

ASHR ARMA-X Analysis

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	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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 1: ARMAX Model Results

CSI 300 China Univariate ARMA-X Models

Here we try various specifications with multiple variables to see what comes out.

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=T, max.p = 6, max.q = 6, max.d=0)
```

```
#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=T)
```

```
#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=T)
```

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

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

	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

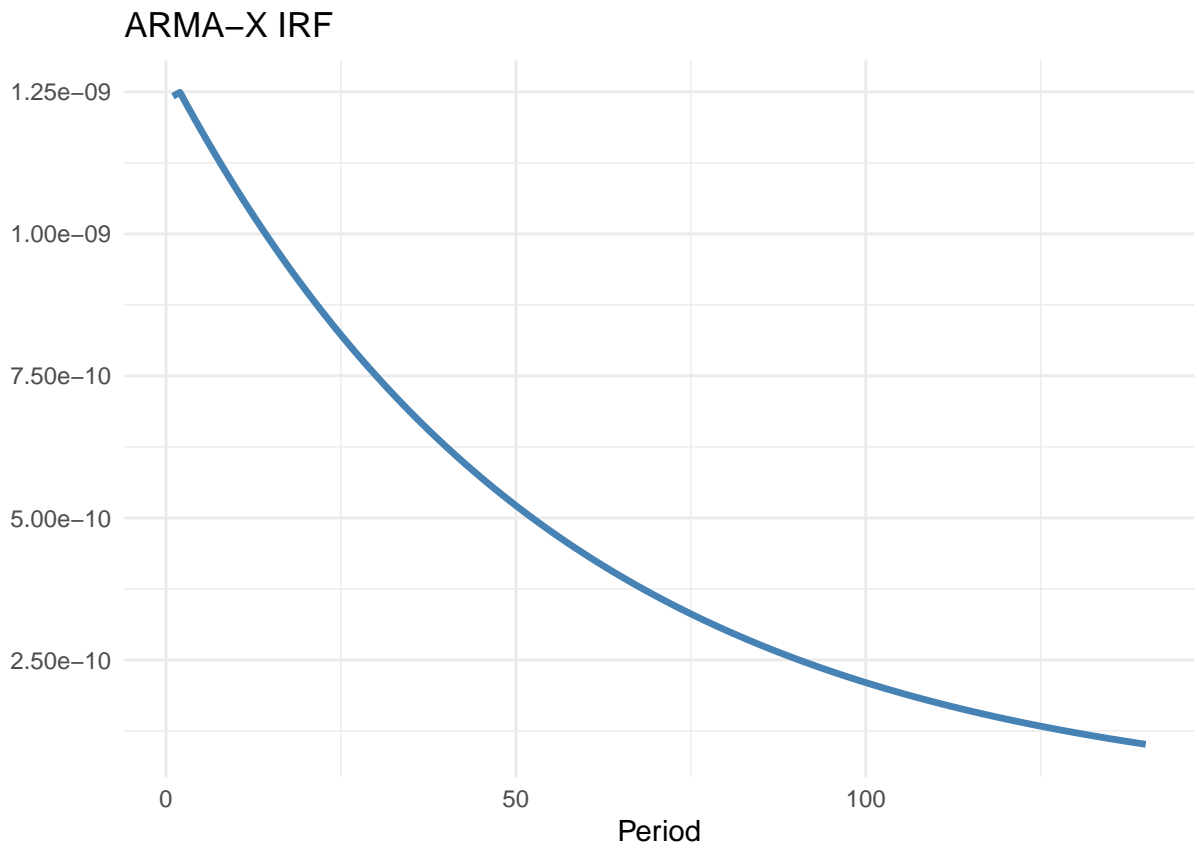
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 2: ARMAX Model Results

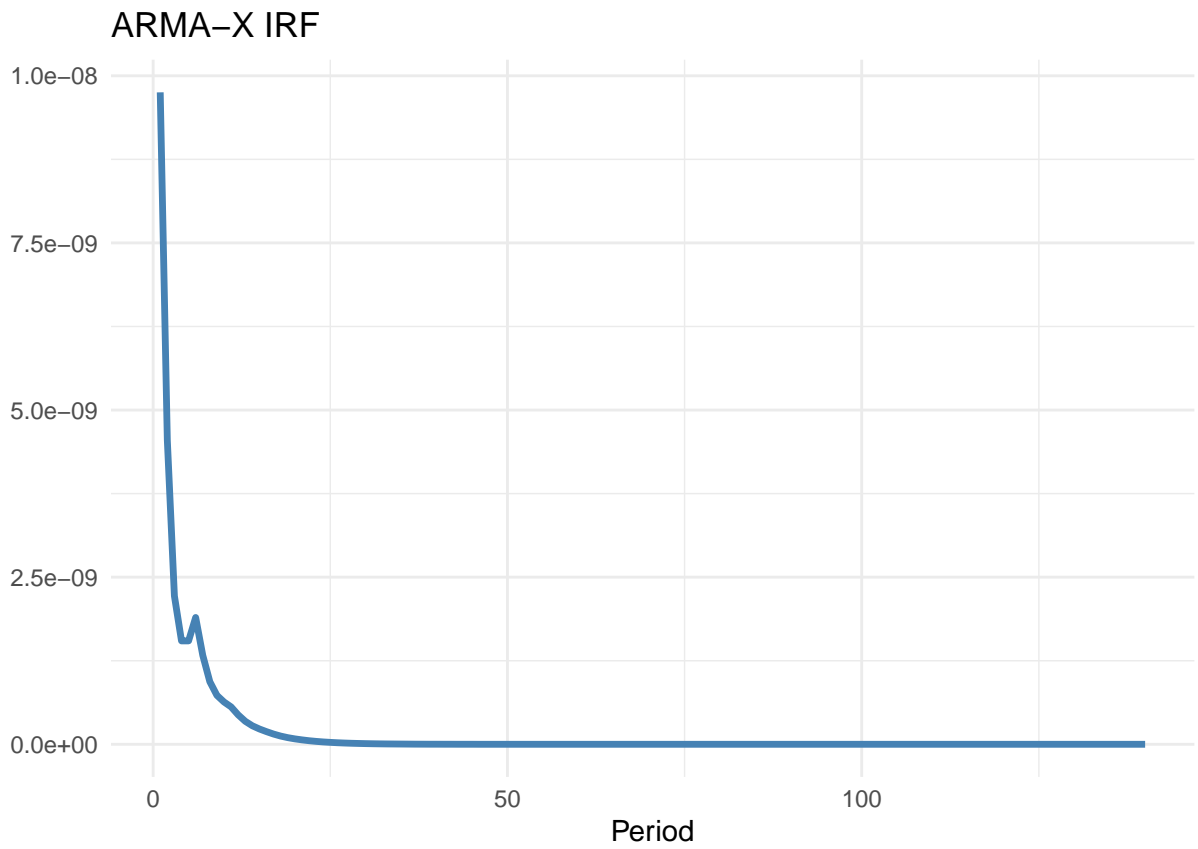
	Model 1
ar1	0.9910*** (0.0014)
ma1	−0.7445*** (0.0072)
ma2	−0.1387*** (0.0088)
ma3	−0.0470*** (0.0072)
intercept	0.0001
dummy_lag_0	0.0000
AIC	−256599.7623
AICc	−256599.7567
BIC	−256544.4480
Log Likelihood	128306.8811
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 3: ARMAX selected by AIC

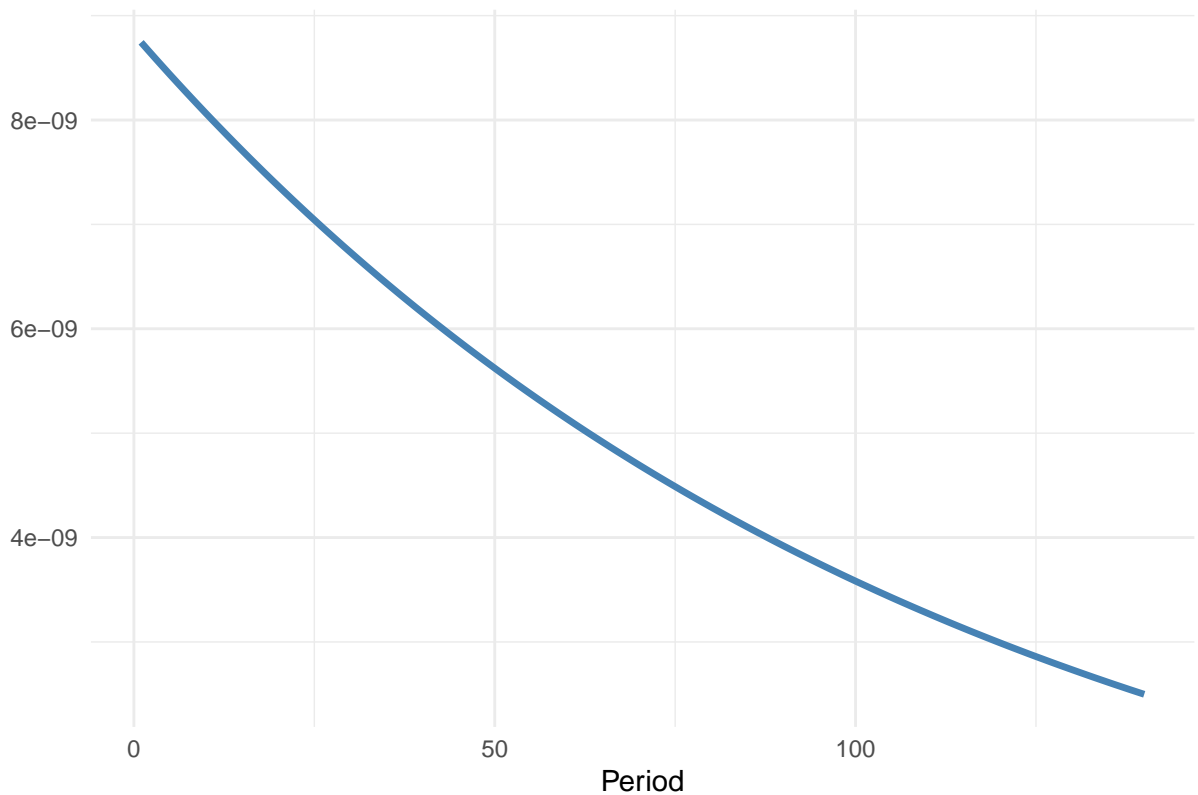


