ASHR ARMA-X Analysis

Contents

Stationarity

```
adf.test(data$ASHR_vol)

adf.test(data$N)
adf.test(data$tariff)
adf.test(data$china)
```

CSI 300 China Univariate ARMA-X Models

Tweet Dummy as Exogenous

```
#auto.armax selects the lowest AIC value given r (exogenous variable lags)
res1 = auto.armax(data$ASHR_vol,xreg=data$dummy,nb.lags=2,
                  latex=F,max.p = 6, max.q = 6, max.d=0)
```

========== Model 1
———— ar1 0.9820 ***(0.0029)***
ma1 -0.8749 (0.0088)
dummy_lag_0 0.0000 ** (0.0000)
dummy_lag_1 0.0000
(0.0000)
dummy_lag_2 0.0000
(0.0000)
———— AIC -255919.4761
AICc -255919.4719
BIC -255872.0645
Log Likelihood 127965.7380
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$dummy, nb.lags=2,
                    p=5, q=0, d=0, latex=F)
```

========== Model 1
———— ar1 0.2927 ***(0.0071)***
ar2 0.0828 (0.0073)
ar3 0.0534 ***(0.0073)***
ar4 0.0684 (0.0073)
ar5 0.0909 *** (0.0073)
intercept 0.0001

dummy_lag_0 0.0000 ***(0.0000)***
dummy_lag_1 0.0000
(0.0000)
dummy_lag_2 0.0000
(0.0000)
———— ***AIC -255731.1908***

AICc -255731.1798
BIC -255652.1715
Log Likelihood 127875.5954
Num. obs. 19969
========== p < 0.001; ** p < 0.01; * p < 0.05

```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$dummy,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

========== Model 1
———— ar1 0.9910 ***(0.0014)***
ma1 -0.7445 (0.0072)
ma2 -0.1387 ***(0.0088)***
ma3 -0.0470 (0.0072)
intercept 0.0001

dummy_lag_0 0.0000

AIC -256599.7623 AICc -256599.7567 BIC -256544.4480 Log Likelihood 128306.8811 Num. obs. 19971
==========
*** p < 0.001; ** p < 0.01; * p < 0.05

ar1 0.3092 ***(0.0075)*** ***ar2 0.0926*** (0.0074) ar3 0.0657 ***(0.0075)*** ***ar4 0.0809*** (0.0073) ar5 0.1049 *** (0.0065) N_lag_0 0.0000 (0.0000) N_lag_1 0.0000 (0.0000) N_lag_2 0.0000 (0.0000)

AIC -255345.1057
AICc -255345.0966
BIC -255273.9882
Log Likelihood 127681.5528
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$N, nb.lags=2,
                  p=5, q=0, d=0, latex=F)
```

========== Model 1
———— ar1 0.2931 ***(0.0080)***
ar2 0.0802 (0.0076)
ar3 0.0535 ***(0.0077)***
ar4 0.0680 (0.0073)
ar5 0.0907 *** (0.0118)
intercept 0.0001

N_lag_0 0.0000
(0.0000)
N_lag_1 0.0000
(0.0000)

N_lag_2 -0.0000
(0.0000)
——————————— AIC -255638.6089
AICc -255638.5979
BIC -255559.5895
Log Likelihood 127829.3044
Num. obs. 19969
================================== *** p < 0.001; ** p < 0.01; * p < 0.05

```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$N,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

================================== Model 1
——————————— ar1 0.9909 ***(0.0014)***
ma1 -0.7439 (0.0072)
ma2 -0.1410 ***(0.0087)***
ma3 -0.0452 (0.0072)
intercept 0.0001

N_lag_0 0.0000

AIC -256508.5319 AICc -256508.5263 BIC -256453.2176 Log Likelihood 128261.2659 Num. obs. 19971
==========
*** p < 0.001; ** p < 0.01; * p < 0.05

ar1 0.9900 ***(0.0015)*** ***ma1 -0.7563*** (0.0070)
ma2 -0.1692 ***(0.0069)*** ***intercept 0.0002***
(0.0000) tariff_lag_0 0.0000 (0.0000)
tariff_lag_1 0.0000 (0.0000) tariff_lag_2
-0.0000 (0.0000)

AIC -255927.0698
AICc -255927.0626
BIC -255863.8543
Log Likelihood 127971.5349
Num. obs. 19969
================================== *** p < 0.001; ** p < 0.01; * p < 0.05

```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$tariff, nb.lags=2,
                  p=5, q=0, d=0, latex=F)
```

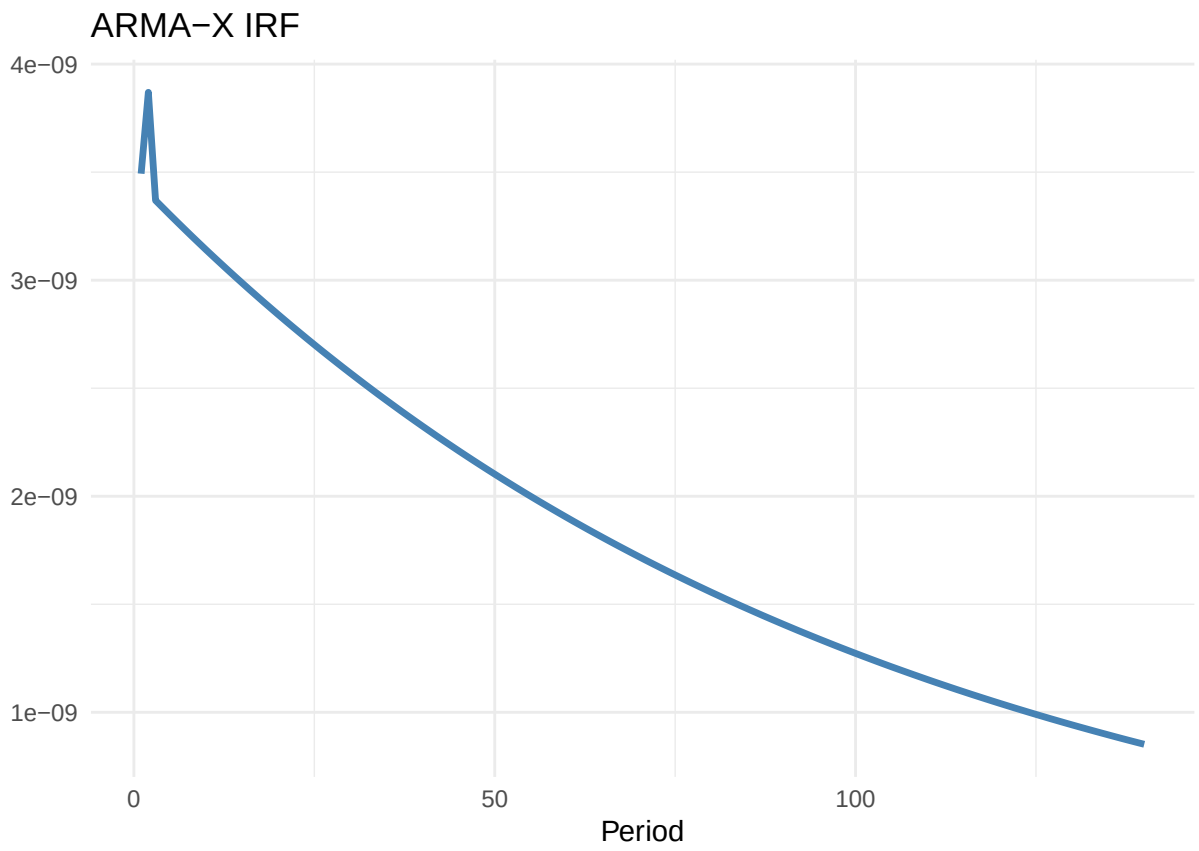
================================== Model 1
——————————— ar1 0.2907 ***(0.0070)***
ar2 0.0796 (0.0073)
ar3 0.0507 ***(0.0073)***
ar4 0.0651 (0.0073)
ar5 0.0887 ***(0.0070)***
intercept 0.0002 (0.0000)
tariff_lag_0 0.0000

