb-12	1.736841e+13
111	Mar-12	3.097392e+13
112	Apr-12	3.142917e+13

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113  May-12 3.203509e+13
114  Jun-12 4.334273e+13
115  Jul-12 4.710881e+13
116  Aug-12 8.481623e+13
117  Sep-12 1.665319e+13
118  Oct-12 3.303989e+13
119  Nov-12 3.280378e+13
120  Dec-12 6.531518e+13
121  Jan-13 1.269050e+13
122  Feb-13 2.626810e+13
123  Mar-13 3.516336e+13
124  Apr-13 2.738102e+13
125  May-13 4.030401e+13
126  Jun-13 3.642705e+13
127  Jul-13 8.662138e+13
128  Aug-13 4.818236e+13
129  Sep-13 2.881963e+13
130  Oct-13 3.764691e+13
131  Nov-13 3.893983e+13
132  Dec-13 7.426376e+13
133  Jan-14 2.124351e+13
134  Feb-14 2.288010e+13
135  Mar-14 3.620830e+13
136  Apr-14 3.406307e+13
137  May-14 4.046914e+13
138  Jun-14 3.784230e+13
139  Jul-14 1.168769e+14
140  Aug-14 1.582402e+13
141  Sep-14 3.369179e+13
142  Oct-14 4.298894e+13
143  Nov-14 3.712189e+13
144  Dec-14 7.286750e+13
> library(tseries)
Registered S3 method overwritten by 'quantmod':
  method            from
  as.zoo.data.frame zoo

    'tseries' version: 0.10-47

    'tseries' is a package for time series analysis and computational
    finance.

    See 'library(help="tseries")' for details.

Warning message:
package 'tseries' was built under R version 3.6.3
> library(forecast)
This is forecast 8.12
  Want to meet other forecasters? Join the International Institute of Forecasters:
  http://forecasters.org/
Warning message:
package 'forecast' was built under R version 3.6.3
> data=penarikan$NASIONAL
> data
  [1] 1.063949e+13 1.386427e+13 1.078713e+13 1.653761e+13 1.765481e+13
  [6] 1.777099e+13 1.495606e+13 1.860203e+13 1.925665e+13 1.836467e+13
 [11] 3.464181e+13 2.319530e+13 1.748276e+13 1.514898e+13 1.627010e+13
 [16] 2.288022e+13 1.485091e+13 2.657411e+13 2.154767e+13 1.652193e+13
 [21] 2.292159e+13 2.711937e+13 3.120725e+13 2.641769e+13 1.418633e+13
 [26] 1.957418e+13 1.738889e+13 2.251303e+13 2.012169e+13 2.563028e+13
 [31] 2.750047e+13 1.962557e+13 2.974841e+13 5.024923e+13 1.508410e+13
 [36] 3.406435e+13 2.140424e+13 2.119080e+13 2.301984e+13 2.337205e+13
 [41] 2.109938e+13 2.803959e+13 2.164494e+13 1.728710e+13 2.850770e+13
 [46] 3.911643e+13 1.764658e+13 3.140219e+13 4.108486e+12 6.748068e+12
 [51] 8.942374e+12 1.101155e+13 1.253952e+13 1.527544e+13 8.976616e+12
 [56] 1.105826e+13 1.756490e+13 2.825908e+13 9.928709e+12 3.396930e+13
 [61] 4.913317e+12 8.498029e+12 9.444774e+12 1.298753e+13 1.446796e+13
 [66] 2.048466e+13 1.182261e+13 1.076517e+13 5.057300e+13 2.533512e+12
 [71] 8.113499e+12 3.784541e+13 3.484692e+12 4.682820e+12 1.101214e+13
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 [76] 1.366493e+13 9.245561e+12 1.845486e+13 1.072653e+13 9.559560e+12
 [81] 3.794631e+13 4.242680e+12 1.240306e+13 1.994904e+13 1.952119e+12
 [86] 3.569295e+12 5.071173e+12 1.365221e+13 1.566029e+13 1.574879e+13
 [91] 1.870920e+13 3.077439e+13 3.104076e+13 1.184979e+13 4.103530e+13
 [96] 7.842955e+13 8.055254e+12 9.385204e+12 1.785850e+13 2.571476e+13
[101] 2.412833e+13 2.748675e+13 3.111010e+13 7.899806e+13 1.020726e+13
[106] 2.433580e+13 2.447620e+13 5.549305e+13 1.219429e+13 1.736841e+13
[111] 3.097392e+13 3.142917e+13 3.203509e+13 4.334273e+13 4.710881e+13
[116] 8.481623e+13 1.665319e+13 3.303989e+13 3.280378e+13 6.531518e+13
[121] 1.269050e+13 2.626810e+13 3.516336e+13 2.738102e+13 4.030401e+13
[126] 3.642705e+13 8.662138e+13 4.818236e+13 2.881963e+13 3.764691e+13
[131] 3.893983e+13 7.426376e+13 2.124351e+13 2.288010e+13 3.620830e+13
[136] 3.406307e+13 4.046914e+13 3.784230e+13 1.168769e+14 1.582402e+13
[141] 3.369179e+13 4.298894e+13 3.712189e+13 7.286750e+13
> plot.ts(data,xlab="Data ke-",ylab="Outlow Nasional",main="Plot Time Series Outflow Nasional")
> #Cek stationeritas terhadap mean
> adf.test(data)

        Augmented Dickey-Fuller Test

data:  data
Dickey-Fuller = -3.4273, Lag order = 5, p-value = 0.05283
alternative hypothesis: stationary

> #Transformasi akar terhadap data asli
> datatrans=sqrt(data)
> datatrans
  [1]  3261824  3723475  3284377  4066646  4201763  4215565  3867306  4313007
  [9]  4388240  4285402  5885729  4816150  4181239  3892169  4033621  4783327
 [17]  3853688  5155008  4641947  4064718  4787649  5207627  5586345  5139814
 [25]  3766475  4424271  4169999  4744790  4485721  5062636  5244089  4430076
 [33]  5454211  7088669  3883825  5836467  4626471  4603346  4797900  4834465
 [41]  4593407  5295242  4652412  4157776  5339260  6254313  4200784  5603766
 [49]  2026940  2597704  2990380  3318366  3541118  3908381  2996100  3325396
 [57]  4191049  5315927  3150985  5828319  2216600  2915138  3073235  3603822
 [65]  3803678  4525999  3438402  3281032  7111469  1591701  2848420  6151862
 [73]  1866733  2163982  3318454  3696611  3040651  4295912  3275139  3091854
 [81]  6160058  2059777  3521798  4466435  1397182  1889258  2251926  3694890
 [89]  3957308  3968475  4325414  5547467  5571424  3442352  6405880  8856046
 [97]  2838178  3063528  4225931  5070972  4912060  5242781  5577643  8888085
[105]  3194881  4933133  4947343  7449366  3492032  4167542  5565421  5606172
[113]  5659955  6583520  6863586  9209573  4080832  5748034  5727459  8081781
[121]  3562373  5125242  5929870  5232688  6348544  6035483  9307061  6941352
[129]  5368392  6135708  6240179  8617642  4609068  4783315  6017334  5836358
[137]  6361536  6151610 10810961  3977942  5804463  6556595  6092773  8536246
> #Differencing terhadap hasil transformasi akar
> datadiff=diff(datatrans)
> datadiff
  [1]   461651.21  -439097.89   782268.61   135117.40    13802.00  -348258.73
  [7]   445700.27    75233.34  -102837.91  1600327.22 -1069579.42  -634910.53
 [13]  -289069.98   141452.11   749705.68  -929639.01  1301319.85  -513061.02
 [19]  -577229.00   722931.25   419977.32   378718.75  -446531.18 -1373339.00
 [25]   657796.35  -254272.73   574790.77  -259068.90   576915.02   181453.66
 [31]  -814013.44  1024134.75  1634458.26 -3204843.41  1952641.44 -1209995.43
 [37]   -23125.02   194553.13    36564.95  -241057.92   701835.19  -642829.39
 [43]  -494636.58  1181484.46   915052.85 -2053529.36  1402982.26 -3576825.93
 [49]   570764.33   392675.81   327985.76   222752.19   367262.72  -912280.86
 [55]   329296.14   865653.23  1124877.25 -2164941.24  2677333.68 -3611718.79
 [61]   698537.55   158097.28   530586.40   199856.25   722320.82 -1087596.95
 [67]  -157369.36  3830437.05 -5519768.39  1256719.40  3303441.62 -4285128.92
 [73]   297249.28  1154471.54   378157.39  -655959.88  1255260.92 -1020773.63
 [79]  -183284.81  3068204.03 -4100281.31  1462021.82   944636.35 -3069252.39
 [85]   492075.48   362668.62  1442963.44   262418.22    11166.43   356939.04
 [91]  1222053.13    23956.91 -2129071.17  2963527.52  2450165.73 -6017867.78
 [97]   225350.06  1162403.40   845040.89  -158912.72   330721.24   334862.47
[103]  3310442.02 -5693204.80  1738252.45    14210.17  2502022.47 -3957333.21
[109]   675510.04  1397879.00    40750.92    53782.83   923564.33   280066.32
[115]  2345986.71 -5128740.07  1667201.35   -20575.25  2354322.44 -4519408.36
[121]  1562868.89   804628.41  -697182.26  1115855.85  -313060.67  3271577.70
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[127] -2365708.96 -1572959.99   767316.41   104470.48  2377463.70 -4008573.79
[133]   174246.08  1234019.11  -180976.10   525178.48  -209926.25  4659350.96
[139] -6833018.51  1826520.67   752132.44  -463821.95  2443473.05
> ##Membuat plot grafik hasil differencing
> plot.ts(datadiff,xlab="Data ke-",ylab="Outlow Nasional",main="Plot Setelah Differencing",col="b
lue")
> ##Uji akar unit(Uji Augmented Dickey Fuller) terhadap data hasil differencing
> adf.test(datadiff)