```
irf.plot(res2,nb.periods)
```



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

ARMA-X IRF



Tweet Count as Exogenous

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

```
#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=T)
```

```
#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=T)
```

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

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

	Model 1
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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 4: ARMAX Model Results

	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

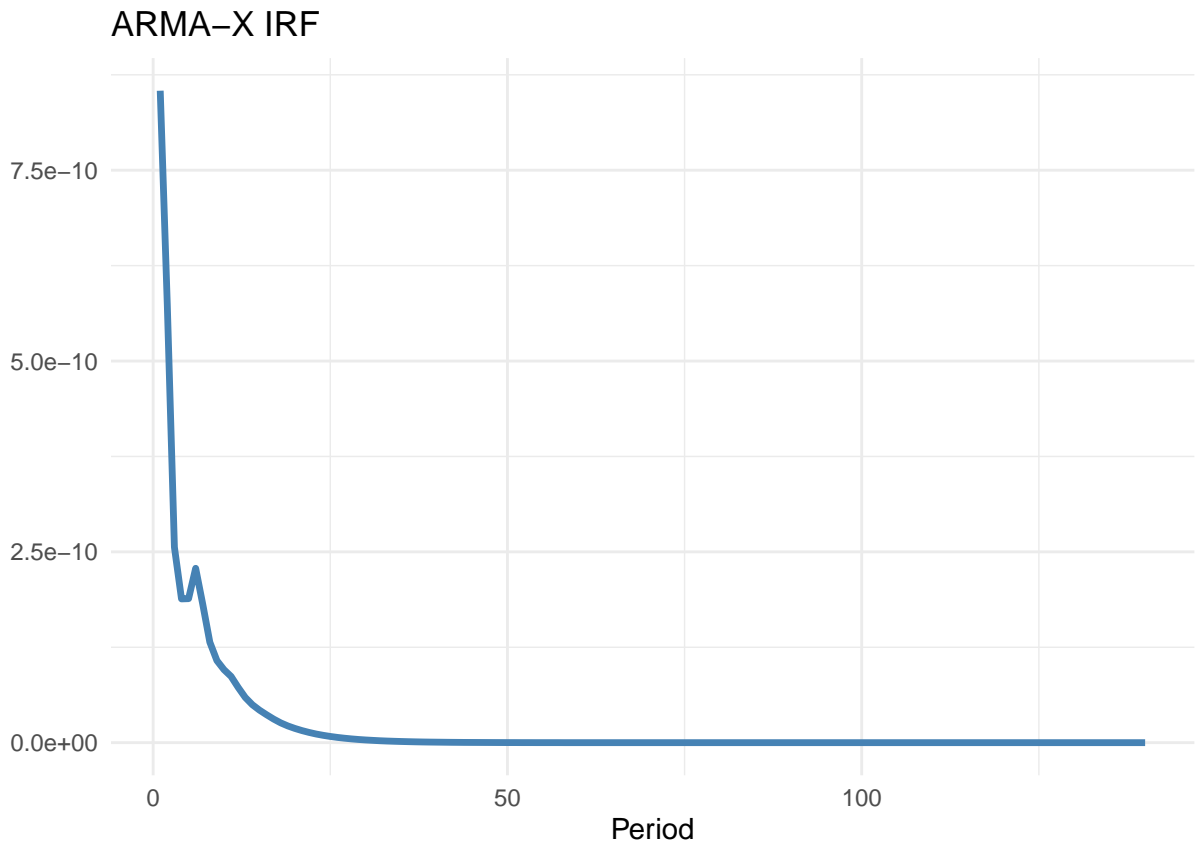