(0.0000)
tariff_lag_1 0.0000
(0.0000)
tariff_lag_2 0.0000
(0.0000)
——————————— AIC -255036.7200
AICc -255036.7090
BIC -254957.7006
Log Likelihood 127528.3600
Num. obs. 19969
================================= *** p < 0.001; ** p < 0.01; * p < 0.05

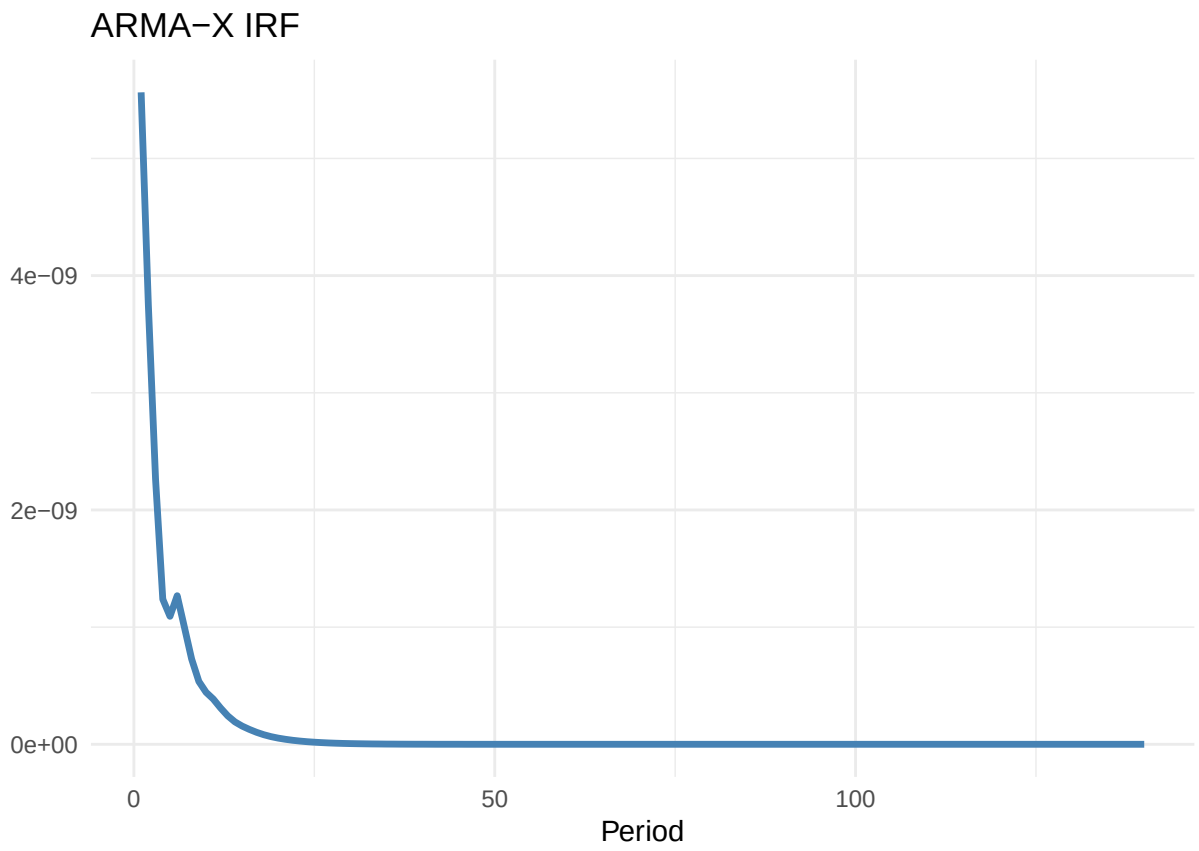
```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$tariff,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

================================= Model 1
——————————— ar1 0.9913 ***(0.0013)***
ma1 -0.7508 (0.0072)
ma2 -0.1387 ***(0.0088)***
ma3 -0.0429 (0.0073)
intercept 0.0002 ***(0.0000)***
tariff_lag_0 0.0000
(0.0000)
——————————————— ***AIC -255990.0623***
AICc -255990.0567
BIC -255934.7481
Log Likelihood 128002.0312
Num. obs. 19971
================================= p < 0.001; ** p < 0.01; * p < 0.05

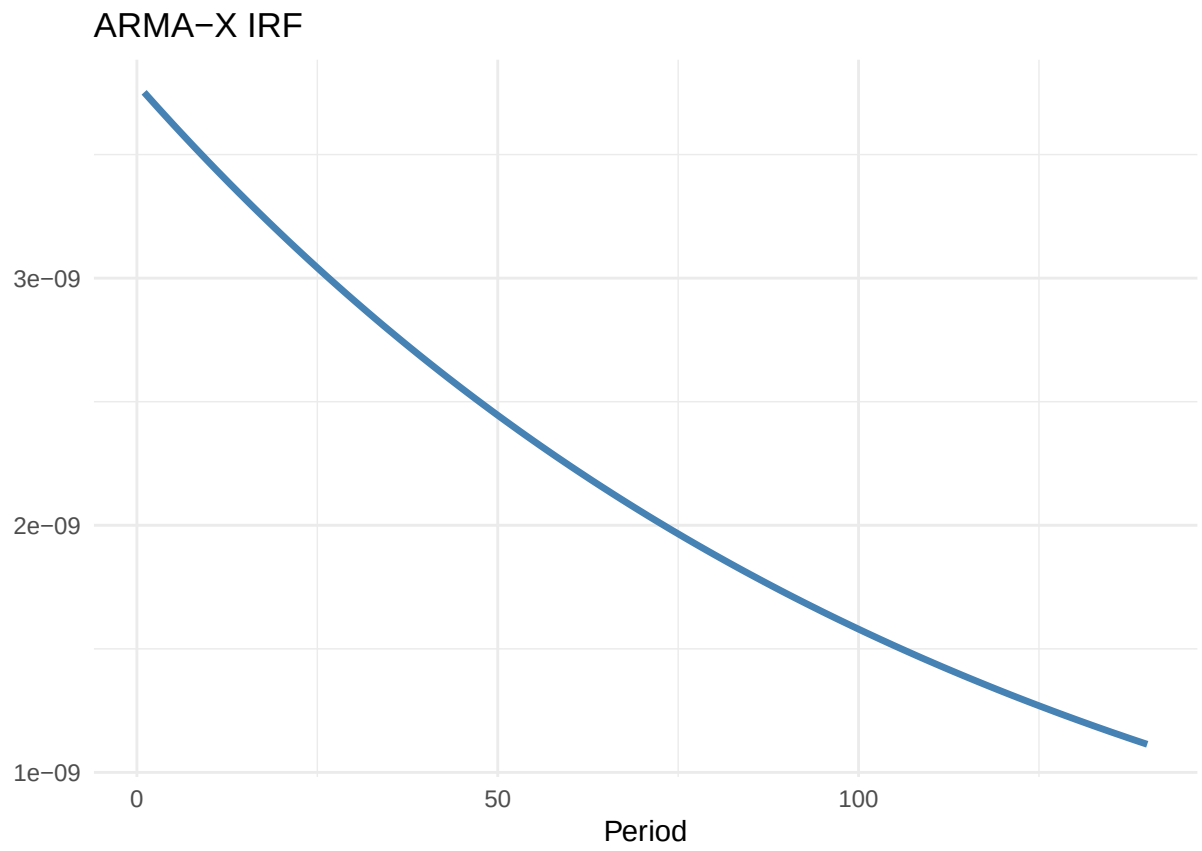
```
#we want to plot the IRFs of these models
nb.periods = 7 * 20