        Augmented Dickey-Fuller Test

data:  datadiff
Dickey-Fuller = -7.3361, Lag order = 5, p-value = 0.01
alternative hypothesis: stationary

Warning message:
In adf.test(datadiff) : p-value smaller than printed p-value
> ###Estimasi Model
> ##Membuat plot grafik PACF berdasarkan hasil differencing
> ##Membuat plot grafik ACF berdasarkan hasil differencing
> acf(datadiff)
> ##Membuat plot grafik PACF berdasarkan hasil differencing
> pacf(datadiff)
> ##Hasil Estimasi Model
> Model1=arima(datatrans,order=c(1,1,0))
> summary(Model1)

Call:
arima(x = datatrans, order = c(1, 1, 0))

Coefficients:
          ar1
      -0.5027
s.e.   0.0723

sigma^2 estimated as 2.752e+12:  log likelihood = -2251.06,  aic = 4506.12

Training set error measures:
                    ME    RMSE     MAE      MPE     MAPE      MASE       ACF1
Training set 46098.88 1653202 1220479 -8.68646 30.36005 0.9365765 -0.2117717
> residual1=resid(Model1)
> residual1
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.822   399080.871  -207024.913   561533.239   528365.379
  [6]    81725.785  -341320.442   270629.922   299287.747   -65017.957
 [11]  1548630.403  -265091.771 -1172590.211  -608240.756    -3863.936
 [16]   820813.941  -552760.486   833988.481   141115.029  -835145.793
 [21]   432757.087   783396.278   589842.176  -256148.512 -1597811.101
 [26]   -32583.872    76402.797   446967.372    29879.559   446680.578
 [31]   471469.981  -722796.323   614928.592  2149292.818 -2383198.018
 [36]   341560.334  -228398.728  -631392.109   182928.141   134367.191
 [41]  -222676.646   580654.895  -290015.462  -817788.182   932829.676
 [46]  1508987.416 -1593530.488   370669.004 -2871543.979 -1227313.115
 [51]   679600.167   525384.662   387631.273   479240.682  -727657.163
 [56]  -129309.243  1031191.048  1560042.838 -1599463.230  1589013.451
 [61] -2265817.868 -1117080.611   509253.479   610062.216   466583.077
 [66]   822788.952  -724484.852  -704106.494  3751327.162 -3594200.132
 [71] -1518079.057  3935196.936 -2624482.304 -1856893.476  1303899.340
 [76]   958512.507  -465859.414   925508.599  -389751.484  -696429.722
 [81]  2976066.392 -2557889.094  -599197.685  1679597.604 -2594381.829
 [86] -1050843.749   610035.935  1625277.669   987798.784   143084.588
 [91]   362552.427  1401487.085   638285.424 -2117027.983  1893239.244
 [96]  3939936.860 -4786164.637 -2799843.938  1275687.317  1429383.371
[101]   265890.999   250835.503   501116.688  3478778.046 -4029039.062
[106] -1123732.830   888033.104  2509165.953 -2699561.581 -1313849.167
[111]  1737459.234   743467.450    74268.396   950601.069   744343.935
```

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[116]  2486776.599 -3949407.923  -911026.391   817530.159  2343979.222
[121] -3335885.822  -709046.606  1590285.678  -292693.977   765380.951
[126]   247882.269  3114201.481  -721080.403 -2762206.553   -23413.680
[131]   490201.950  2429981.219 -2813418.094 -1840871.869  1321612.956
[136]   439367.737   434201.439    54082.013  4553820.619 -4490753.599
[141] -1608451.215  1670327.977   -85723.488  2210308.842
> Box.test(residual1,type="Ljung")

        Box-Ljung test

data:  residual1
X-squared = 6.5935, df = 1, p-value = 0.01024

> ks.test(residual1,"pnorm",mean(residual1),sd(residual1))

        One-sample Kolmogorov-Smirnov test

data:  residual1
D = 0.092671, p-value = 0.1685
alternative hypothesis: two-sided

> Model2=arima(datatrans,order=c(1,1,1))
> summary(Model2)

Call:
arima(x = datatrans, order = c(1, 1, 1))

Coefficients:
          ar1      ma1
      -0.0895  -0.8489
s.e.   0.0924   0.0437

sigma^2 estimated as 1.958e+12:  log likelihood = -2227.3,  aic = 4460.6

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE        ACF1
Training set 149277.4 1394561 1016013 -5.868216 24.20709 0.7796722 -0.02228981
> residual2=resid(Model2)
> residual2
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.821   336001.275  -164346.478   572366.686   618516.468
  [6]   506078.220    66306.888   461863.715   495127.017   316836.012
 [11]  1847227.478   630210.681  -197289.686  -511819.325  -317518.962
 [16]   492695.064  -444371.782   840679.870   316575.496  -354422.976
 [21]   370389.183   798940.133  1094325.703   516218.698  -975070.898
 [26]  -292846.210  -443959.023   175151.513   -58923.129   503695.791
 [31]   660687.081  -236906.172   750143.413  2362942.972 -1052586.847
 [36]   772165.698  -379679.429  -453767.053  -192725.084  -109623.625
 [41]  -330845.009   399395.475  -240943.995  -756727.867   494805.346
 [46]  1440874.734  -748430.778   583782.260 -2955640.076 -2258539.602
 [51] -1473526.237  -887752.922  -501508.062   -38530.969  -912110.003
 [56]  -526679.570   448029.797  1582715.228  -720647.389  1871744.855
 [61] -1783076.080 -1138486.690  -745839.174   -88411.323   172305.086
 [66]   886485.388  -270381.002  -484269.291  3405246.082 -2286083.156
 [71] -1178137.228  2415818.185 -1938561.703 -1732057.552  -289280.837
 [76]   235940.796  -421811.271   838453.568  -196619.465  -441585.132
 [81]  2676928.000 -1553115.155  -223525.797   885774.331 -2232736.621
 [86] -1678105.133 -1017840.522   611375.337   910607.547   807685.870
 [91]  1043592.990  2139927.754  1949975.124  -471569.036  2372595.669
 [96]  4729609.047 -1783487.672 -1827440.998  -368758.119   636065.202
[101]   456705.391   704196.820   962272.382  4157306.142 -1867640.789
[106]  -356910.817  -133153.657  2390258.939 -1704212.903 -1125508.424
[111]   502898.355   592816.519   560680.241  1404347.593  1554918.630
[116]  3691049.565 -1785332.511  -307554.094  -132400.616  2240083.908
[121] -2406996.706  -885072.593   193199.981  -461135.803   661974.874
[126]   348797.967  3539648.825   932038.883  -993537.888  -216933.617
```

```
[131]   -10990.867  2377486.445 -1777447.684 -1693529.734  -188038.756
[136]  -230125.349   313619.901   103327.574  4728272.724 -2401989.156
[141]  -824302.455   215896.696  -213207.825  2220953.369
> Box.test(residual2,type="Ljung")

        Box-Ljung test

data:  residual2
X-squared = 0.073045, df = 1, p-value = 0.787

> ks.test(residual2,"pnorm",mean(residual2),sd(residual2))

        One-sample Kolmogorov-Smirnov test

data:  residual2
D = 0.11325, p-value = 0.04975
alternative hypothesis: two-sided

> Model2=arima(datatrans,order=c(1,1,10))
> Model3=arima(datatrans,order=c(1,1,10))
> summary(Model3)

Call:
arima(x = datatrans, order = c(1, 1, 10))

Coefficients:
          ar1      ma1      ma2     ma3     ma4      ma5     ma6     ma7
      -0.5739  -0.4252  -0.6092  0.5236  0.0785  -0.5110  0.0389  0.4682
s.e.   0.1264   0.1162   0.1119  0.0919  0.0884   0.0908  0.0963  0.1006
          ma8      ma9    ma10
      -0.4357  -0.4273  0.6172
s.e.   0.0799   0.0800  0.0743

sigma^2 estimated as 1.423e+12:  log likelihood = -2207.31,  aic = 4438.61

Training set error measures:
                    ME    RMSE      MAE       MPE    MAPE     MASE       ACF1
Training set 106565.8 1188718 884104.7 -3.59175 21.1415 0.678448 0.04544103
> residual3=resid(Model3)
> residual3
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.818   240109.031  -137585.545   600977.209   567896.543
  [6]   633543.959    88377.920   307119.262   241963.958   416974.000
 [11]  1615556.529   535664.391   353945.148  -725947.330  -532888.894
 [16]   393452.884   -76199.216   834584.280   440490.541    32518.276
 [21]   255187.032   404357.491   423816.207   655395.471 -1222453.243
 [26]  -492191.996  -478376.276   284665.315   253961.120   413950.845
 [31]   412279.477   120894.078   491639.305  1482047.479 -1004860.417
 [36]   604839.180  -880293.368  -150434.075   220346.273  -258742.771
 [41]  -378563.124   907035.027  -401885.389  -793590.656   272231.674
 [46]   275228.017   375815.641   478567.279 -3711445.258 -2247164.023
 [51] -1839560.843  -710187.243   585471.466    85669.037  -903422.653
 [56]   300907.714  -346956.458   462392.845  -738005.389  1111411.215
 [61] -1027922.390   169208.626 -1125851.271   155661.682   789774.709
 [66]  1489590.440   145609.700  -453143.653  3313841.141 -2499041.197
 [71]   138200.230    -7301.563 -1087084.474    25287.109  -314962.842
 [76]  -944724.138  1360606.838  1028280.364 -1503723.081   521767.909
 [81]   579221.327  -636480.308   493907.675  -744822.277 -2026846.110
 [86]  -203386.319 -1972313.215   764706.268  1781097.697   844045.454
 [91]  1471283.293  1802051.876   862982.656  -177693.496  1440580.291
 [96]  3563540.930   595409.338 -1205987.286 -1903104.477   608123.456
[101]  2095838.137  1262819.963  -119215.046  4149217.647 -1084673.579
[106]   -31663.740 -3258730.661   452436.040  -331381.891   658458.472
[111]  -840371.193   846632.539  1352338.420   734775.912   942334.026
[116]  1105255.653 -1012002.050  -666571.759  -570424.581  1560254.046
[121]  -770075.658  -682644.140  -759087.263   -54274.472  1229174.163
```

```
[126]  -323950.686  2832724.212   726569.696   181823.706 -1677177.724
[131]  -995387.495  1797950.569  -228271.196 -1319338.421 -1096478.399
[136]   433871.821  1030522.489   649671.162  2532147.532 -2268900.697