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 5: ARMAX Model Results

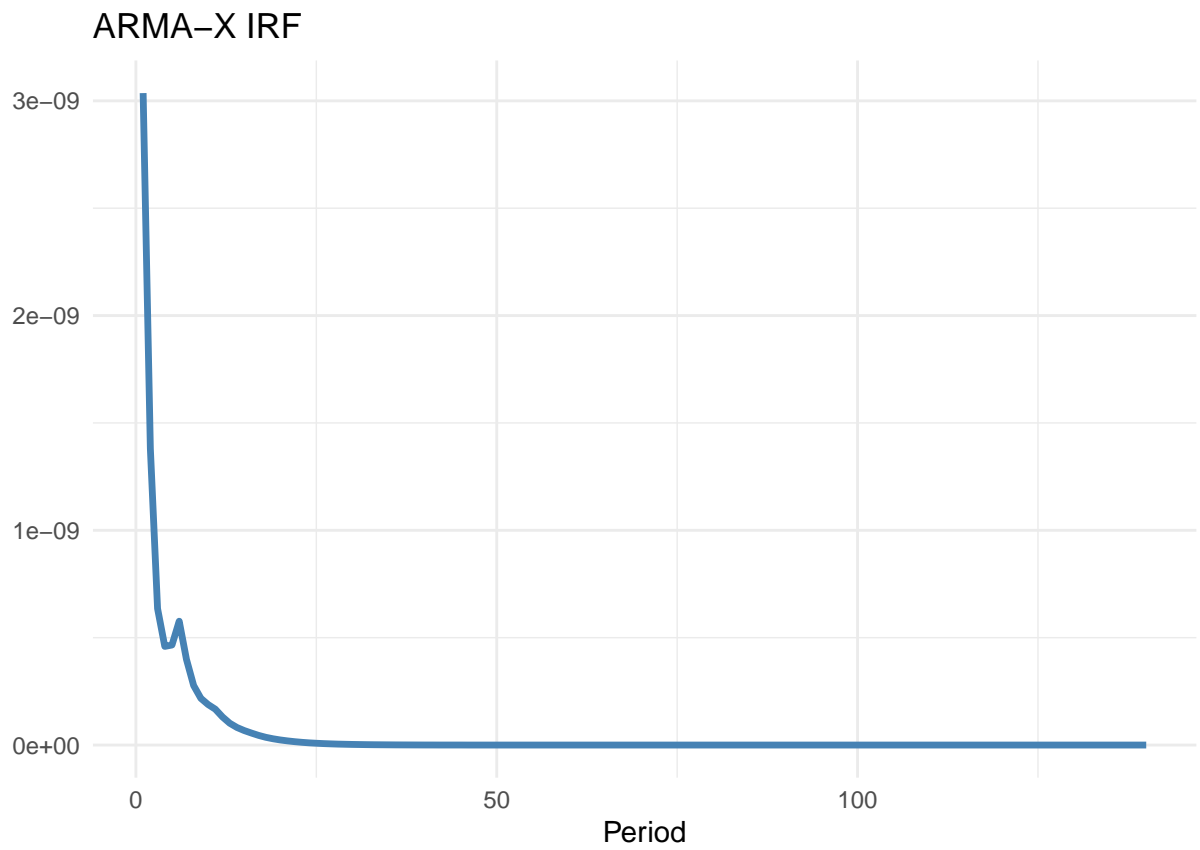
	Model 1
ar1	0.9909*** (0.0014)
ma1	−0.7439*** (0.0072)
ma2	−0.1410*** (0.0087)
ma3	−0.0452*** (0.0072)
intercept	0.0001
N_lag_0	0.0000
AIC	−256508.5319
AICc	−256508.5263
BIC	−256453.2176
Log Likelihood	128261.2659
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

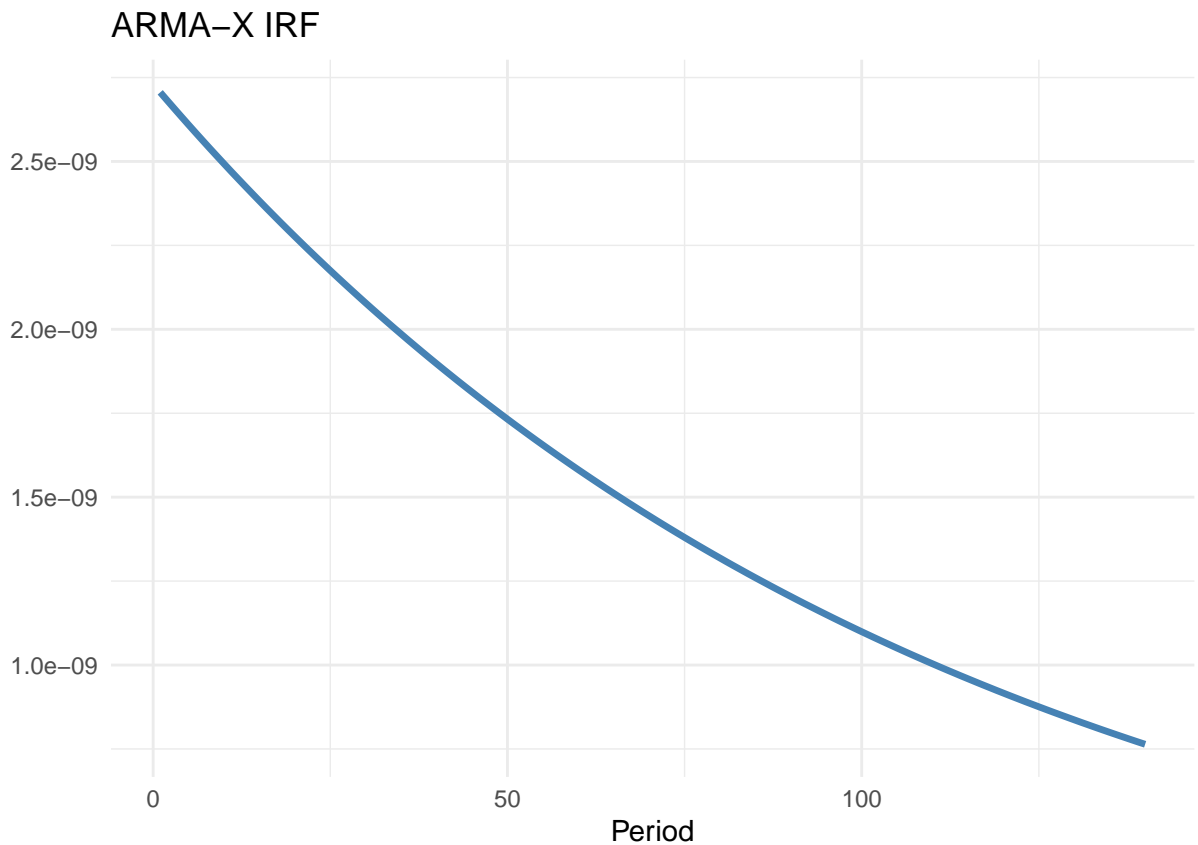
Table 6: ARMAX selected by AIC




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



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



Tariff as Exogenous

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