irf.plot(res1,nb.periods)
```




```
irf.plot(res2,nb.periods)
```




```
irf.plot(res3$model,nb.periods)
```



Trade Mention as Exogenous

```
#auto.armax selects the lowest AIC value given r (exogenous variable lags)
res1 = auto.armax(data$ASHR_vol,xreg=data$trade,nb.lags=2,
                  latex=F,max.p = 6, max.q = 6, max.d=0)
```

========== Model 1
———— ar1 0.9900 ***(0.0015)***
ma1 -0.7555 (0.0070)
ma2 -0.1703 ***(0.0069)***
intercept 0.0002 (0.0000)
trade_lag_0 0.0000 ** (0.0000)
trade_lag_1 -0.0000
(0.0000)
trade_lag_2 0.0000
(0.0000)
———— AIC -255946.3538
AICc -255946.3466
BIC -255883.1383
Log Likelihood 127981.1769
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

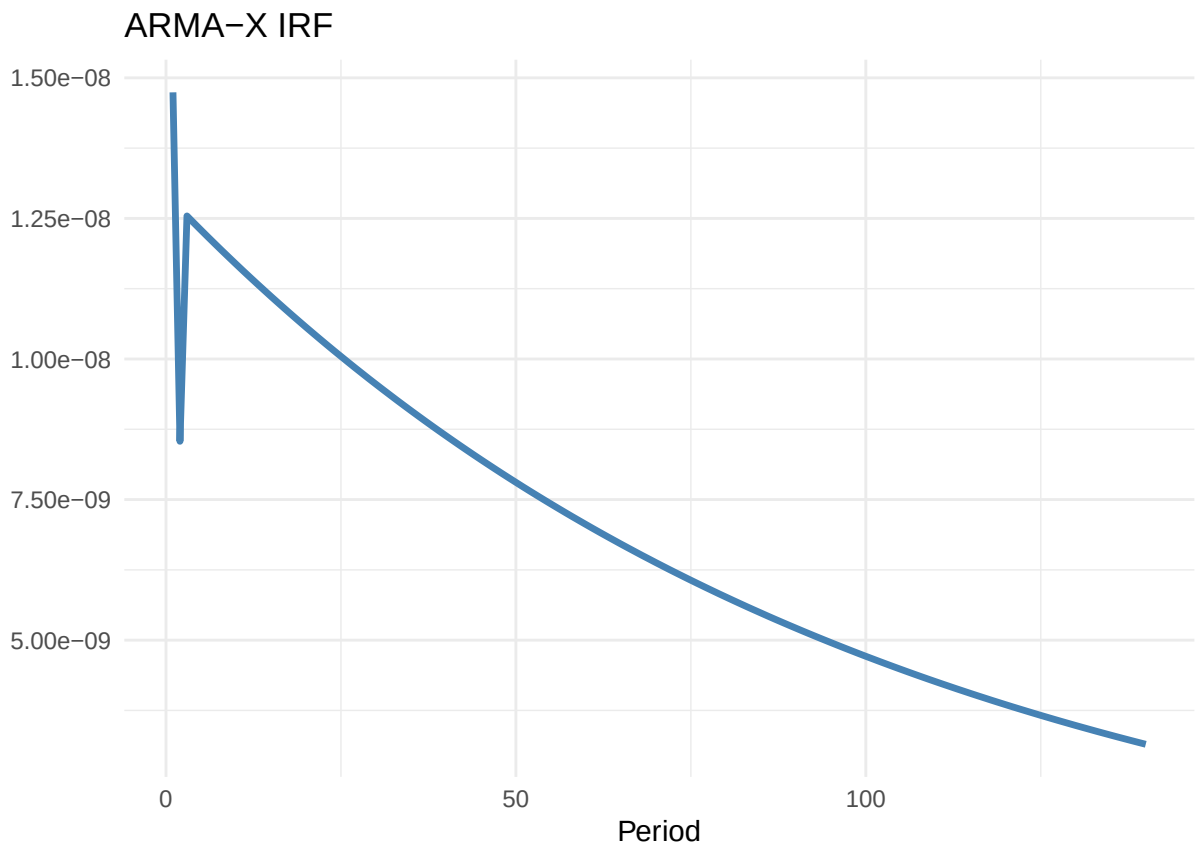
```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$trade, nb.lags=2,
                    p=5, q=0, d=0, latex=F)
```

========== Model 1
———— ar1 0.2916 ***(0.0070)***
ar2 0.0787 (0.0073)
ar3 0.0502 ***(0.0073)***
ar4 0.0661 (0.0073)
ar5 0.0881 ***(0.0071)***
intercept 0.0002 (0.0000)
trade_lag_0 0.0000 ** (0.0000)
trade_lag_1 -0.0000
(0.0000)
trade_lag_2 0.0000
(0.0000)
———— AIC -255055.5611
AICc -255055.5501
BIC -254976.5418
Log Likelihood 127537.7806
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

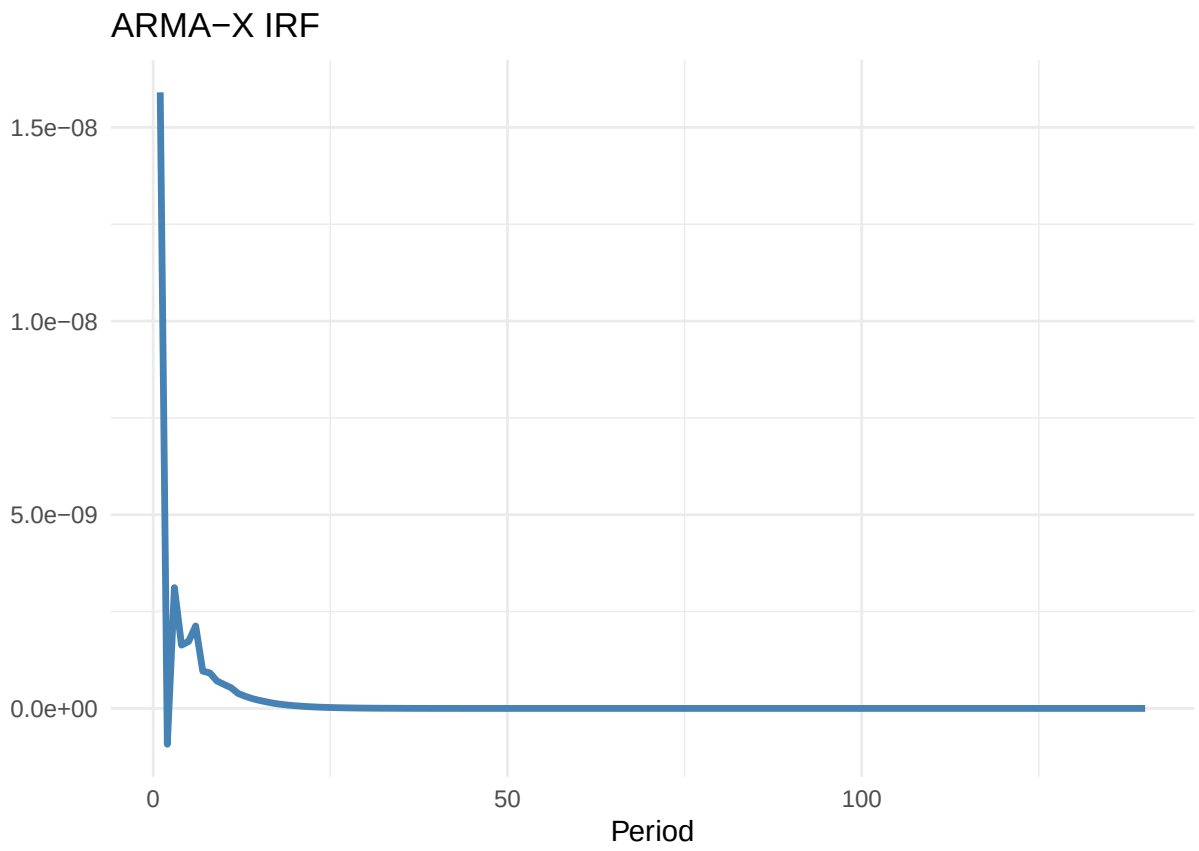
```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$trade,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

========== Model 1
———— ar1 0.9914 ***(0.0013)***
ma1 -0.7494 (0.0072)
ma2 -0.1406 ***(0.0087)***
ma3 -0.0427 (0.0073)
intercept 0.0002 ***(0.0000)***
trade_lag_0 0.0000 *(0.0000)*
———— *AIC -256004.3080*
AICc -256004.3024
BIC -255948.9937
Log Likelihood 128009.1540
Num. obs. 19971
========== ** p < 0.001; ** p < 0.01; * p < 0.05