[141]   227054.303 -1621294.874  -405746.451  2397080.927
> Box.test(residual3,type="Ljung")

        Box-Ljung test

data:  residual3
X-squared = 0.30358, df = 1, p-value = 0.5816

> ks.test(residual3,"pnorm",mean(residual3),sd(residual3))

        One-sample Kolmogorov-Smirnov test

data:  residual3
D = 0.085023, p-value = 0.2489
alternative hypothesis: two-sided

> Model4=arima(datatrans,order=c(1,1,12))
> summary(Model4)

Call:
arima(x = datatrans, order = c(1, 1, 12))

Coefficients:
          ar1      ma1      ma2     ma3    ma4      ma5      ma6     ma7
      -0.6383  -0.1859  -0.4817  0.1283  0.003  -0.1502  -0.1250  0.0069
s.e.   0.0988   0.1131   0.0913  0.0962  0.096   0.0930   0.0844  0.0955
          ma8      ma9     ma10     ma11    ma12
      -0.0736  -0.1070  -0.2275  -0.0588  0.6975
s.e.   0.1136   0.0941   0.0886   0.1000  0.1124

sigma^2 estimated as 1.201e+12:  log likelihood = -2197.16,  aic = 4422.31

Training set error measures:
                   ME    RMSE      MAE       MPE     MAPE      MASE        ACF1
Training set 78227.37 1092083 808310.4 -4.404408 19.76329 0.6202846 -0.07622217
> Box.test(residual4,type="Ljung")

        Box-Ljung test

data:  residual4
X-squared = 0.017259, df = 1, p-value = 0.8955

> ks.test(residual4,"pnorm",mean(residual4),sd(residual4))

        One-sample Kolmogorov-Smirnov test

data:  residual4
D = 0.10994, p-value = 0.06155
alternative hypothesis: two-sided

> Model5=arima(datatrans,order=c(2,1,0))
> summary(Model5)

Call:
arima(x = datatrans, order = c(2, 1, 0))

Coefficients:
          ar1      ar2
      -0.7122  -0.4130
s.e.   0.0763   0.0758

sigma^2 estimated as 2.276e+12:  log likelihood = -2237.66,  aic = 4481.32

Training set error measures:
                   ME    RMSE     MAE       MPE     MAPE      MASE       ACF1
Training set 58878.31 1503348 1130395 -7.455556 27.20144 0.8674471 -0.1182691
```

```
> residual5=resid(Model5)
> residual5
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.821   363128.318  -187983.733   660212.713   510893.829
  [6]   433121.183  -282623.439   203371.376   248824.259   134824.123
 [11]  1558158.732    27697.542  -735703.974 -1183004.768  -326650.738
 [16]   731057.384  -337277.917   948872.172    29781.977  -405165.481
 [21]    99927.673   696443.516   976407.493    -3351.278 -1534941.236
 [26]  -504717.696  -353000.973   665377.979    45277.720   629803.845
 [31]   485332.274  -446507.783   519338.748  2027645.577 -1617801.608
 [36]   345212.911 -1142976.049   -78411.429  -321662.895   165574.405
 [41]  -134663.029   545255.986  -242544.027  -662590.125   563706.783
 [46]  1552211.862  -913859.170   318392.502 -3425762.836 -1397192.658
 [51]  -678109.958   843383.172   618524.189   661369.564  -558716.890
 [56]  -168743.812   723391.631  1877398.436 -1006277.517  1600057.206
 [61] -2599079.379  -767943.661  -836099.887   931689.619   643035.630
 [66]  1083798.347  -490617.526  -633624.798  3269164.831 -2856732.970
 [71] -1092422.645  1918727.342 -1413378.772 -1390241.527  -403651.081
 [76]  1323138.687    90177.448   944272.036  -397700.093  -391836.446
 [81]  2516073.913 -1990810.541  -190977.497   292407.793 -1792646.697
 [86] -1303692.218  -554523.673  1904490.090  1439882.179   794026.021
 [91]   473274.451  1480876.464  1041722.482 -1607282.658  1457100.888
 [96]  3681446.835 -3048881.815 -3048610.541 -1162573.113  1765975.781
[101]   923014.290   566558.525   504768.265  3685523.434 -3197209.834
[106]  -949176.550 -1099188.871  3230067.504 -2169527.657 -1109523.407
[111]   244537.700  1315314.056   660150.756   978699.129   960040.537
[116]  2926895.557 -3342260.329 -1016551.380  -951444.293  3028248.173
[121] -2851161.441  -683475.960    51117.160   521361.349   951647.429
[126]   193703.317  3509481.727  -164995.176 -1906603.155 -1330016.873
[131]     1295.755  2768780.707 -2272199.922 -1698725.486  -297484.748
[136]   769856.668   905956.152    89359.189  4726748.471 -3601338.678
[141] -1115562.095  -769162.433   826226.292  2423781.855
> Box.test(residual5,type="Ljung")

        Box-Ljung test

data:  residual5
X-squared = 2.0565, df = 1, p-value = 0.1516

> ks.test(residual5,"pnorm",mean(residual5),sd(residual5))

        One-sample Kolmogorov-Smirnov test

data:  residual5
D = 0.090313, p-value = 0.1908
alternative hypothesis: two-sided

> Model6=arima(datatrans,order=c(2,1,1))
> summary(Model6)

Call:
arima(x = datatrans, order = c(2, 1, 1))

Coefficients:
          ar1      ar2      ma1
      -0.1220  -0.0969  -0.8230
s.e.   0.0991   0.0948   0.0585

sigma^2 estimated as 1.944e+12:  log likelihood = -2226.78,  aic = 4461.56

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE        ACF1
Training set 144955.3 1389318 1010481 -5.859135 24.03828 0.7754273 -0.01083485
> residual6=resid(Model6)
> residual6
Time Series:
```

```
Start = 1
End = 144
Frequency = 1
  [1]     3261.821   334790.918  -172846.824   597244.682   603909.235
  [6]   558595.536   108948.392   485559.556   485455.602   343303.220
 [11]  1868197.466   645039.315   -80689.424  -535803.267  -395417.430
 [16]   413555.206  -484147.409   862097.056   264789.689  -295742.289
 [21]   359402.075   747908.463  1115459.310   558321.201  -931598.950
 [26]  -319661.342  -570241.577   138253.006   -99833.497   518876.199
 [31]   653725.039  -197955.719   779528.053  2321989.922  -995269.330
 [36]   901115.860  -540919.870  -426578.614  -276629.655  -169607.022
 [41]  -357320.413   381912.320  -266291.556  -724156.169   462874.746
 [46]  1392140.595  -681689.230   680209.280 -3044982.306 -2235435.347
 [51] -1724160.257  -987732.018  -512057.141     4816.066  -841929.076
 [56]  -439257.664   455880.845  1637560.823  -596151.308  2031708.261
 [61] -1822993.991  -982713.863  -915577.465  -135911.872   168044.910
 [66]   936429.544  -209463.451  -392382.442  3382888.728 -2283796.136
 [71]  -924699.425  2160623.240 -1982244.997 -1536500.908  -489182.230
 [76]   145196.830  -378427.317   900477.075  -190190.179  -342622.271
 [81]  2664924.197 -1550657.108   -16800.604   711644.001 -2226640.682
 [86] -1623173.483 -1210683.443   538536.591   916774.189   937538.812
 [91]  1155311.983  2217464.792  2032530.855  -334957.962  2430508.403
 [96]  4605477.306 -1641540.448 -1622065.291  -728411.006   409198.254
[101]   393600.560   717181.983   950018.280  4165187.302 -1829125.028
[106]  -140545.690  -441349.937  2309043.570 -1750500.997 -1005230.264
[111]   269360.905   498410.134   604444.747  1431518.043  1576030.532
[116]  3766712.513 -1715540.431  -142768.046  -431910.397  2157981.556
[121] -2458283.402  -783232.857   -87449.759  -519505.769   681282.622
[126]   316131.877  3601735.539   967112.918  -748440.203  -269817.764
[131]  -176479.388  2319352.076 -1799700.199 -1565308.588  -421535.594
[136]  -360486.904   326060.387   104924.685  4771008.528 -2358650.809
[141]  -496320.730   -95950.940  -273985.844  2234330.344
> Box.test(residual6,type="Ljung")

        Box-Ljung test

data:  residual6
X-squared = 0.017259, df = 1, p-value = 0.8955

> ks.test(residual6,"pnorm",mean(residual6),sd(residual6))

        One-sample Kolmogorov-Smirnov test

data:  residual6
D = 0.10994, p-value = 0.06155
alternative hypothesis: two-sided

> Model7=arima(datatrans,order=c(2,1,10))
> summary
function (object, ...)
UseMethod("summary")
<bytecode: 0x0000000004cbdc10>
<environment: namespace:base>
> summary(Model7)

Call:
arima(x = datatrans, order = c(2, 1, 10))

Coefficients:
          ar1      ar2     ma1      ma2      ma3     ma4      ma5      ma6
      -1.4532  -0.5913  0.6110  -0.7096  -0.3485  0.0785  -0.5202  -0.2878
s.e.   0.2613   0.2790  0.2676   0.1254   0.2742  0.1099   0.0999   0.1776
         ma7     ma8      ma9    ma10
      0.6222  0.3831  -0.2436  0.0002
s.e.  0.1063  0.1990   0.1030  0.1150

sigma^2 estimated as 1.491e+12:  log likelihood = -2209.83,  aic = 4445.66

Training set error measures:
```

```
                    ME    RMSE      MAE       MPE     MAPE      MASE        ACF1
Training set 120137.5 1216770 902459.3 -4.149572 21.14808 0.6925331 -0.01482155
> Box.test(residual7,type="Ljung")

        Box-Ljung test

data:  residual7
X-squared = 0.00022111, df = 1, p-value = 0.9881

> ks.test(residual7,"pnorm",mean(residual7),sd(residual7))

        One-sample Kolmogorov-Smirnov test

data:  residual7
D = 0.098047, p-value = 0.1255
alternative hypothesis: two-sided

> Model8=arima(datatrans,order=c(2,1,12))
> summary(Model8)

Call:
arima(x = datatrans, order = c(2, 1, 12))

Coefficients:
          ar1      ar2     ma1      ma2      ma3     ma4      ma5      ma6
      -0.9606  -0.4125  0.1001  -0.3834  -0.1701  0.1047  -0.1028  -0.1544
s.e.   0.1329   0.1488  0.1297   0.0934   0.1343  0.0882   0.0906   0.0943
          ma7      ma8      ma9     ma10     ma11    ma12
      -0.0028  -0.0647  -0.1412  -0.2640  -0.0199  0.6868
s.e.   0.0770   0.1046   0.0858   0.0841   0.0835  0.0763

sigma^2 estimated as 1.139e+12:  log likelihood = -2193.73,  aic = 4417.46