```
#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=T)
```

```
#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=T)
```

```
#we want to plot the IRFs of these models  
nb.periods = 7 * 20  
  
irf.plot(res1, nb.periods)
```

	Model 1
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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 7: ARMAX Model Results

	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

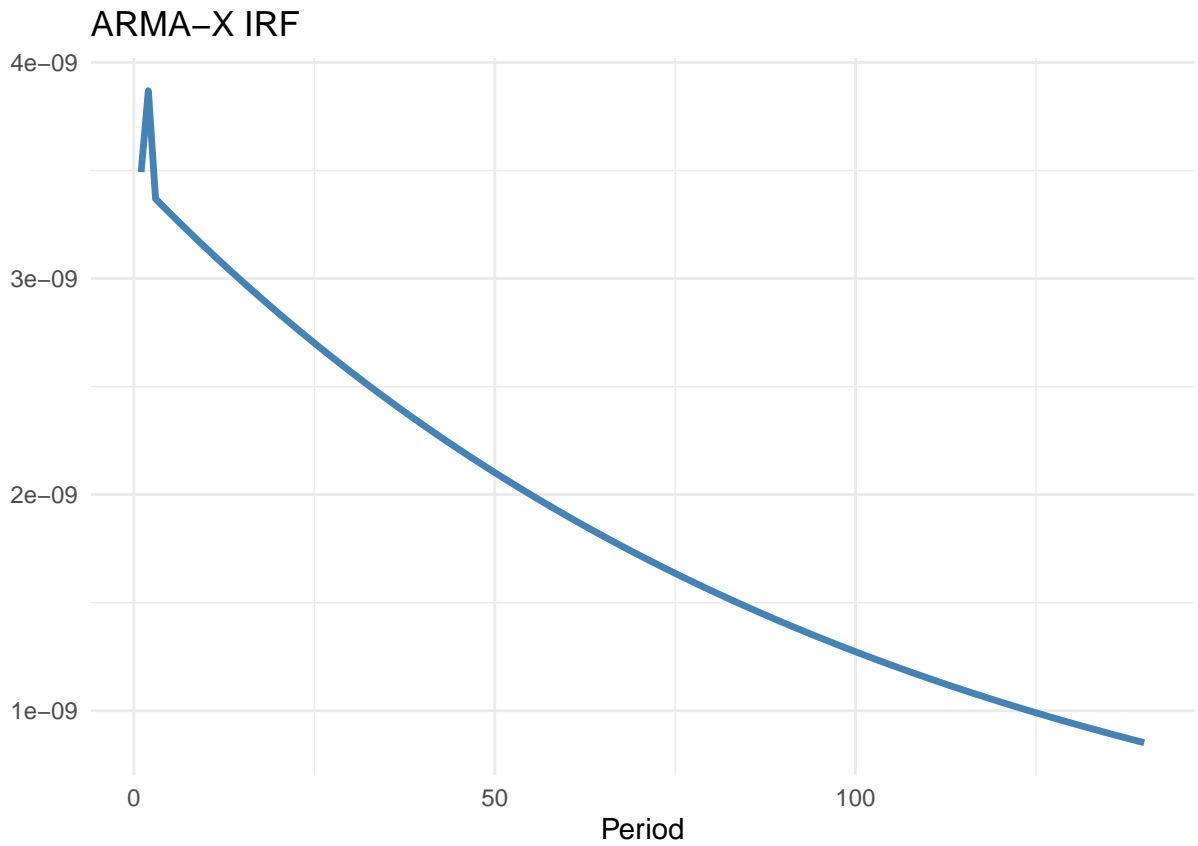