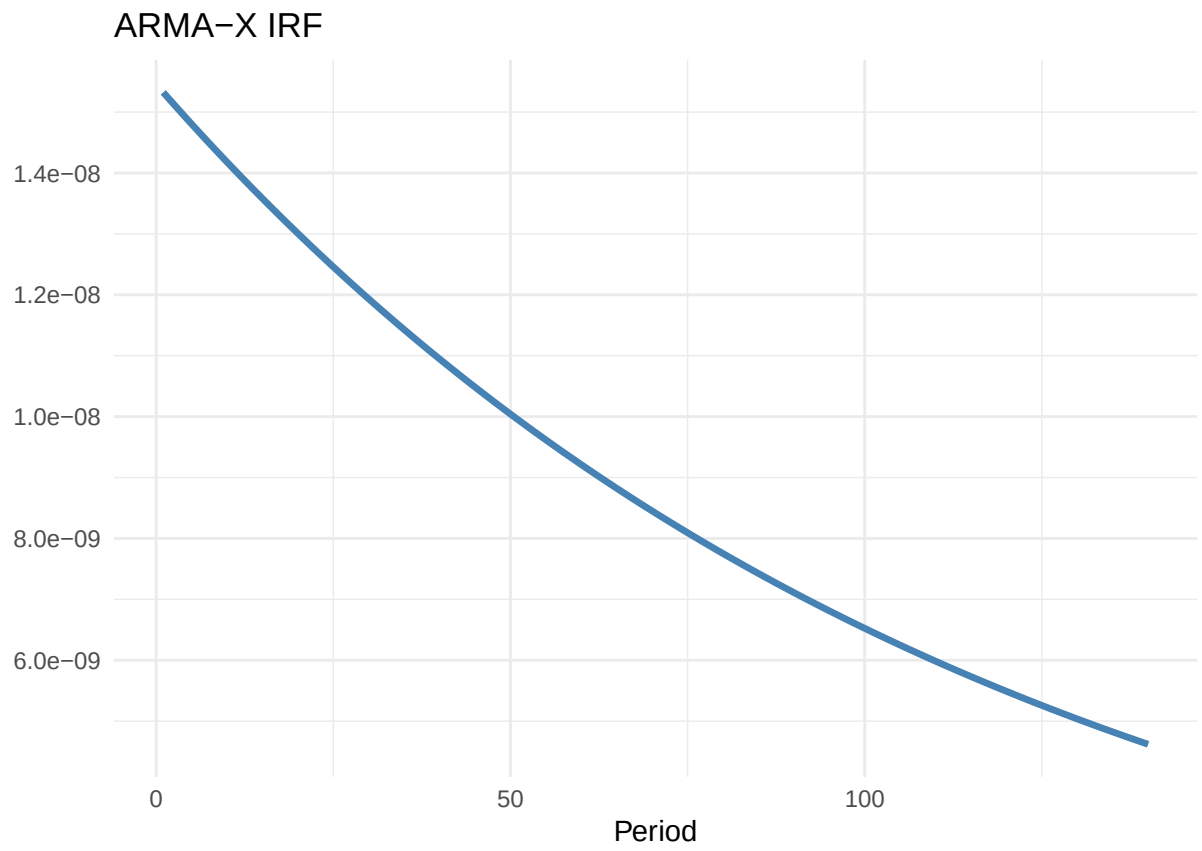
```
#we want to plot the IRFs of these models
nb.periods = 7 * 20

irf.plot(res1,nb.periods)
```




```
irf.plot(res2,nb.periods)
```




```
irf.plot(res3$model,nb.periods)
```



China Mention as Exogenous

```
#auto.armax selects the lowest AIC value given r (exogenous variable lags)
res1 = auto.armax(data$ASHR_vol,xreg=data$china,nb.lags=2,
                  latex=F,max.p = 6, max.q = 6, max.d=0)
```

========== Model 1
———— ar1 0.9900 ***(0.0015)***
ma1 -0.7563 (0.0070)
ma2 -0.1697 ***(0.0069)***
intercept 0.0002 (0.0000)
china_lag_0 0.0000 ** (0.0000)
china_lag_1 0.0000
(0.0000)
china_lag_2 0.0000
(0.0000)
———— AIC -255947.4425
AICc -255947.4352
BIC -255884.2270
Log Likelihood 127981.7212
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

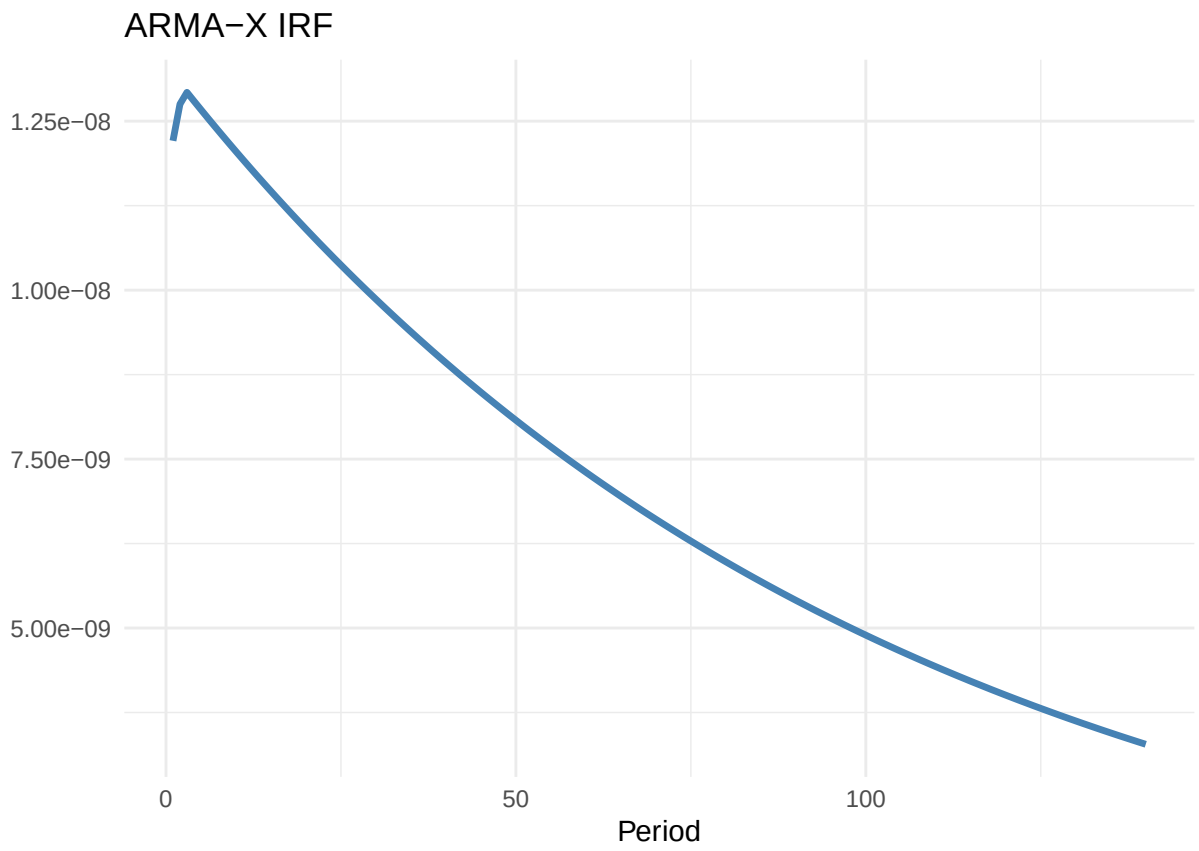
```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$china, nb.lags=2,
                    p=5, q=0, d=0, latex=F)
```

========== Model 1
———— ar1 0.2909 ***(0.0070)***
ar2 0.0795 (0.0073)
ar3 0.0507 ***(0.0073)***
ar4 0.0655 (0.0073)
ar5 0.0889 ***(0.0071)***
intercept 0.0002 (0.0000)
china_lag_0 0.0000 ** (0.0000)
china_lag_1 0.0000
(0.0000)
china_lag_2 -0.0000
(0.0000)
———— AIC -255054.9774
AICc -255054.9663
BIC -254975.9580
Log Likelihood 127537.4887
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