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE        ACF1
Training set 82855.84 1063600 784793.4 -4.079985 18.93892 0.6022381 -0.02239168
> ks.test(residual8,"pnorm",mean(residual8),sd(residual8))

        One-sample Kolmogorov-Smirnov test

data:  residual8
D = 0.15733, p-value = 0.001603
alternative hypothesis: two-sided

> Box.test(residual8,type="Ljung")

        Box-Ljung test

data:  residual8
X-squared = 0.00032567, df = 1, p-value = 0.9856

> residual8=resid(Model8)
> residual8
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.819   276128.133  -137753.023   500984.801   493718.578
  [6]   440801.767   -53057.633   287299.702   280461.858   253028.069
 [11]  1404715.252   394328.548  -164610.071  -604576.260    23413.215
 [16]   468496.483  -236859.151   857249.467   345806.399  -259299.823
 [21]   485800.139   684773.057   291282.975   199201.004 -1176490.006
 [26]  -167380.921  -439111.866   455220.654   318706.935    73366.328
 [31]   633481.089  -106217.221   291293.885  1756699.423 -1698011.241
 [36]   262609.953  -259265.736  -316993.772   342482.328   -67323.732
 [41]  -252713.986   550732.918  -434221.967  -340446.892  -153672.030
 [46]   448930.680   226121.977  -196598.312 -2674972.968 -2007312.162
 [51] -1647844.778    99595.548   -15710.560   -71451.881  -581565.161
 [56]  -510338.504   350809.935   902785.729 -1903148.579   927931.784
```

```
 [61] -1380547.170  -239960.029   310671.379   329091.794   544893.553
 [66]  1251683.445   130924.905   -68805.673  2813180.610 -2706207.525
 [71]   -61951.278  1185896.610  -244498.664 -1091669.851   158241.553
 [76]   772154.541   -97740.720   786033.519    23647.075 -1159922.672
 [81]  1007358.929   331304.152 -1119811.021   225440.774 -1813245.571
 [86] -1124482.144  -730437.472   897326.073  1221248.410   263107.263
 [91]   970332.520  2137200.575   388969.681  -937462.876  1688109.068
 [96]  3363563.593  -672236.552 -1262269.822    29029.557   901734.931
[101]  1257221.612  1737954.010   280973.740  3042358.583 -1644953.584
[106]   467871.510 -1982851.286   778447.160 -1139185.903  -356291.718
[111]   727164.639  1125624.474   279401.631   927972.508   493800.785
[116]  1024230.204 -1652198.429 -1861538.917   297512.089  1635006.336
[121] -1099018.034  -216272.851  -395288.911  -312436.767   913664.525
[126]  -331011.903  2588032.814  -689530.345  -298416.200    45987.296
[131]  -694731.075  1829059.009 -1100848.150 -1923356.944   402664.544
[136]   369630.431   782495.154   731582.943  2689666.436 -2090207.483
[141] -1225632.887  -337535.555   121454.741   858303.398
> ks.test(residual8,"pnorm",mean(residual8),sd(residual8))

        One-sample Kolmogorov-Smirnov test

data:  residual8
D = 0.096855, p-value = 0.1341
alternative hypothesis: two-sided

> Box.test(residual8,type="Ljung")

        Box-Ljung test

data:  residual8
X-squared = 0.073714, df = 1, p-value = 0.786

> Model7=arima(datatrans,order=c(2,1,10))
> summary(Model7)

Call:
arima(x = datatrans, order = c(2, 1, 10))

Coefficients:
          ar1      ar2     ma1      ma2      ma3     ma4      ma5      ma6
      -1.4532  -0.5913  0.6110  -0.7096  -0.3485  0.0785  -0.5202  -0.2878
s.e.   0.2613   0.2790  0.2676   0.1254   0.2742  0.1099   0.0999   0.1776
         ma7     ma8      ma9    ma10
      0.6222  0.3831  -0.2436  0.0002
s.e.  0.1063  0.1990   0.1030  0.1150

sigma^2 estimated as 1.491e+12:  log likelihood = -2209.83,  aic = 4445.66

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE        ACF1
Training set 120137.5 1216770 902459.3 -4.149572 21.14808 0.6925331 -0.01482155
> residual7=resid(Model7)
> residual7
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.820   287920.477  -160776.103   570894.291   458096.940
  [6]   412766.773    18655.247   428562.770   524027.850   584670.289
 [11]  1704395.408   399292.257   -12417.589  -558364.706   -60096.498
 [16]   845780.887  -325407.552   227649.710  -193421.196  -373959.918
 [21]   597692.042   697508.976   700428.534   514161.573 -1444473.822
 [26]   -14672.953  -134697.279   389806.479   -80447.749  -332004.952
 [31]   327631.005   106986.414   830619.369  2148695.592 -1292745.543
 [36]   795757.329  -502463.438   -11599.545   547680.647  -807675.067
 [41]  -735213.852   594048.150  -608212.643  -429561.789   295976.649
 [46]   523449.799   159851.843   120696.845 -3225522.978 -1726287.938
 [51] -1104899.872  -383598.121  -401250.420 -1260854.685 -1639251.137
 [56]   147762.739   957437.260  1869062.806  -825216.476  1257389.268
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 [61] -1320336.982   241881.761   -72570.887  -112459.194   192103.474
 [66]   792236.427  -565858.578  -153597.090  3483708.710 -2831421.504
 [71]   313492.844   724580.653 -1052219.787  -623636.077 -1054676.080
 [76]  -889832.452  1098648.471   299260.376 -1100028.798   137294.711
 [81]  1550915.300   -48661.258  -140922.749   137371.239 -2219298.958
 [86]  -318187.868 -1230510.551   628700.220   881380.928   118928.134
 [91]   548712.694  2316230.629  2011863.080   213131.495  2260876.294
 [96]  4017192.913  -530434.044 -1585016.179 -1188922.316  1001414.510
[101]  2191858.279  -438276.013 -1304804.117  3430561.927 -1682070.498
[106]  1108549.414 -1550901.393  1587180.801  -776942.690  -996944.583
[111]  -878480.219   833730.094   689349.619  1151547.065   932644.814
[116]  2475167.655  -570797.765  -721440.888   566489.372  1913465.355
[121] -1304688.115 -1642296.523 -1053600.590    -8513.280  1794488.754
[126]  -788213.958  2497400.752   -58781.850    -3677.757  -127104.606
[131]   263411.621  2437558.659 -1348465.518 -2423879.579  -709635.567
[136]   501416.967   852731.716   107571.010  2136599.874 -2253969.232
[141]   190658.595    15403.643   552962.088  2377685.320
> Box.test(residual7,type="Ljung")

        Box-Ljung test

data:  residual7
X-squared = 0.032297, df = 1, p-value = 0.8574

> ks.test(residual7,"pnorm",mean(residual7),sd(residual7))

        One-sample Kolmogorov-Smirnov test

data:  residual7
D = 0.085777, p-value = 0.2399
alternative hypothesis: two-sided

> Model9=arima(datatrans,order=c(3,1,0))
> summary(Model9)

Call:
arima(x = datatrans, order = c(3, 1, 0))

Coefficients:
          ar1      ar2      ar3
      -0.8283  -0.6086  -0.2715
s.e.   0.0810   0.0930   0.0803

sigma^2 estimated as 2.105e+12:  log likelihood = -2232.18,  aic = 4472.36

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE        ACF1
Training set 69560.61 1445668 1111664 -7.324059 26.82756 0.8530733 -0.04279982
> residual9=resid(Model9)
> residual9
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.821   348773.787  -179957.059   634446.001   641149.267
  [6]   482593.160   -42229.178   202326.209   236197.022   136181.168
 [11]  1681931.757   213773.430  -574794.196 -1031437.870  -774742.482
 [16]   518579.723  -301063.741  1025984.787   202550.627  -462589.938
 [21]   285857.961   528185.900  1009841.654   319004.903 -1398692.876
 [26]  -648650.908  -666457.107   391682.943   240845.014   643117.129
 [31]   657674.176  -382945.673   616954.793  2036585.906 -1448765.067
 [36]   570883.778 -1099386.484  -707015.118   -30897.755  -144848.591
 [41]   -98646.817   577241.770  -198294.040  -665389.215   571099.641
 [46]  1418106.723  -710853.949   579725.848 -3416110.108 -2095481.748
 [51]  -930517.670    29571.761   888342.296   857973.895  -383480.691
 [56]  -142341.469   682899.741  1794622.863  -617007.297  1803753.931
 [61] -2406328.412 -1251297.818  -734545.048   106165.219   925181.073
 [66]  1253686.215  -223643.334  -564348.289  3234283.414 -2738132.827
 [71] -1026737.340  2024948.309 -2282616.848  -900417.298  -310406.500
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 [76]   351976.392   440554.784  1255497.366  -277619.398  -442906.509
 [81]  2635933.275 -1947617.167  -116628.413   493148.318 -2510184.911
 [86] -1078318.240  -841226.579  1209599.605  1811895.054  1205149.906
 [91]   917621.910  1595733.524  1256416.824 -1268599.021  1546403.029
 [96]  3615561.502 -2762868.383 -2463443.808 -1648197.639   311276.755
[101]  1309619.404  1028944.473   741486.478  3745933.748 -2657663.780
[106]  -871692.638 -1112157.594  2026110.692 -1404423.653 -1075696.804
[111]   228233.447   535372.907  1121655.065  1372401.642  1088828.387
[116]  3154631.858 -2764441.769 -1077043.777 -1124091.353  1959595.938
[121] -2129294.071  -753224.242   -12207.925  -306488.353  1452364.415
[126]   405316.301  3502107.318   456466.851 -1626362.855 -1087124.693
[131]  -859497.555  2503955.403 -1767487.091 -1670703.933  -415811.206
[136]  -141050.249  1173594.988   449932.741  4755961.500 -2958969.151
[141] -1054470.899  -628608.295  -584241.477  3012895.137
> Box.test(residual9,type="Ljung")

        Box-Ljung test

data:  residual9
X-squared = 0.26932, df = 1, p-value = 0.6038

> ks.test(residual9,"pnorm",mean(residual9),sd(residual9))

        One-sample Kolmogorov-Smirnov test

data:  residual9
D = 0.065214, p-value = 0.5727
alternative hypothesis: two-sided

> Model10=arima(datatrans,order=c(3,1,1))
> summary(Model10)

Call:
arima(x = datatrans, order = c(3, 1, 1))

Coefficients:
          ar1      ar2     ar3      ma1
      -0.1005  -0.0767  0.0549  -0.8400
s.e.   0.1038   0.0998  0.0954   0.0597

sigma^2 estimated as 1.939e+12:  log likelihood = -2226.61,  aic = 4463.23

Training set error measures:
                    ME    RMSE     MAE       MPE     MAPE      MASE        ACF1
Training set 146920.8 1387765 1013298 -5.774975 24.04901 0.7775889 -0.01779176
> residual10=resid(Model10)
> residual10
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.821   334467.361  -172716.326   609159.576   596825.510
  [6]   569933.162    82330.402   465145.566   472816.244   348771.510
 [11]  1853150.681   626258.040   -89528.004  -596805.620  -377628.268
 [16]   459378.348  -441725.272   886392.127   249507.693  -268359.541
 [21]   328678.175   752526.761  1140081.146   541679.542  -957186.603
 [26]  -339329.416  -554005.115   209700.212   -80754.177   541080.006
 [31]   642541.248  -197540.485   758612.194  2302268.469  -983305.173
 [36]   873614.573  -615389.182  -335984.855  -290023.359  -122853.626
 [41]  -324393.733   397222.423  -259095.053  -709838.704   447632.357
 [46]  1407197.875  -661667.332   646055.085 -3100828.519 -2173250.435
 [51] -1726945.620  -843103.088  -453744.448    12083.502  -866137.222
 [56]  -474058.814   410387.865  1631976.735  -632623.849  1967038.822
 [61] -1918007.265  -951503.776  -994999.622   -37497.528   195462.904
 [66]   938622.131  -240308.988  -424132.770  3335254.231 -2285340.747
 [71]  -915468.808  2027069.890 -1850810.888 -1503870.173  -588998.391
 [76]   257478.571  -329429.714   878210.657  -227935.629  -345075.137
 [81]  2612693.594 -1555110.522   -11097.576   599334.290 -2133582.289
 [86] -1616557.059 -1233120.114   649791.897   954113.224   929802.949
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 [91]  1080042.533  2151665.178  1981053.031  -388356.130  2358028.657
 [96]  4564288.421 -1593188.312 -1692675.235  -832948.434   609847.961
[101]   515108.819   748456.504   938259.435  4166372.176 -1852984.370
[106]  -155077.136  -559749.099  2479129.367 -1717603.633  -974010.388
[111]   206678.109   623957.892   652158.945  1403191.651  1553531.933
[116]  3747058.201 -1774457.033  -174387.235  -521653.071  2323495.067
[121] -2424031.944  -745999.490  -140840.151  -366619.530   713708.154
[126]   300999.152  3616824.233   916159.153  -773024.606  -401230.555
[131]  -146212.574  2410350.878 -1778911.468 -1546435.157  -485521.103
[136]  -231351.226   397721.891    95335.392  4768552.303 -2403813.013
[141]  -510730.568  -273199.821  -102478.733  2268170.529
> Box.test(residual10,type="Ljung")

        Box-Ljung test

data:  residual10
X-squared = 0.046539, df = 1, p-value = 0.8292

> ks.test(residual10,"pnorm",mean(residual10),sd(residual10))

        One-sample Kolmogorov-Smirnov test

data:  residual10
D = 0.11331, p-value = 0.04955
alternative hypothesis: two-sided

> Model11=arima(datatrans,order=c(3,1,10))
> summary(Model11)

Call:
arima(x = datatrans, order = c(3, 1, 10))

Coefficients:
          ar1      ar2     ar3     ma1     ma2      ma3     ma4      ma5
      -0.9197  -0.7936  0.1641  0.0441  0.1113  -0.8544  0.1728  -0.4468
s.e.   0.3916   0.4172  0.3684  0.3934  0.1129   0.1375  0.2779   0.0964
          ma6     ma7     ma8     ma9     ma10
      -0.0926  0.3416  0.3492  0.1099  -0.2454
s.e.   0.2033  0.1204  0.1345  0.1233   0.0940

sigma^2 estimated as 1.469e+12:  log likelihood = -2210.61,  aic = 4449.22

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE
Training set 119974.6 1207641 905618.9 -4.159478 21.39542 0.6949577
                     ACF1
Training set -0.007982909
> residual11=resid(Model11)
> residual11
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.820   291366.670  -149850.854   509714.419   479568.862
  [6]   347006.344     5065.619   411324.784   573307.021   551263.283
 [11]  1661581.230   477402.137  -173974.248  -404834.207   -54826.490
 [16]   929096.397  -458736.438   200353.634  -136042.759  -541891.722
 [21]   683101.431   731753.984   648966.118   430413.157 -1309771.166
 [26]  -144789.101   191568.640   262817.533  -196783.677  -194219.232
 [31]   161857.585   170377.440   877813.219  2119170.190 -1264143.051
 [36]   617081.958  -235324.747   -19123.897   490038.396  -690637.461
 [41]  -914397.157   599655.045  -579183.148  -459720.549   272488.579
 [46]   692436.156  -309779.653   578467.793 -3413939.326 -1587131.276
 [51]  -808027.941  -846381.995  -126209.283 -1266467.173 -2068036.682
 [56]   648790.584   670495.611  1872047.967  -379662.937   697507.951
 [61] -1069125.831   505099.529  -279319.557   211113.349   144851.948
 [66]   120628.123  -163208.524    10096.407  2853776.399 -1869234.692
 [71] -1169505.956  2022352.946 -1503823.000  -738143.166  -919453.139
 [76]  -760423.241   723163.458   434270.421  -899777.616  -274336.298
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 [81]  2066739.389  -641857.863   427578.721   -55363.122 -2026123.863
 [86]  -476863.252 -1212340.006   755206.530  1161071.176  -835563.025
 [91]  1115661.824  2339295.358  1518136.617   954531.498  1853107.706
 [96]  3940493.912  -176585.791 -1986446.488  -954328.805  1751761.549
[101]   980284.029  -309314.521  -713306.524  2602398.313 -1389088.011
[106]   877986.728 -1153519.152  1472181.732  -430954.201 -1937214.710
[111]   -96093.078  1246902.337  -234046.573  1703294.127   751795.269
[116]  2445383.442  -648889.398    -6005.972  -481392.084  3210006.686
[121] -2091949.066 -1971605.159   -39331.652  -578736.647  1092538.449
[126]   543334.763  1180188.000   593764.738  -287500.081  -100502.372
[131]   543111.494  2891104.635 -2192427.005 -2309821.149    28424.517
[136]  -219466.535  1415567.843  -372144.556  2090158.634 -2113657.791
[141]  -143713.478   655656.089   381324.860  2371226.227
> Box.test(residual11,type="Ljung")

        Box-Ljung test

data:  residual11
X-squared = 0.0093692, df = 1, p-value = 0.9229

> ks.test(residual11,"pnorm",mean(residual11),sd(residual11))

        One-sample Kolmogorov-Smirnov test

data:  residual11
D = 0.090837, p-value = 0.1856
alternative hypothesis: two-sided

> Model12=arima(datatrans,order=c(3,1,12))
> summary(Model12)

Call:
arima(x = datatrans, order = c(3, 1, 12))

Coefficients:
          ar1      ar2      ar3     ma1      ma2      ma3      ma4      ma5
      -1.1563  -0.7215  -0.1971  0.2944  -0.2504  -0.2388  -0.0209  -0.0729
s.e.   0.1903   0.3003   0.1905  0.1842   0.1650   0.1124   0.1429   0.0917
          ma6      ma7      ma8      ma9     ma10    ma11    ma12
      -0.1540  -0.0303  -0.0929  -0.1571  -0.2458  0.0297  0.6822
s.e.   0.1051   0.0981   0.0956   0.0966   0.0892  0.1034  0.0767

sigma^2 estimated as 1.134e+12:  log likelihood = -2193.42,  aic = 4418.85

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE        ACF1
Training set 86459.06 1061060 772264.9 -3.888779 18.38617 0.5926239 -0.01719811
> residual12=resid(Model12)
> residual12
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.819   271284.588  -135117.178   503011.990   509044.185
  [6]   462874.054   -17103.082   280768.319   295699.935   266356.772
 [11]  1418636.959   456061.986   -69044.311  -610195.950   -73705.595
 [16]   410388.519  -255852.162   870452.548   400127.736  -256662.273
 [21]   443811.960   529316.956   305370.752   318557.160 -1129854.838
 [26]  -197724.318  -497956.143   433786.547   277251.225    31991.080
 [31]   684908.693  -111863.810   225377.985  1822358.210 -1565717.843
 [36]   390353.691  -228633.109  -385314.690   282627.167  -195706.794
 [41]  -170460.173   568232.366  -450622.608  -340658.517  -169519.389
 [46]   566790.191   364799.203  -326569.658 -2761531.037 -2021750.770
 [51] -1601090.612    54448.969   -18183.747  -105962.720  -442334.964
 [56]  -435204.409   219558.175   731699.842 -1772090.973  1386431.844
 [61] -1045320.022  -326385.639    14287.698    75930.322   630536.586
 [66]  1329087.757    38949.108  -204909.888  2886749.897 -2399283.170
 [71]   -34096.726   827855.769  -480970.429 -1155585.780    86337.389
 [76]   659606.148   -88553.465   606147.223   153702.731 -1161121.397
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 [81]  1116862.526   298748.550 -1404786.357   306339.938 -1580714.145
 [86]  -988820.658 -1039364.083   936075.022  1255618.851   439788.150
 [91]  1063931.308  2117187.471   189204.128  -629910.048  2034649.830
 [96]  3394059.402  -606494.195 -1332270.262  -178189.462   666848.149
[101]  1408291.863  1374094.551   136545.570  3314892.089 -1220625.476
[106]    28431.160 -2530548.545   900683.026  -697960.119  -387268.896
[111]   487269.423   907197.074   148150.438  1240073.971   475370.454
[116]   996005.432 -1478569.431 -1366004.674   543207.997  1409438.166
[121] -1141425.845  -535424.281  -345336.885  -164759.063  1129771.017
[126]  -635716.358  2916500.769  -220847.529   -78774.673  -441409.255
[131] -1150189.785  1948667.049  -795780.718 -1732115.166   322058.560
[136]   152517.416   721702.900   780026.059  2422986.416 -2057704.086