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 8: ARMAX Model Results

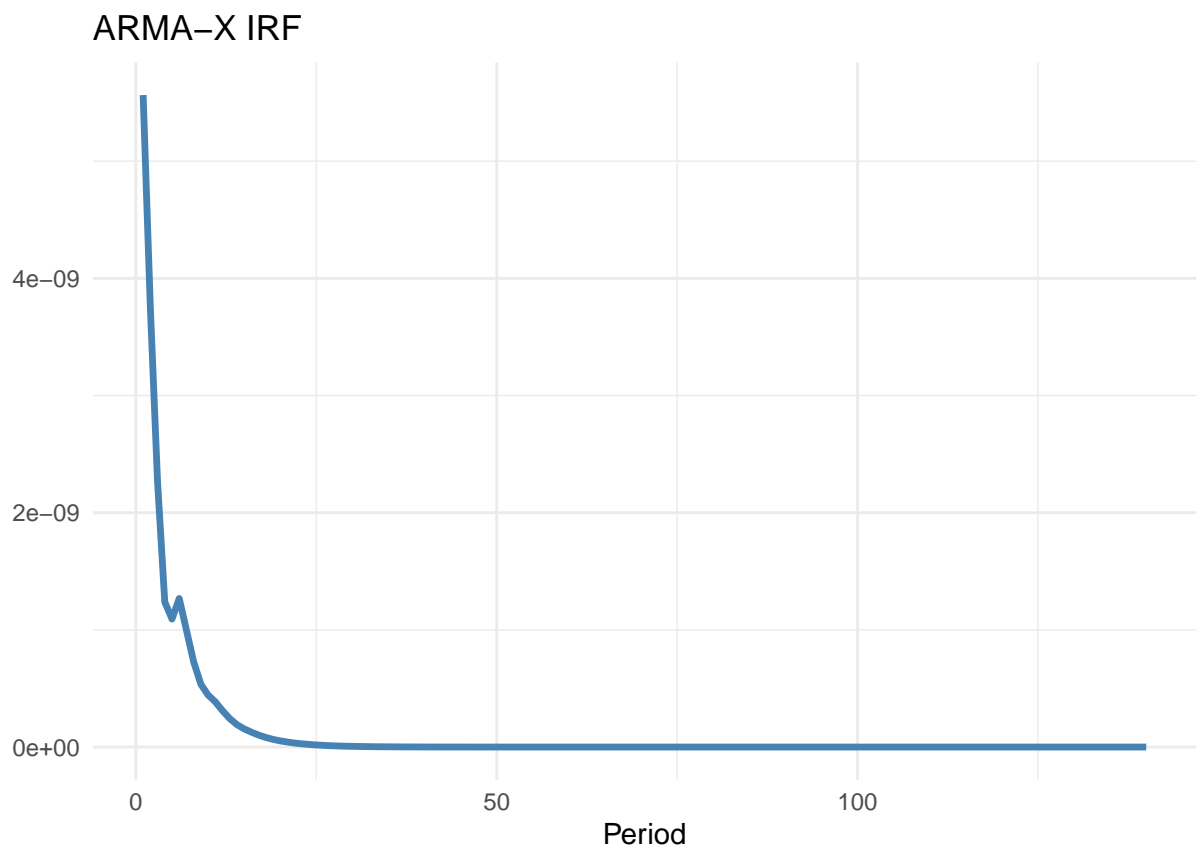
	Model 1
ar1	0.9913*** (0.0013)
ma1	-0.7508*** (0.0072)
ma2	-0.1387*** (0.0088)
ma3	-0.0429*** (0.0073)
intercept	0.0002*** (0.0000)
tariff_lag_0	0.0000 (0.0000)
AIC	-255990.0623
AICc	-255990.0567
BIC	-255934.7481
Log Likelihood	128002.0312
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

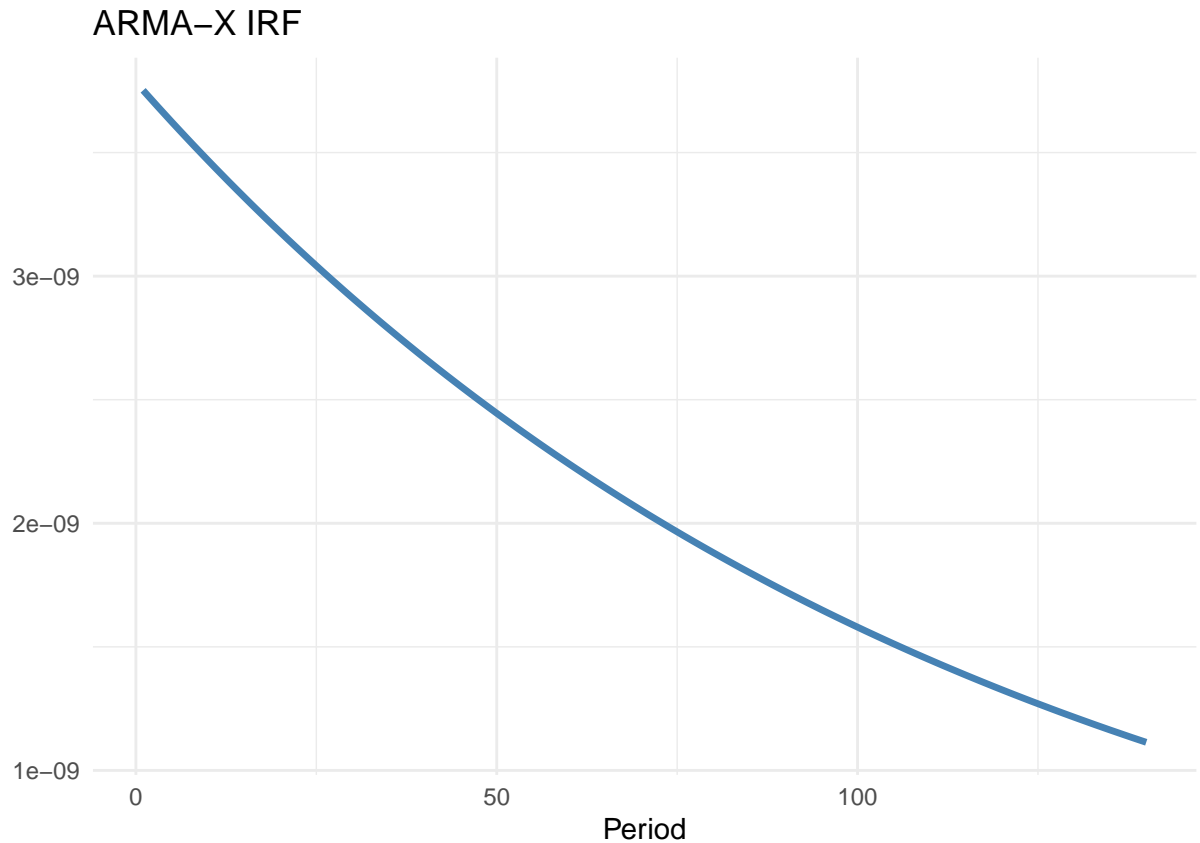
Table 9: ARMAX selected by AIC