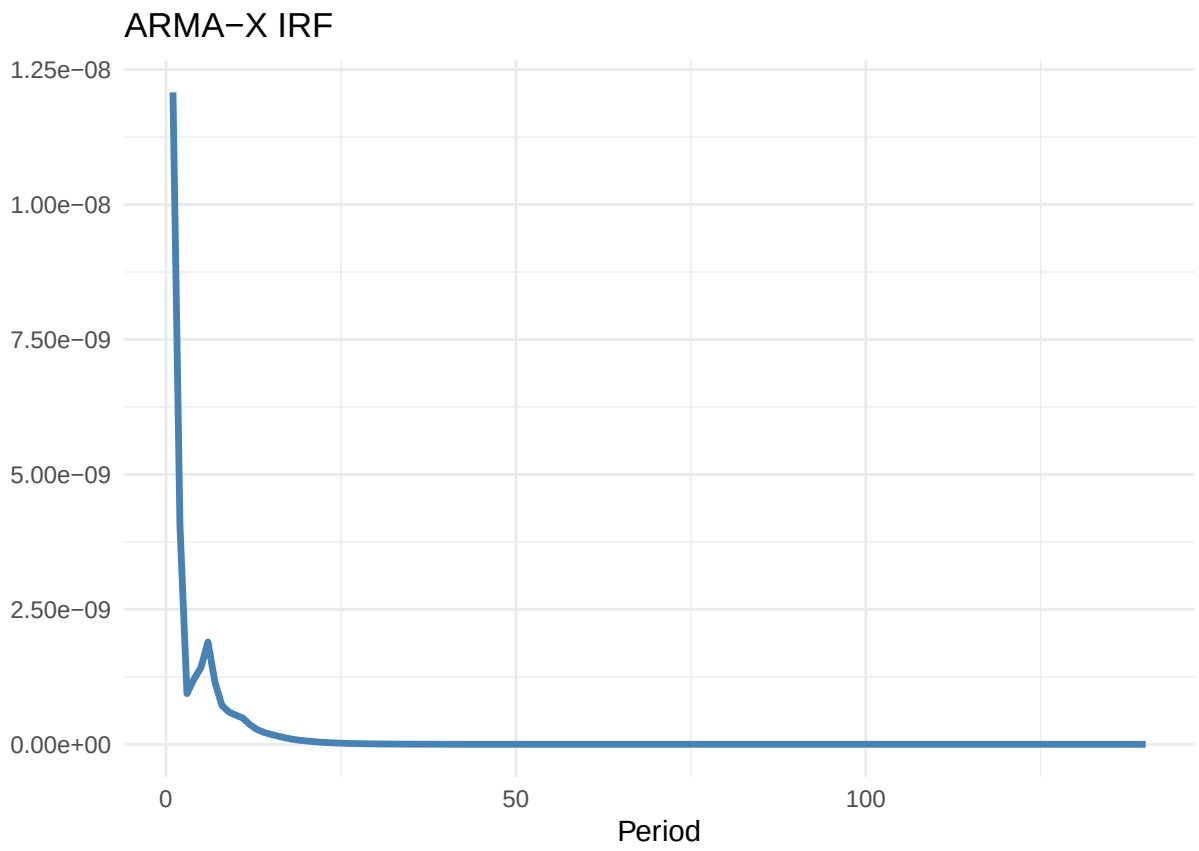
```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$china,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

========== Model 1
———— ar1 0.9915 ***(0.0013)***
ma1 -0.7509 (0.0072)
ma2 -0.1383 ***(0.0088)***
ma3 -0.0434 (0.0073)
intercept 0.0002 ***(0.0000)***
china_lag_0 0.0000 *(0.0000)*
———— *AIC -256010.2273*
AICc -256010.2217
BIC -255954.9130
Log Likelihood 128012.1137
Num. obs. 19971
========== ** p < 0.001; ** p < 0.01; * p < 0.05

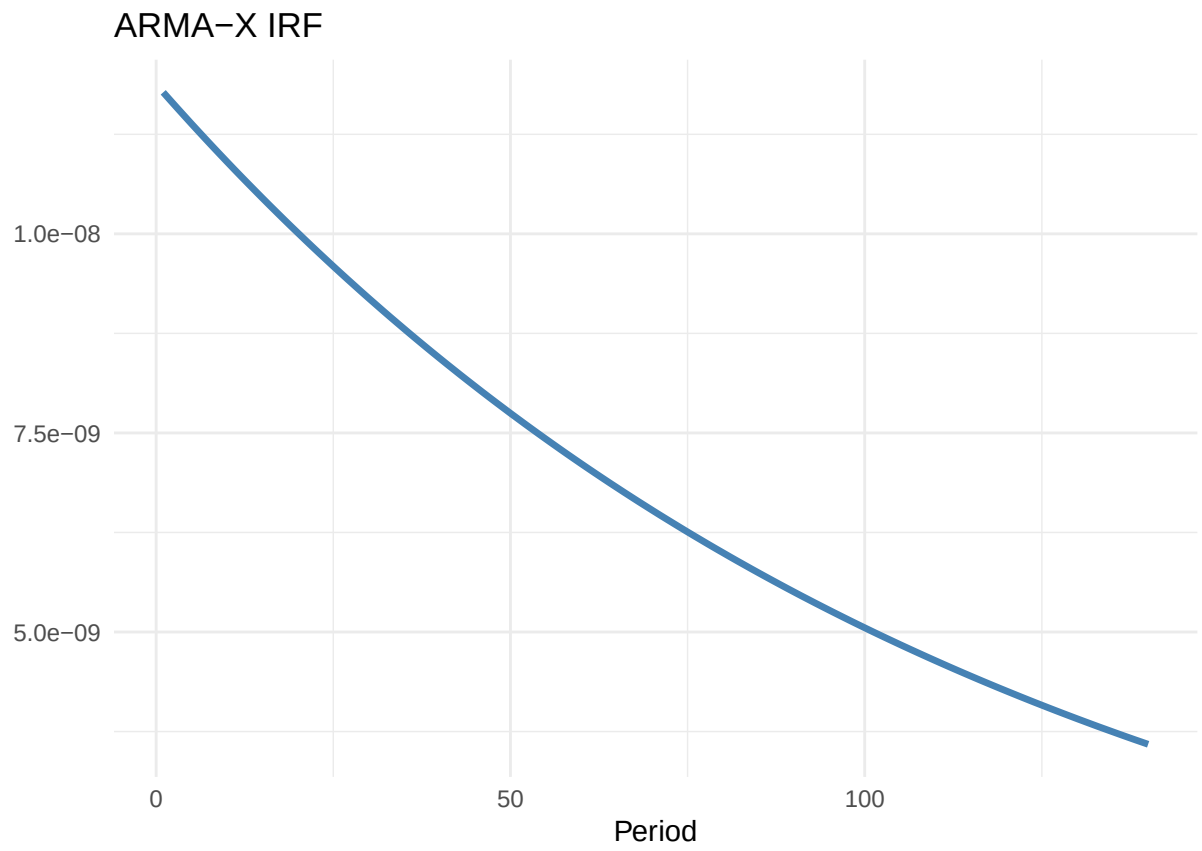
```
#we want to plot the IRFs of these models
nb.periods = 7 * 20