[141] -1303027.963   -91322.446    96278.424  1053817.973
> Box.test(residual12,type="Ljung")

        Box-Ljung test

data:  residual12
X-squared = 0.043485, df = 1, p-value = 0.8348

> ks.test(residual12,"pnorm",mean(residual12),sd(residual12))

        One-sample Kolmogorov-Smirnov test

data:  residual12
D = 0.081866, p-value = 0.2894
alternative hypothesis: two-sided

> Model13=arima(datatrans,order=c(11,1,0))
> summary(Model13)

Call:
arima(x = datatrans, order = c(11, 1, 0))

Coefficients:
          ar1      ar2      ar3      ar4      ar5     ar6      ar7      ar8
      -0.9936  -0.8258  -0.6832  -0.6386  -0.6579  -0.671  -0.5668  -0.5390
s.e.   0.0611   0.0836   0.0977   0.1027   0.1048   0.104   0.1044   0.1043
          ar9     ar10     ar11
      -0.5701  -0.7250  -0.6755
s.e.   0.0987   0.0837   0.0610

sigma^2 estimated as 1.033e+12:  log likelihood = -2185.02,  aic = 4394.04

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE       ACF1
Training set 153294.7 1012785 705858.5 -2.127396 16.91805 0.5416647 0.09283649
> residual13=resid(Model13)
> residual13
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.818   240699.899  -120633.397   432853.106   453574.997
  [6]   412870.173    15290.996   344890.546   317517.834   335267.534
 [11]  1330553.627   471508.574   181400.885  -269303.771   303080.201
 [16]   704193.437  -307449.853   755826.174   551794.073  -317433.846
 [21]   584203.889   901536.101    56877.650   256922.825  -908481.084
 [26]    59394.360   -65992.404   294481.339   440610.264   -74514.897
 [31]   606879.926   296465.722   737777.886  2046994.340 -1703254.517
 [36]   371752.547   215480.008  -120188.270   388266.721   107743.738
 [41]  -162837.491   305645.416  -318711.454  -166386.858  -131978.102
 [46]   214025.764   -62915.180  -182412.017 -2841682.158 -2163367.006
 [51] -1328685.324  -712787.198  -594570.503  -709532.651 -1180794.505
 [56]  -251319.719  -363191.006   355701.938 -1221292.364   427718.701
 [61]  -628213.057  -338468.823   -75358.839   401875.750   215823.515
 [66]   828765.277   136536.088   -31492.540  3018229.176 -2752700.919
 [71] -1282603.537   835608.016  -717653.598 -1105730.390   149299.697
 [76]   200182.234  -297866.992   364206.946    73907.263  -754606.530
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 [81]   429925.153   338555.475  -338504.018 -1027766.670  -959810.955
 [86]  -723145.450  -901210.162   451573.933  1307480.268   185646.469
 [91]  1152697.705  1958433.897   354034.598   689236.085  1821169.302
 [96]  4092103.351    33697.426  -580391.031   654929.398  1221183.012
[101]  1321518.315  1166778.430   577076.602  3335039.839 -1675870.924
[106]   845612.579 -1847273.253  -255696.554    73587.253    80762.551
[111]   543894.041   937800.952  1108946.179  1797891.016   477203.010
[116]  1350525.339   -75540.538    76407.556  -191183.493  1174506.225
[121]  -556392.160   -71545.418   -50297.152   136666.835  1149638.888
[126]   227116.426  2055465.548 -1038788.598   261612.291   -32769.207
[131]  -173005.714  1267374.036   264236.621 -1546236.682  -180864.011
[136]   777326.997   956679.054   145962.637  2076498.094 -2642439.580
[141]  -326202.394   499752.321  -325255.063   734987.345
> Box.test(residual13,type="Ljung")

        Box-Ljung test

data:  residual13
X-squared = 1.2671, df = 1, p-value = 0.2603

> ks.test(residual13,"pnorm",mean(residual13),sd(residual13))

        One-sample Kolmogorov-Smirnov test

data:  residual13
D = 0.11778, p-value = 0.0368
alternative hypothesis: two-sided

> Model14=arima(datatrans,order=c(11,1,1))
> summary(Model14)

Call:
arima(x = datatrans, order = c(11, 1, 1))

Coefficients:
          ar1      ar2      ar3      ar4      ar5      ar6      ar7      ar8
      -1.0887  -0.9129  -0.7589  -0.6917  -0.6971  -0.7074  -0.6079  -0.5702
s.e.   0.0815   0.1037   0.1163   0.1182   0.1188   0.1177   0.1186   0.1170
          ar9     ar10     ar11     ma1
      -0.5888  -0.7312  -0.6890  0.1754
s.e.   0.1092   0.0911   0.0596  0.1041

sigma^2 estimated as 1.01e+12:  log likelihood = -2183.57,  aic = 4393.14

Training set error measures:
                    ME    RMSE      MAE       MPE     MAPE      MASE
Training set 140028.5 1001382 700627.7 -2.237903 16.85284 0.5376507
                     ACF1
Training set -0.001226353
> residual14=resid(Model14)
> residual14
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.818   235887.459  -116795.094   423420.956   450382.724
  [6]   412084.825     7299.830   343693.536   302027.340   339261.459
 [11]  1311852.795   476416.907   180718.752  -331814.764   300218.992
 [16]   606335.664  -365048.300   790219.483   496640.730  -404809.042
 [21]   596136.539   836373.652   -29169.616   363497.916  -917490.680
 [26]   117897.435  -125742.553   249653.348   445848.187  -150001.307
 [31]   669536.272   220472.575   664356.878  1998962.696 -1834543.992
 [36]   581418.014   206682.998  -226032.250   388359.162    22088.560
 [41]  -159456.228   286952.824  -349097.040  -139285.102  -162031.908
 [46]   246047.048    56943.544  -266228.922 -2728114.197 -1987739.340
 [51] -1189534.523  -638429.106  -512901.991  -644284.778 -1064139.802
 [56]  -168797.953  -377568.365   452364.329 -1086211.096   552952.674
 [61]  -509701.618  -432437.299   -86647.155   351801.218   184322.420
 [66]   818722.031    96825.124  -100529.980  2985450.546 -2993937.938
```

```
 [71]  -930082.981   886491.982  -653213.559 -1177919.438   232156.164
 [76]   134134.674  -321635.345   381352.941   108758.279  -767001.366
 [81]   448639.842   527449.822  -521937.902  -975249.991  -713978.817
 [86]  -798354.577  -896641.150   512464.731  1285619.768    52657.830
 [91]  1228171.556  1853197.002   156746.876   859244.792  1664690.532
 [96]  4002348.535  -231647.613  -708850.123   619570.422  1005548.019
[101]  1166438.251  1041668.849   497918.825  3267046.819 -1956032.590
[106]   999924.379 -2006636.379   -18923.725   322030.004  -101984.083
[111]   495805.004   815742.110   992689.356  1683623.511   379204.728
[116]  1327011.871    38754.731  -120103.732  -160383.469  1107299.805
[121]  -514307.052  -174855.908   -85103.808    81503.406  1074891.110
[126]   110249.083  2117278.039 -1161109.618   551611.285  -223965.028
[131]  -145425.586  1229718.610   319627.641 -1723965.271   -55571.803
[136]   710137.493   773838.375   104570.374  2070528.755 -2600170.702
[141]  -127791.433   454020.404  -391777.011   761484.570
> Box.test(residual14,type="Ljung")

        Box-Ljung test

data:  residual14
X-squared = 0.00022111, df = 1, p-value = 0.9881

> ks.test(residual14,"pnorm",mean(residual14),sd(residual14))

        One-sample Kolmogorov-Smirnov test

data:  residual14
D = 0.098047, p-value = 0.1255
alternative hypothesis: two-sided

> Model15=arima(datatrans,order=c(11,1,10))
> summary(Model15)

Call:
arima(x = datatrans, order = c(11, 1, 10))

Coefficients:
          ar1      ar2      ar3      ar4      ar5      ar6      ar7      ar8
      -0.9427  -0.8184  -1.0127  -0.8834  -0.9109  -1.1241  -0.8389  -0.9108
s.e.      NaN      NaN      NaN      NaN      NaN      NaN      NaN      NaN
          ar9     ar10     ar11      ma1     ma2     ma3      ma4     ma5
      -0.9389  -0.9298  -0.6915  -0.0879  0.0509  0.5934  -0.0884  0.2248
s.e.      NaN      NaN      NaN   0.1242  0.0145     NaN      NaN  0.1423
         ma6      ma7     ma8     ma9     ma10
      0.6757  -0.2566  0.4693  0.1692  -0.0708
s.e.     NaN      NaN  0.1211     NaN      NaN

sigma^2 estimated as 7.511e+11:  log likelihood = -2167.5,  aic = 4379

Training set error measures:
                    ME     RMSE      MAE       MPE     MAPE      MASE
Training set 84309.66 863619.7 601967.1 -2.304995 14.57956 0.4619401
                     ACF1
Training set -0.003091315
Warning message:
In sqrt(diag(x$var.coef)) : NaNs produced
> residual15=resid(Model15)
> residual15
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.815   204839.136  -105321.387   363075.472   366997.826
  [6]   340362.352    37930.808   331017.310   289851.760   247175.414
 [11]  1081845.076   396855.498   180282.117  -187927.305    99966.308
 [16]   289963.259  -460461.731   286034.176   335453.228  -280602.844
 [21]   125244.609   511719.234   114736.904   122739.988  -762301.769
 [26]   469774.185  -140653.066   243495.370   143846.897  -114524.576
 [31]   596482.815  -164124.803   947975.592  1385566.582 -1725037.196
```

```
 [36]    93550.705    56937.010   631867.524  -242269.658   -66197.975
 [41]  -175210.091  -180822.838  -237505.017  -497056.946    16667.423
 [46]   -76977.630  -101344.628   500797.391 -2101025.864 -2180333.119
 [51] -1107716.605    40093.082  -356365.200   -57329.306  -315122.128
 [56]   419432.826   120660.782   887384.378  -668580.210  1070491.881
 [61]  -270194.060  -119520.398   127929.580  -319699.276    40064.603
 [66]   274583.420   242136.015  -362634.620  2556040.688 -2722363.592
 [71] -1760284.298   831350.501   307687.554  -529050.829  -225732.873