```
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=T, max.p = 6, max.q = 6, max.d=0)
```

```
#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=T)
```

```
#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=T)
```

```
#we want to plot the IRFs of these models  
nb.periods = 7 * 20  
  
irf.plot(res1, nb.periods)
```

	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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 10: ARMAX Model Results

	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

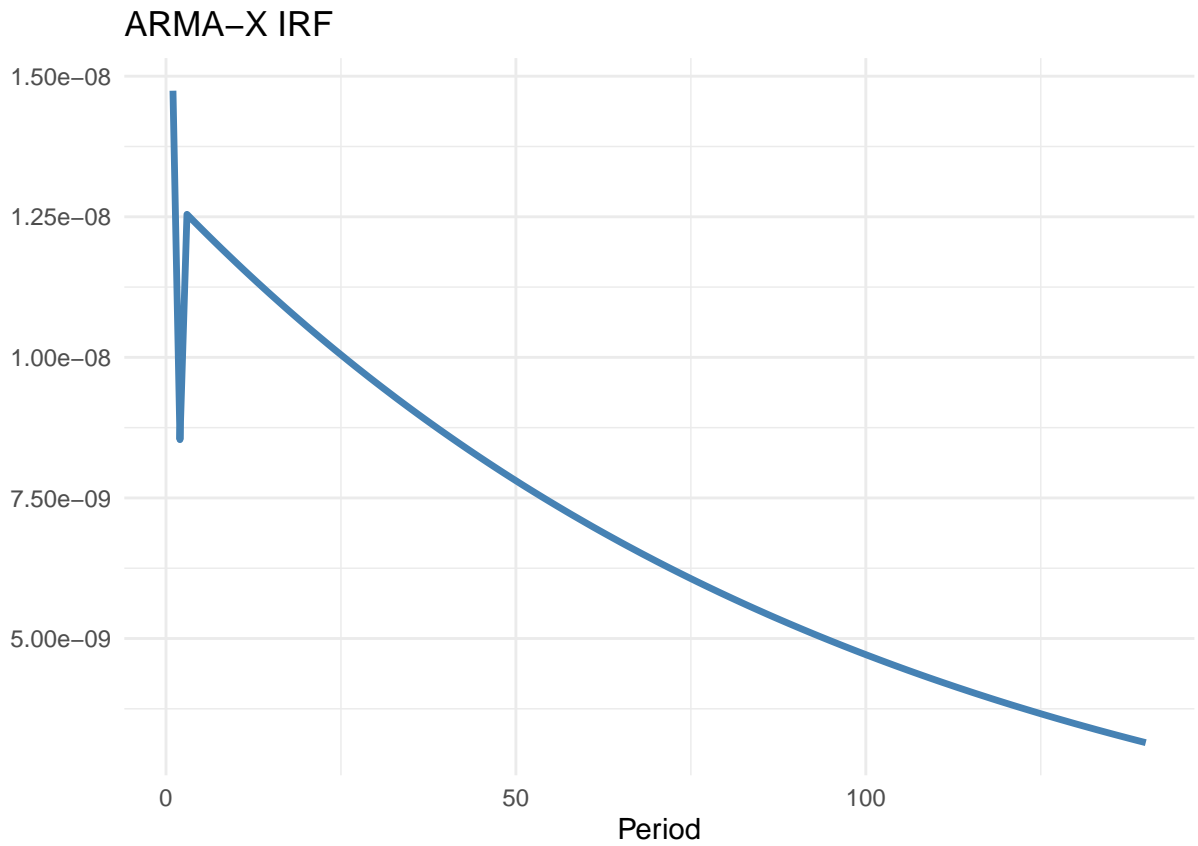
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 11: ARMAX Model Results

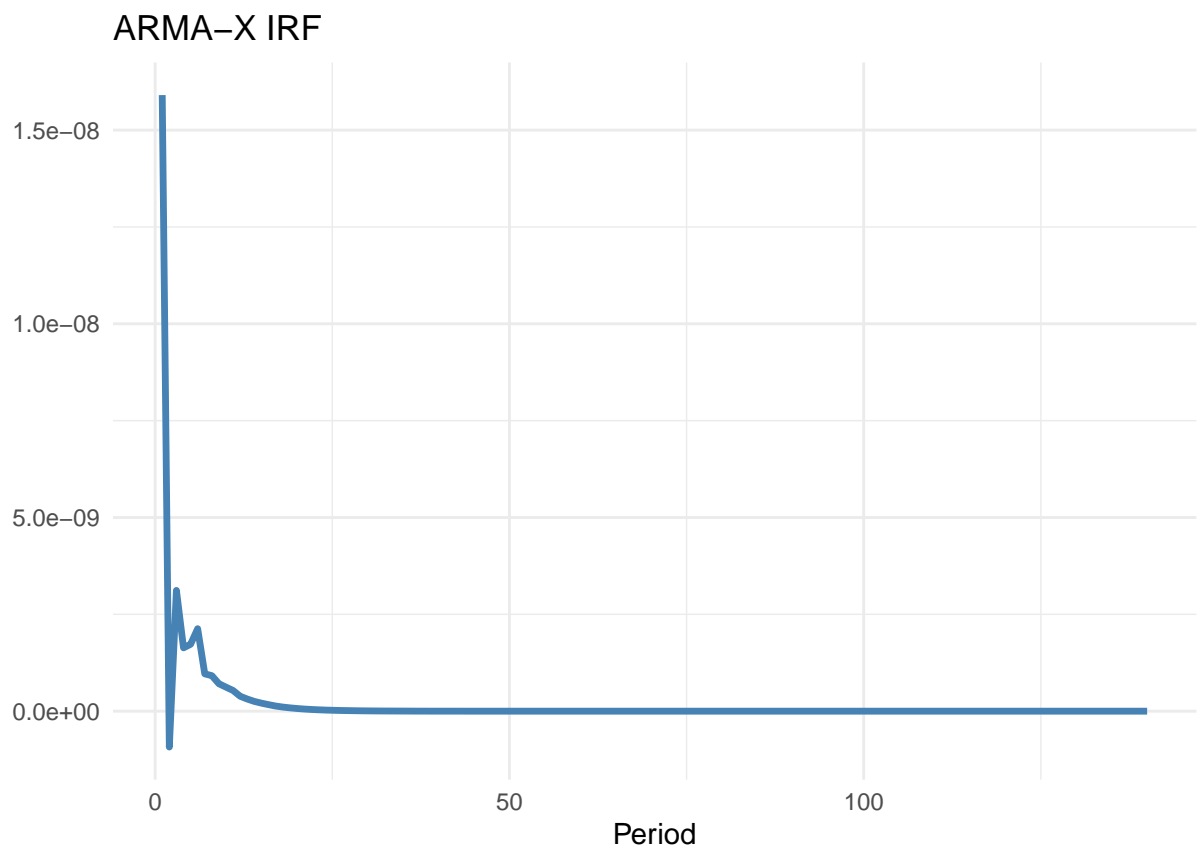
	Model 1
ar1	0.9914*** (0.0013)
ma1	-0.7494*** (0.0072)
ma2	-0.1406*** (0.0087)
ma3	-0.0427*** (0.0073)
intercept	0.0002*** (0.0000)
trade_lag_0	0.0000** (0.0000)
AIC	-256004.3080
AICc	-256004.3024
BIC	-255948.9937
Log Likelihood	128009.1540
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

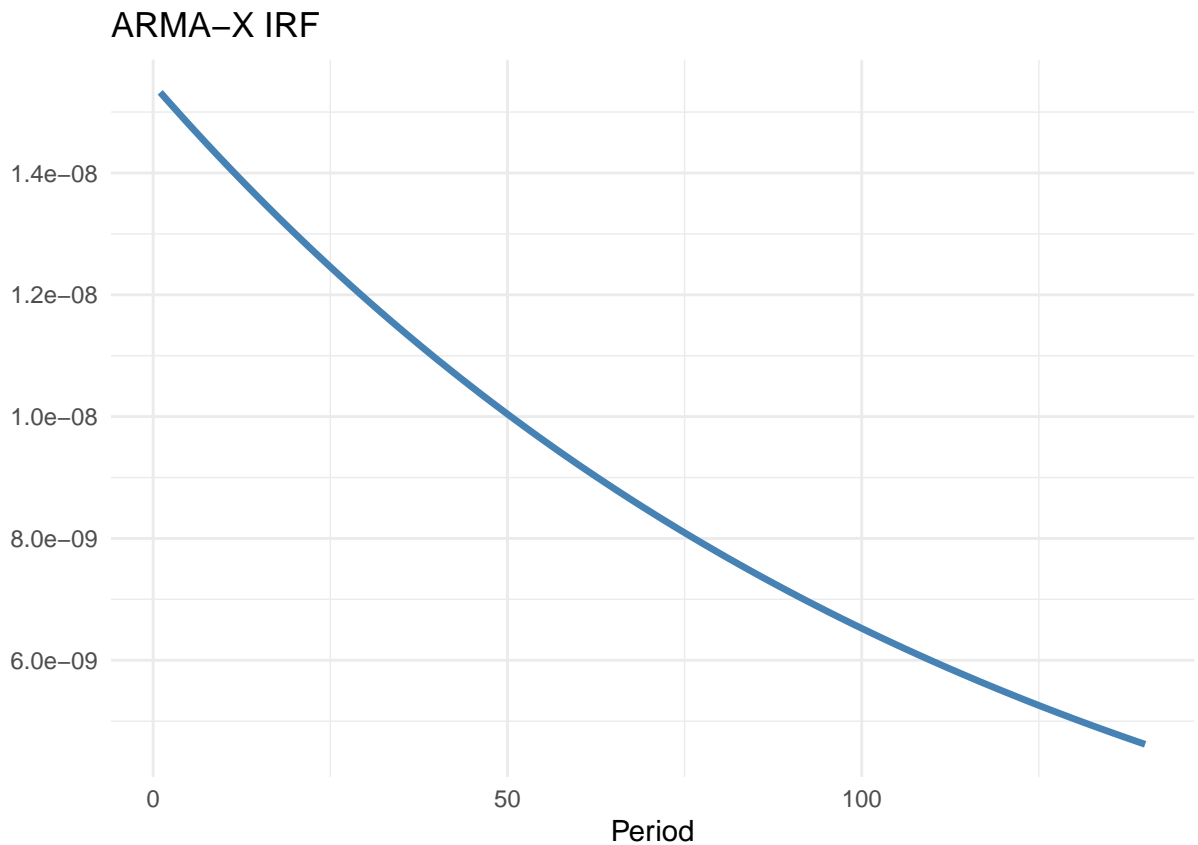
Table 12: ARMAX selected by AIC