irf.plot(res1,nb.periods)
```




```
irf.plot(res2,nb.periods)
```




```
irf.plot(res3$model,nb.periods)
```



Positive Vibe as Exogenous

```
#auto.armax selects the lowest AIC value given r (exogenous variable lags)
res1 = auto.armax(data$ASHR_vol,xreg=data$prop_positive,nb.lags=2,
                  latex=F,max.p = 6, max.q = 6, max.d=0)
```

========== Model 1
———————- ar1 0.9892 ***(0.0016)***
ma1 -0.7522 (0.0070)
ma2 -0.1708 ***(0.0070)***
intercept 0.0001 (0.0000)
prop_positive_lag_0 0.0001 ***(0.0000)***
prop_positive_lag_1 0.0000
(0.0000)
prop_positive_lag_2 0.0000
(0.0000)
———————————- **AIC -256149.5460**
AICc -256149.5387
BIC -256086.3305
Log Likelihood 128082.7730
Num. obs. 19969
========== * p < 0.001; ** p < 0.01; * p < 0.05

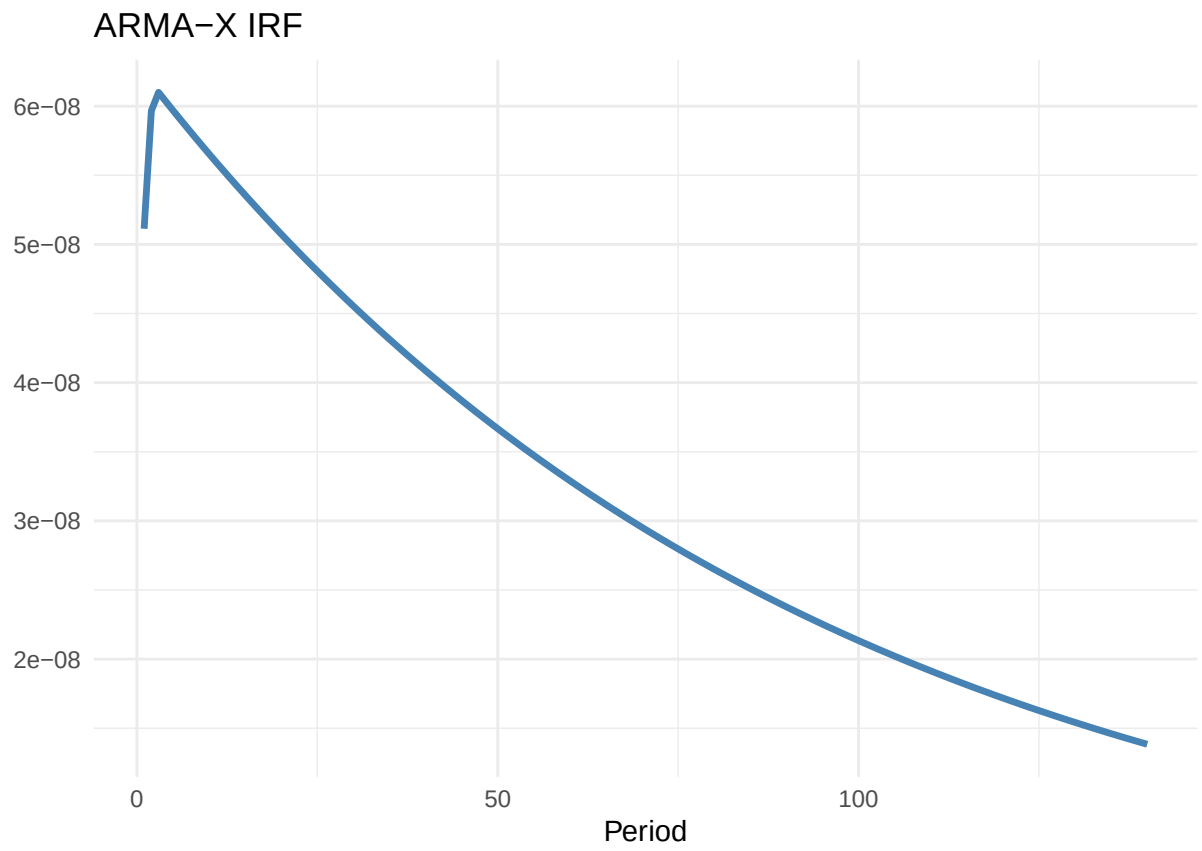
```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$prop_positive, nb.lags=2,
                    p=5, q=0, d=0, latex=F)
```

========== Model 1
----------- ar1 0.2915 ***(0.0070)***
ar2 0.0787 (0.0073)
ar3 0.0505 ***(0.0073)***
ar4 0.0668 (0.0073)
ar5 0.0882 ***(0.0071)***
intercept 0.0001 (0.0000)
prop_positive_lag_0 0.0001 ***(0.0000)***
prop_positive_lag_1 0.0000 (0.0000)
prop_positive_lag_2 0.0000
(0.0000)
----------- AIC -255318.5205
AICc -255318.5095
BIC -255239.5012
Log Likelihood 127669.2603
Num. obs. 19969
========== *** p < 0.001; ** p < 0.01; * p < 0.05

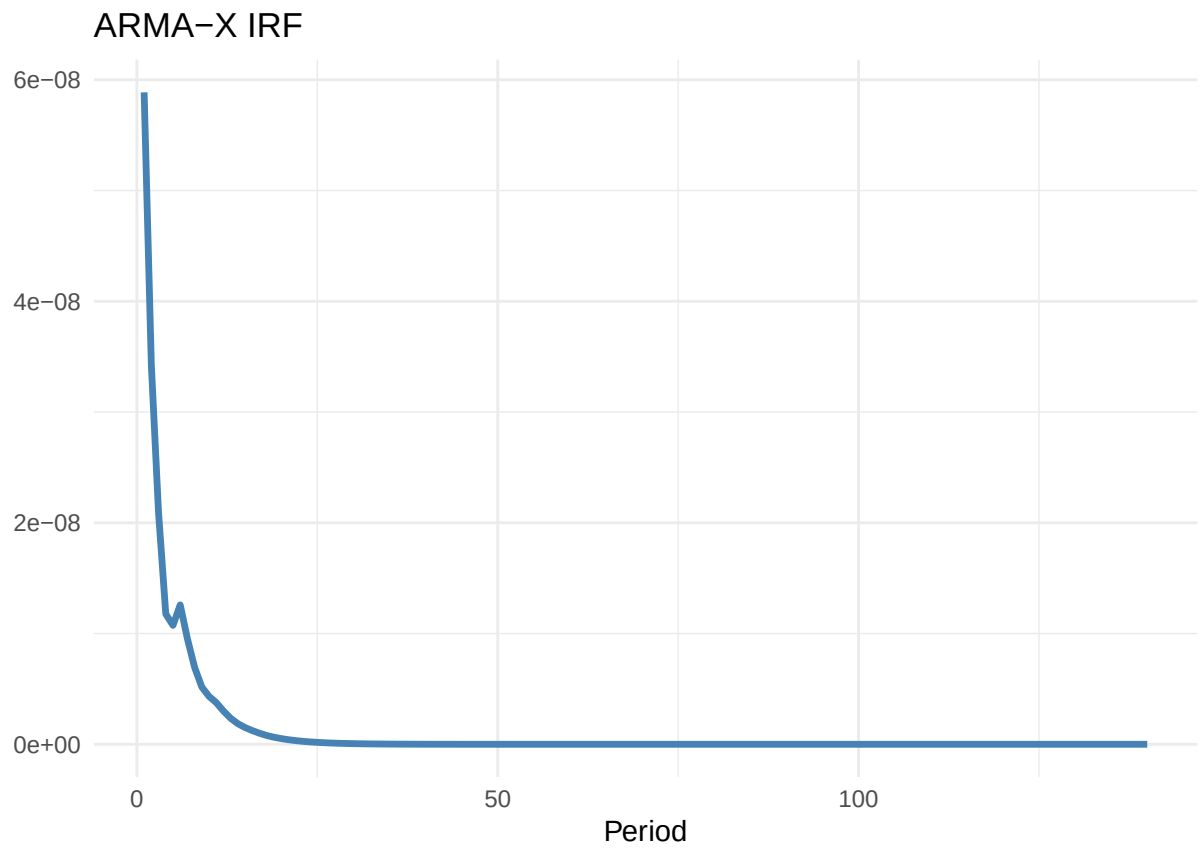
```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$prop_positive,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

========== Model 1
----------- ar1 0.9910 ***(0.0014)***
ma1 -0.7463 (0.0072)
ma2 -0.1410 ***(0.0087)***
ma3 -0.0438 (0.0073)
intercept 0.0001 ***(0.0000)***
prop_positive_lag_0 0.0001 (0.0000)
----------- AIC -256208.9107
AICc -256208.9050
BIC -256153.5964
Log Likelihood 128111.4553
Num. obs. 19971
========== *** p < 0.001; ** p < 0.01; * p < 0.05