 [76]   986174.222  -591558.875   622542.583  -239120.055  -380221.804
 [81]   117787.485  -363006.675   226636.191  -430498.808  -972175.304
 [86]  -557577.464   185032.609  -136430.342  1362510.227   681966.493
 [91]  1064414.910  1414668.678   576341.520   490655.778   750661.125
 [96]  4587008.891  -904885.207  -913969.896 -1085494.408   -68793.328
[101]   400104.891  -786521.342   863697.001  2072587.177  -855053.350
[106]   155066.965 -1719531.277   633773.115  -814729.474  1341152.858
[111]   804433.340   285487.591   894171.954  1056804.765   437340.382
[116]   331549.899  -213117.754  -487792.492  -746317.824   512500.211
[121]  -227294.872   431728.493  -426540.466    98958.646   741691.206
[126]   124075.190  1073524.871  -918562.886   529737.678  -343091.408
[131]   235122.631   982685.918   621877.544 -1130707.815  -873408.546
[136]   472150.053   427587.634  -373719.278   819085.935 -1903001.616
[141]  -193923.692   831010.077   243634.608  1189818.193
> Box.test(residual15,type="Ljung")

        Box-Ljung test

data:  residual15
X-squared = 0.001405, df = 1, p-value = 0.9701

> ks.test(residual15,"pnorm",mean(residual15),sd(residual15))

        One-sample Kolmogorov-Smirnov test

data:  residual15
D = 0.093696, p-value = 0.1595
alternative hypothesis: two-sided

> Model16=arima(datatrans,order=c(11,1,12))
Warning message:
In arima(datatrans, order = c(11, 1, 12)) :
  possible convergence problem: optim gave code = 1
> Model17=arima(datatrans,order=c(12,1,0))
> summary(Model17)

Call:
arima(x = datatrans, order = c(12, 1, 0))

Coefficients:
          ar1      ar2      ar3      ar4      ar5      ar6      ar7      ar8
      -0.8677  -0.6890  -0.5739  -0.5313  -0.5399  -0.5433  -0.4439  -0.4282
s.e.   0.0825   0.1029   0.1081   0.1122   0.1161   0.1168   0.1167   0.1142
          ar9     ar10     ar11    ar12
      -0.4450  -0.5700  -0.4882  0.1901
s.e.   0.1126   0.1088   0.1044  0.0855

sigma^2 estimated as 9.949e+11:  log likelihood = -2182.62,  aic = 4391.23

Training set error measures:
                    ME     RMSE    MAE       MPE     MAPE      MASE       ACF1
Training set 128110.7 993990.2 697815 -2.359071 16.80603 0.5354922 -0.0635571
> residual17=resid(Model17)
> residual17
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.817   233257.319  -114799.630   418287.585   447949.071
  [6]   410552.607     3492.373   341174.936   294099.714   338309.312
 [11]  1300597.283   477415.895   177708.495  -375174.180   272174.706
```

```
 [16]   543035.595  -425459.045   796167.809   471505.706  -475960.614
 [21]   574489.787   799509.392   -88742.473   409661.409  -891664.190
 [26]   142790.363  -152878.706   205270.416   435700.609  -189497.792
 [31]   686099.028   187502.704   597008.827  1953464.500 -1914781.854
 [36]   671924.010   255781.504  -297206.727   351816.857   -29940.609
 [41]  -182238.216   272853.447  -371806.408  -136192.237  -173428.434
 [46]   268791.420   139208.773  -278833.228 -2683404.092 -1861365.585
 [51] -1065551.980  -554985.284  -439102.773  -576689.331  -973447.535
 [56]   -93492.882  -360033.539   523004.450  -964461.996   679167.696
 [61]  -405551.732  -467776.432  -129045.517   316031.160   153889.603
 [66]   806351.413    69961.371  -160981.975  2943107.424 -3131495.513
 [71]  -789247.389  1023052.991  -601091.587 -1211791.353   253291.908
 [76]   117604.142  -357554.579   389194.519   140649.007  -769426.444
 [81]   469589.416   646777.614  -582364.979  -983442.183  -556256.530
 [86]  -787868.397  -921521.925   551369.608  1288266.565   -24013.426
 [91]  1240544.504  1808261.471    24938.215   907585.335  1620719.563
 [96]  3914927.334  -415447.734  -875973.063   541285.562   853174.856
[101]  1007938.486   927174.421   418812.606  3199390.730 -2138214.768
[106]  1002516.787 -2054333.464    97455.181   536954.844  -152098.151
[111]   407410.823   719162.264   885198.575  1586715.765   297107.949
[116]  1302803.108    97796.843  -213038.736  -204146.564  1081989.322
[121]  -510111.880  -236014.448  -141975.419    27228.553  1008885.075
[126]    26705.941  2131593.367 -1195662.274   685810.406  -262665.158
[131]  -187865.281  1224997.738   340646.950 -1819780.167   -42719.901
[136]   689288.981   642680.471    32496.943  2075283.859 -2563909.812
[141]    -9059.751   475422.841  -445124.979   773568.021
> Box.test(residual17,type="Ljung")

        Box-Ljung test

data:  residual17
X-squared = 0.59389, df = 1, p-value = 0.4409

> ks.test(residual17,"pnorm",mean(residual17),sd(residual17))

        One-sample Kolmogorov-Smirnov test

data:  residual17
D = 0.091609, p-value = 0.1783
alternative hypothesis: two-sided

> Model18=arima(datatrans,order=c(12,1,1))
> summary(Model18)

Call:
arima(x = datatrans, order = c(12, 1, 1))

Coefficients:
          ar1      ar2      ar3      ar4      ar5      ar6     ar7      ar8
      -0.2116  -0.0325  -0.0290  -0.0738  -0.1058  -0.0963  0.0088  -0.0425
s.e.   0.0933   0.0937   0.0847   0.0767   0.0746   0.0727  0.0766   0.0721
          ar9     ar10    ar11    ar12      ma1
      -0.0705  -0.1647  0.0240  0.6732  -0.6922
s.e.   0.0694   0.0694  0.0748  0.0687   0.1020

sigma^2 estimated as 9.095e+11:  log likelihood = -2176.78,  aic = 4381.56

Training set error measures:
                    ME     RMSE    MAE       MPE     MAPE      MASE        ACF1
Training set 73800.02 950343.1 646854 -2.779788 15.63615 0.4963856 -0.08127083
> residual18=resid(Model18)
> residual18
Time Series:
Start = 1
End = 144
Frequency = 1
  [1]     3261.817   223178.730  -110084.334   399687.372   427564.994
  [6]   395114.950    11341.566   335600.910   284979.509   314068.084
 [11]  1232228.529   451243.950   179933.735  -398880.368   153775.222
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 [16]   401253.471  -615969.682   574943.512   375951.308  -613528.653
 [21]   336997.366   638881.775  -250338.494   260993.611  -860159.225
 [26]   129007.916  -132589.565   123238.223   342920.137  -262297.334
 [31]   576668.215   173845.501   482035.346  1802164.896 -1992171.024
 [36]   443554.307   351774.887  -251850.919   237706.592  -147484.021
 [41]  -358949.517   110389.024  -501190.551  -280604.128  -283119.358
 [46]   174412.284   206231.247  -133775.543 -2606372.950 -1823837.755
 [51]  -910604.166  -309707.543  -159509.874  -273526.736  -658018.823
 [56]   221305.892   -54966.235   769507.322  -549782.819  1138432.164
 [61]   204300.214     5912.865    61438.455   378060.900   148387.918
 [66]   773069.810    72702.017  -249357.349  2759261.413 -3201087.813
 [71] -1142053.820  1084557.059  -312577.632 -1032085.972   256955.584
 [76]   171224.521  -388263.651   318760.585   161108.540  -715859.091
 [81]   448981.944   814191.843  -317797.298  -979878.043  -454343.956
 [86]  -544275.829  -860223.834   542190.467  1379860.070    60466.085
 [91]  1196250.431  1870485.557     1786.849   777000.739  1664872.890
 [96]  3893605.089  -377240.188 -1267384.026   -26256.439   296291.543
[101]   357262.399   291875.409  -155176.277  2678916.478 -2490010.408
[106]   356898.339 -2402653.352  -303342.019   662393.269   182490.978
[111]   427181.386   596672.751   644925.031  1282002.726    18218.851
[116]  1001562.776    35594.285  -252518.881  -432352.036   869839.754
[121]  -599816.868  -367495.564  -393508.547  -259516.393   694276.146
[126]  -264555.526  1834434.979 -1240901.045   620615.277   -83877.802
[131]  -231312.256  1158417.998   409120.900 -1797766.410  -301158.405
[136]   556817.449   437780.173  -284781.382  1786134.164 -2568129.346
[141]   -59678.679   619255.816  -363332.280   738485.940
> Box.test(residual18,type="Ljung")

        Box-Ljung test

data:  residual18
X-squared = 0.97107, df = 1, p-value = 0.3244

> ks.test(residual18,"pnorm",mean(residual18),sd(residual18))

        One-sample Kolmogorov-Smirnov test

data:  residual18
D = 0.12899, p-value = 0.0166
alternative hypothesis: two-sided

> Model19=arima(datatrans,order=c(12,1,10))
Error in arima(datatrans, order = c(12, 1, 10)) :
  non-stationary AR part from CSS
> Model20=arima(datatrans,order=c(12,1,12))
Error in arima(datatrans, order = c(12, 1, 12)) :
  non-stationary AR part from CSS
> fcast=forecast(Model17,h=12)
> fcast
    Point Forecast   Lo 80    Hi 80   Lo 95    Hi 95
145        4889314 3611018  6167610 2934330  6844299
146        6284744 4995313  7574176 4312729  8256760
147        6187207 4873606  7500808 4178228  8196186
148        5817584 4487223  7147946 3782972  7852196
149        5746766 4408353  7085179 3699840  7793692
150        6669991 5329058  8010923 4619212  8720770
151        9369301 8026735 10711866 7316024 11422578
152        4081794 2728052  5435537 2011424  6152165
153        6669749 5313362  8026135 4595335  8744163
154        6312022 4954419  7669625 4235747  8388296
155        6362249 5001439  7723059 4281070  8443428
156        7613095 6247740  8978450 5524965  9701225
> plot(fcast)
> ##Plot untuk peramalan dengan Data asli
> dataasli=read.delim("clipboard")
> dataasli
    Nomor Data.Asli
1       1     10639
2       2     13864
```