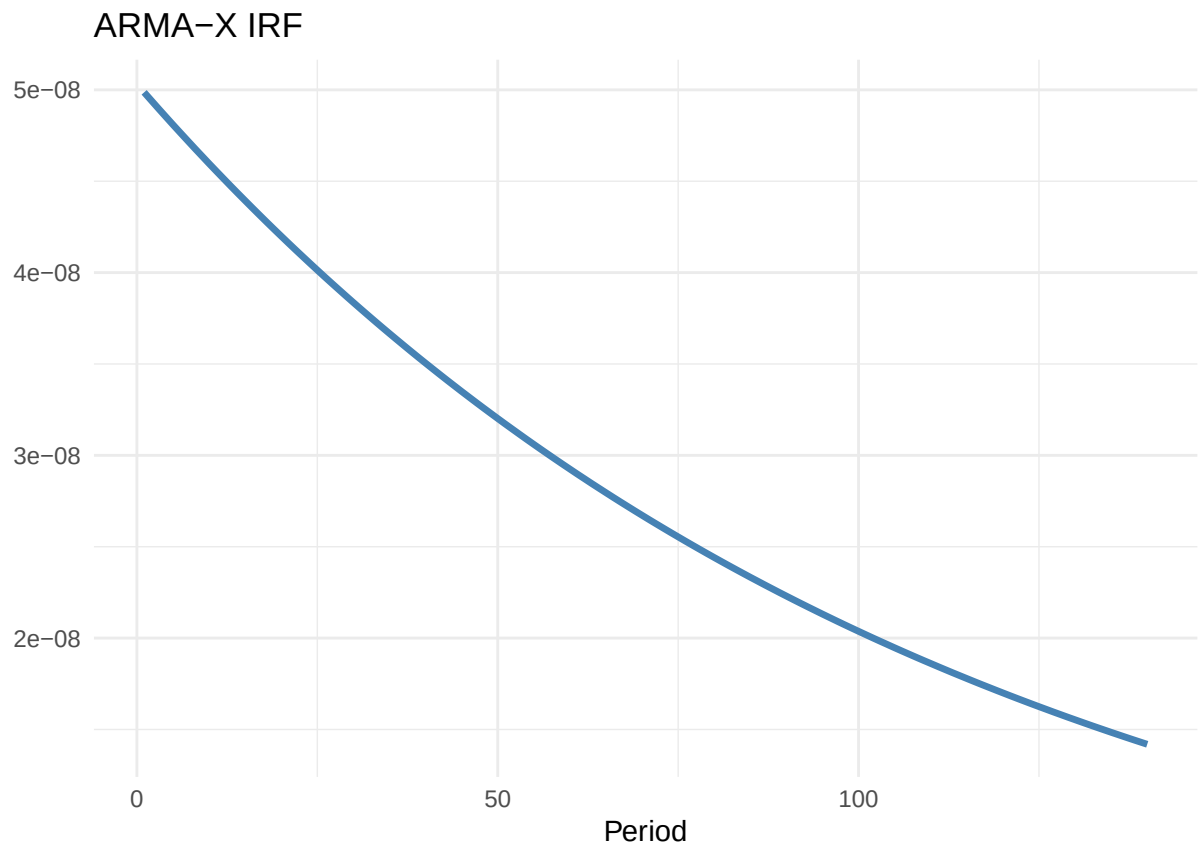
```
#we want to plot the IRFs of these models
nb.periods = 7 * 20

irf.plot(res1,nb.periods)
```




```
irf.plot(res2,nb.periods)
```




```
irf.plot(res3$model,nb.periods)
```



Negative Vibe as Exogenous

```
#auto.armax selects the lowest AIC value given r (exogenous variable lags)
res1 = auto.armax(data$ASHR_vol,xreg=data$prop_negative,nb.lags=2,
                  latex=F,max.p = 6, max.q = 6, max.d=0)
```

========== Model 1
———————- ar1 0.9901 ***(0.0015)***
ma1 -0.7551 (0.0070)
ma2 -0.1707 ***(0.0069)***
intercept 0.0001 (0.0000)
prop_negative_lag_0 0.0001 ***(0.0000)***
prop_negative_lag_1 0.0000
(0.0000)
prop_negative_lag_2 0.0000
(0.0000)
———————————- ***AIC -256009.0491***
AICc -256009.0419
BIC -255945.8336
Log Likelihood 128012.5245
Num. obs. 19969
========== p < 0.001; ** p < 0.01; * p < 0.05

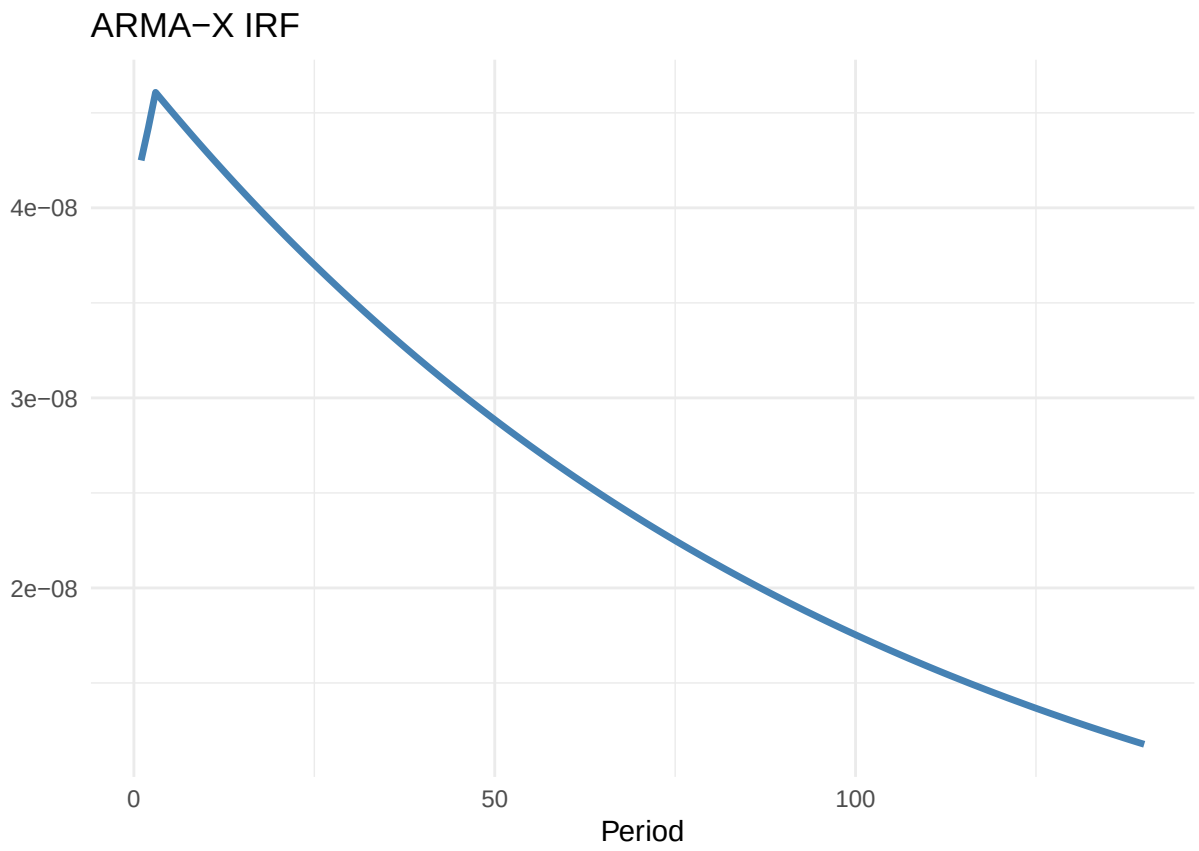
```
#armax enables a custom armax specification with p,q,r
res2 = armax(data$ASHR_vol, xreg=data$prop_negative, nb.lags=2,
                    p=5, q=0, d=0, latex=F)
```

========== Model 1
———————- ar1 0.2925 ***(0.0070)***
ar2 0.0804 (0.0073)
ar3 0.0506 ***(0.0074)***
ar4 0.0650 (0.0073)
ar5 0.0900 ***(0.0071)***
intercept 0.0001 (0.0000)
prop_negative_lag_0 0.0001 ***(0.0000)***
prop_negative_lag_1 0.0000
(0.0000)
prop_negative_lag_2 -0.0000
(0.0000)
———————————————- ***AIC -255118.7457***
AICc -255118.7346
BIC -255039.7263
Log Likelihood 127569.3728
Num. obs. 19969
========== $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

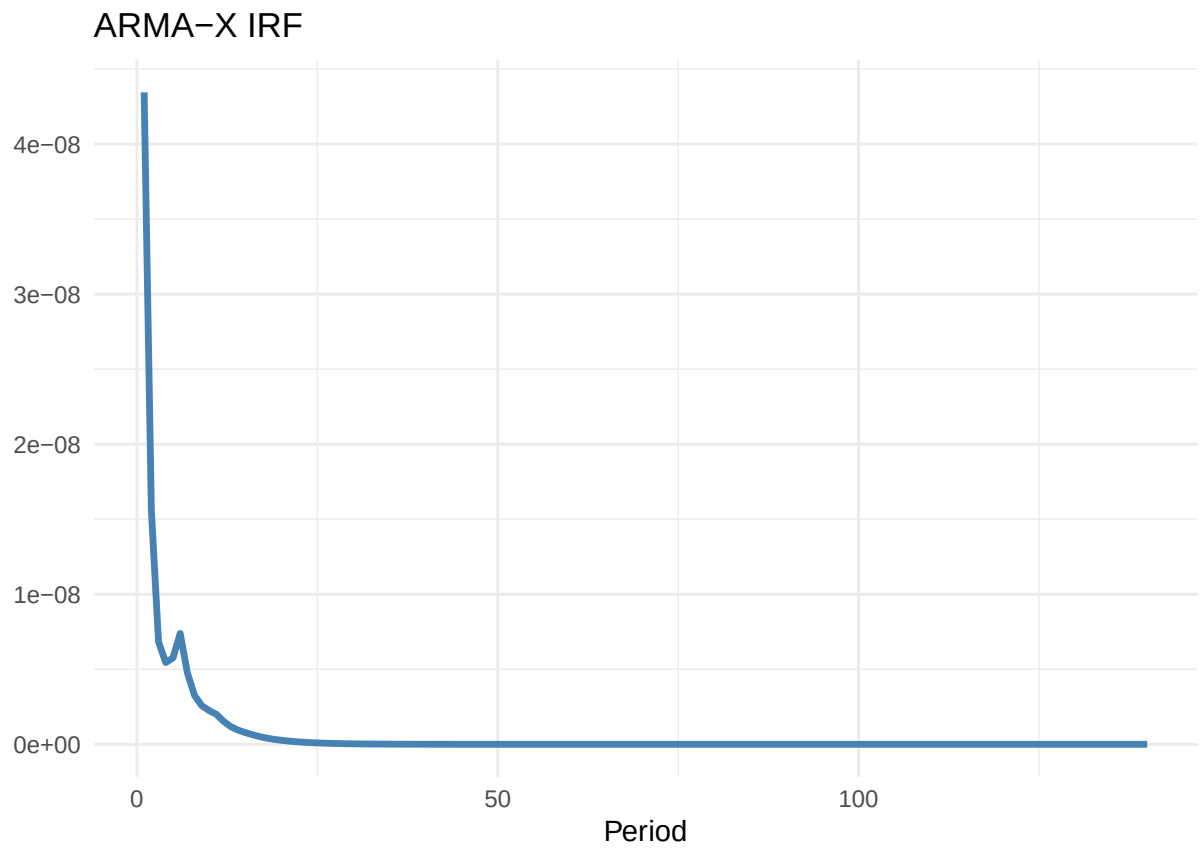
```
#auto.armax.r selects the lowest AIC checking all 3 p,q,r values
res3 = auto.armax.r(data$ASHR_vol, x=data$prop_negative,
                max_p = 3, max_q = 3, max_r = 3, criterion = "AIC", latex=F)
```

========== Model 1
———————- ar1 0.9915 ***(0.0013)***
ma1 -0.7488 (0.0072)
ma2 -0.1400 ***(0.0087)***
ma3 -0.0440 (0.0073)
intercept 0.0001 ***(0.0000)***
prop_negative_lag_0 0.0001 (0.0000)
———————- AIC -256073.7682
AICc -256073.7625
BIC -256018.4539
Log Likelihood 128043.8841
Num. obs. 19971
========== *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

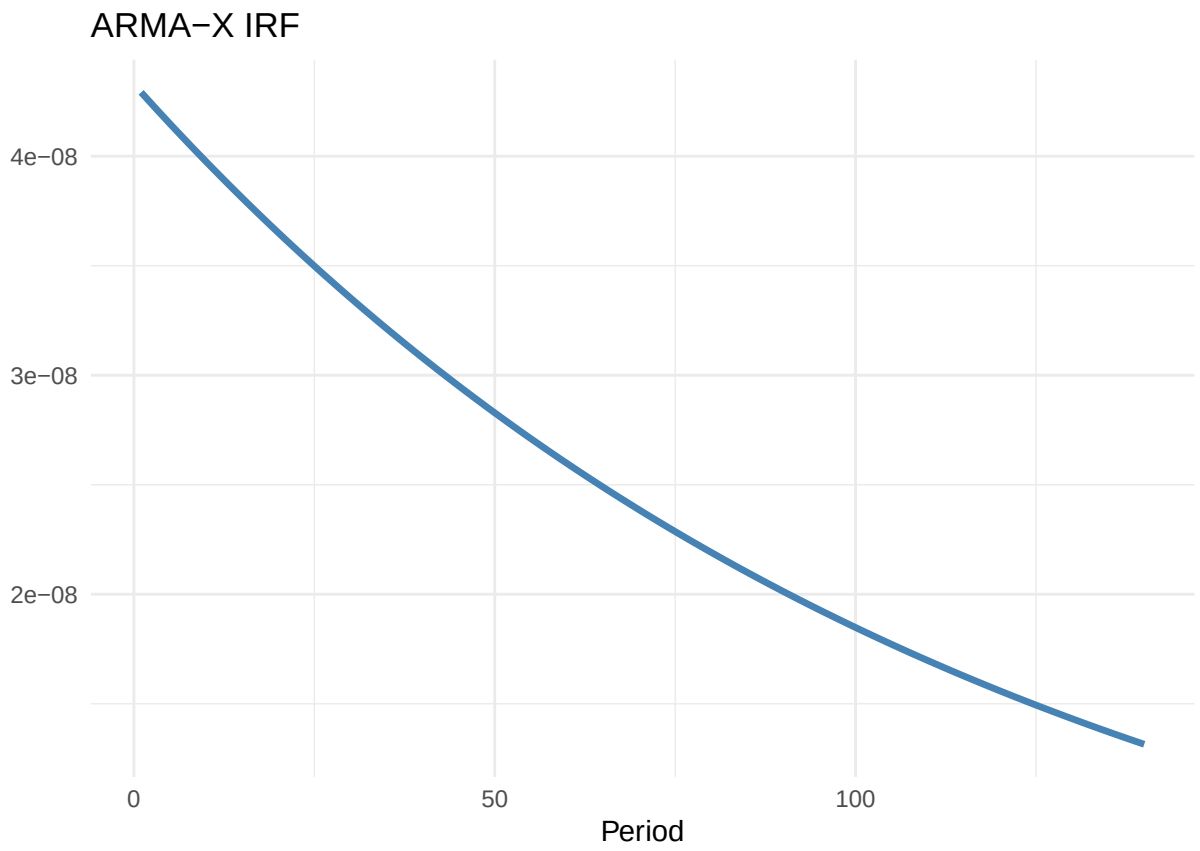
```
#we want to plot the IRFs of these models
nb.periods = 7 * 20

irf.plot(res1,nb.periods)
```




```
irf.plot(res2,nb.periods)
```




```
irf.plot(res3$model,nb.periods)
```


ARMA−X IRF
4e−08
3e−08
2e−08
0
50
100
Period