3	3	10787
4	4	16538
5	5	17319
6	6	17771
7	7	14956
8	8	18593
9	9	19257
10	10	18365
11	11	34642
12	12	21942
13	13	17275
14	14	15149
15	15	16253
16	16	22858
17	17	14851
18	18	26574
19	19	21548
20	20	16522
21	21	22873
22	22	27119
23	23	31207
24	24	26418
25	25	14003
26	26	18849
27	27	17380
28	28	22489
29	29	19046
30	30	25534
31	31	26250
32	32	19548
33	33	29643
34	34	50044
35	35	14982
36	36	33955
37	37	21282
38	38	21045
39	39	22902
40	40	23260
41	41	20994
42	42	27941
43	43	21574
44	44	17195
45	45	28395
46	46	38995
47	47	17563
48	48	31305
49	49	4014
50	50	6656
51	51	8840
52	52	10898
53	53	12412
54	54	15097
55	55	8870
56	56	10966
57	57	17191
58	58	28099
59	59	9837
60	60	33856
61	61	4816
62	62	8417
63	63	9345
64	64	12894
65	65	14393
66	66	20415
67	67	11744
68	68	10696
69	69	50403
70	70	2474
71	71	8074

```
72     72     37816
73     73      3468
74     74      4666
75     75     10994
76     76     13644
77     77      9223
78     78     18420
79     79     10696
80     80      9532
81     81     37807
82     82      4227
83     83     12356
84     84     19946
85     85      6308
86     86      9561
87     87      9476
88     88     17101
89     89     19124
90     90     19129
91     91     21704
92     92     34903
93     93     33569
94     94     13510
95     95     20505
96     96     42429
97     97      7514
98     98     10685
99     99     18615
100   100     26649
101   101     24902
102   102     28774
103   103     31781
104   104     80329
105   105     11163
106   106     25339
107   107     25206
108   108     56658
109   109     12687
110   110     17915
111   111     31709
112   112     32211
113   113     32566
114   114     43835
115   115     39869
116   116     68308
117   117     16877
118   118     33040
119   119     32804
120   120     67729
121   121     12693
122   122     25613
123   123     36020
124   124     24384
125   125     40384
126   126     36427
127   127     86623
128   128     48190
129   129     28820
130   130     37649
131   131     38940
132   132     74264
133   133     21244
134   134     22880
135   135     36208
136   136     34063
137   137     40469
138   138     37827
139   139    116877
140   140     15833
```

```
141   141     33693
142   142     42993
143   143     37122
144   144     72868
> x1=dataasli$Nomor
> x1
  [1]   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18
 [19]  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36
 [37]  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54
 [55]  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71  72
 [73]  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89  90
 [91]  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107 108
[109] 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
[127] 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144
> y1=dataasli$Data.Asli
> y1
  [1]  10639  13864  10787  16538  17319  17771  14956  18593  19257  18365
 [11]  34642  21942  17275  15149  16253  22858  14851  26574  21548  16522
 [21]  22873  27119  31207  26418  14003  18849  17380  22489  19046  25534
 [31]  26250  19548  29643  50044  14982  33955  21282  21045  22902  23260
 [41]  20994  27941  21574  17195  28395  38995  17563  31305   4014   6656
 [51]   8840  10898  12412  15097   8870  10966  17191  28099   9837  33856
 [61]   4816   8417   9345  12894  14393  20415  11744  10696  50403   2474
 [71]   8074  37816   3468   4666  10994  13644   9223  18420  10696   9532
 [81]  37807   4227  12356  19946   6308   9561   9476  17101  19124  19129
 [91]  21704  34903  33569  13510  20505  42429   7514  10685  18615  26649
[101]  24902  28774  31781  80329  11163  25339  25206  56658  12687  17915
[111]  31709  32211  32566  43835  39869  68308  16877  33040  32804  67729
[121]  12693  25613  36020  24384  40384  36427  86623  48190  28820  37649
[131]  38940  74264  21244  22880  36208  34063  40469  37827 116877  15833
[141]  33693  42993  37122  72868
> hasilramal=read.delim("clipboard")
> hasilramal
   Nomor Hasil.Ramal
1    145       23905
2    146       39498
3    147       38282
4    148       33844
5    149       33025
6    150       44489
7    151       87784
8    152       16661
9    153       44486
10   154       39842
11   155       40478
12   156       57959
> x2=hasilramal$Nomor
> x2
 [1] 145 146 147 148 149 150 151 152 153 154 155 156
> y2=hasilramal$Hasil.Ramal
> y2
 [1] 23905 39498 38282 33844 33025 44489 87784 16661 44486 39842 40478 57959
> plot(x1,y1,col="black",type="l",xlim=c(0,160),ylim=c(0,100000),xlab="Data ke-",ylab="Xt",main="
Plot data asli dan peramalan")
> par(new=T)
> plot(x2,y2,col="blue",type="l",xlim=c(0,160),ylim=c(0,100000),xlab="Data ke-",ylab="Xt",main="P
lot data asli dan peramalan")

> >
```