```
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=T, max.p = 6, max.q = 6, max.d=0)
```

```
#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=T)
```

```
#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=T)
```

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

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

	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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 13: ARMAX Model Results

	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

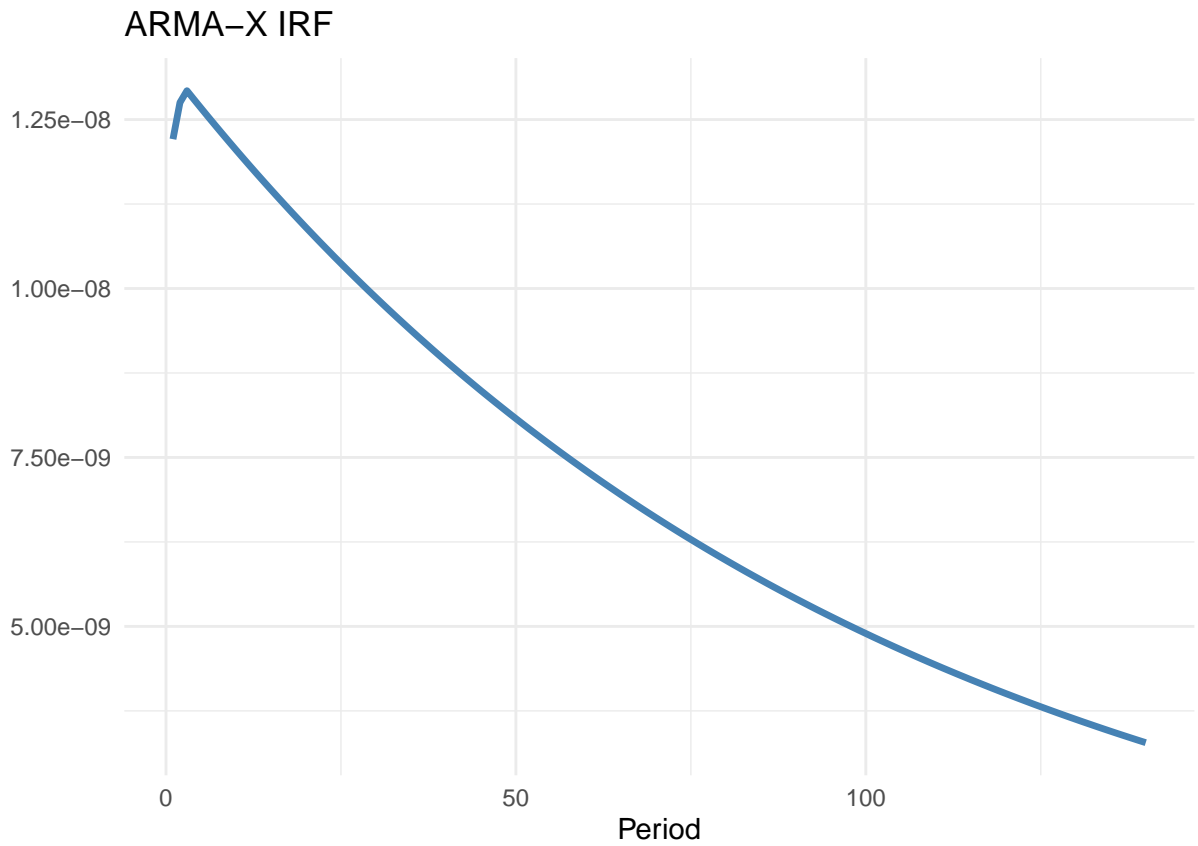
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 14: ARMAX Model Results

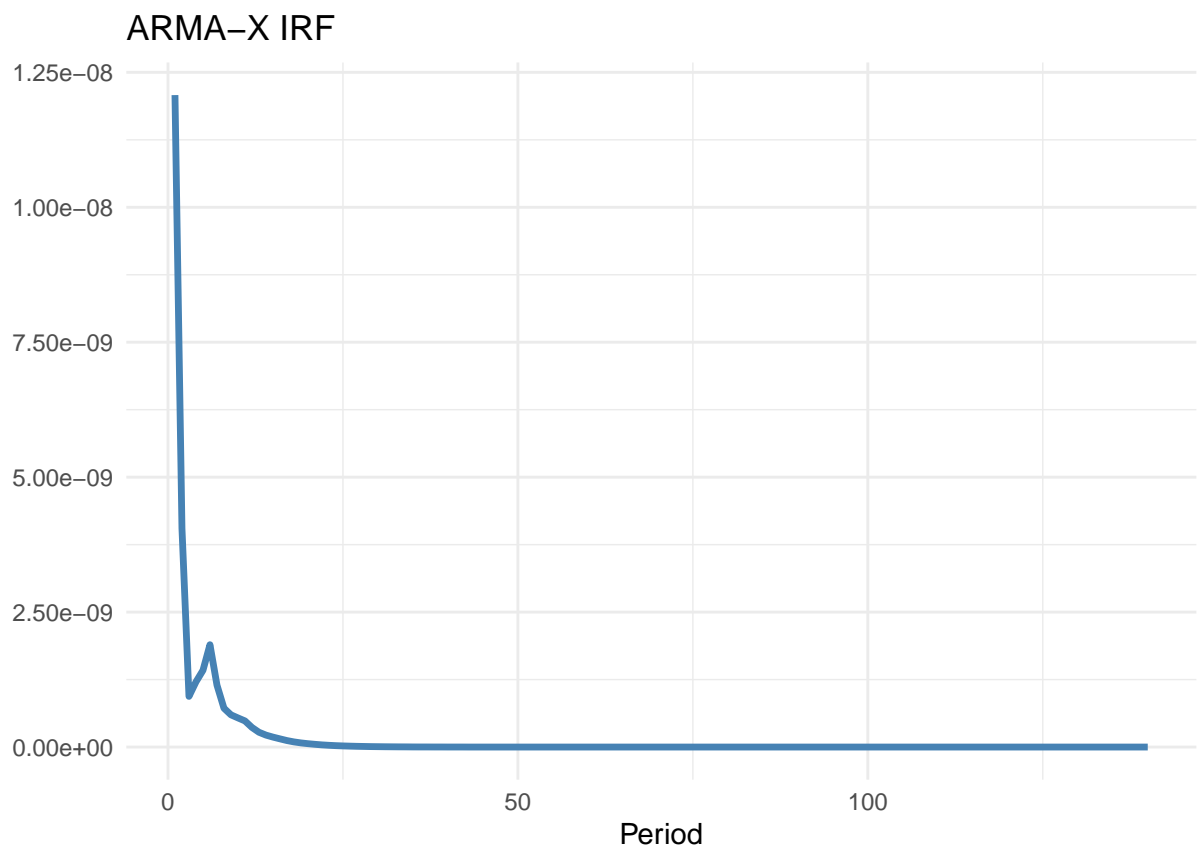
	Model 1
ar1	0.9915*** (0.0013)
ma1	-0.7509*** (0.0072)
ma2	-0.1383*** (0.0088)
ma3	-0.0434*** (0.0073)
intercept	0.0002*** (0.0000)
china_lag_0	0.0000** (0.0000)
AIC	-256010.2273
AICc	-256010.2217
BIC	-255954.9130
Log Likelihood	128012.1137
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

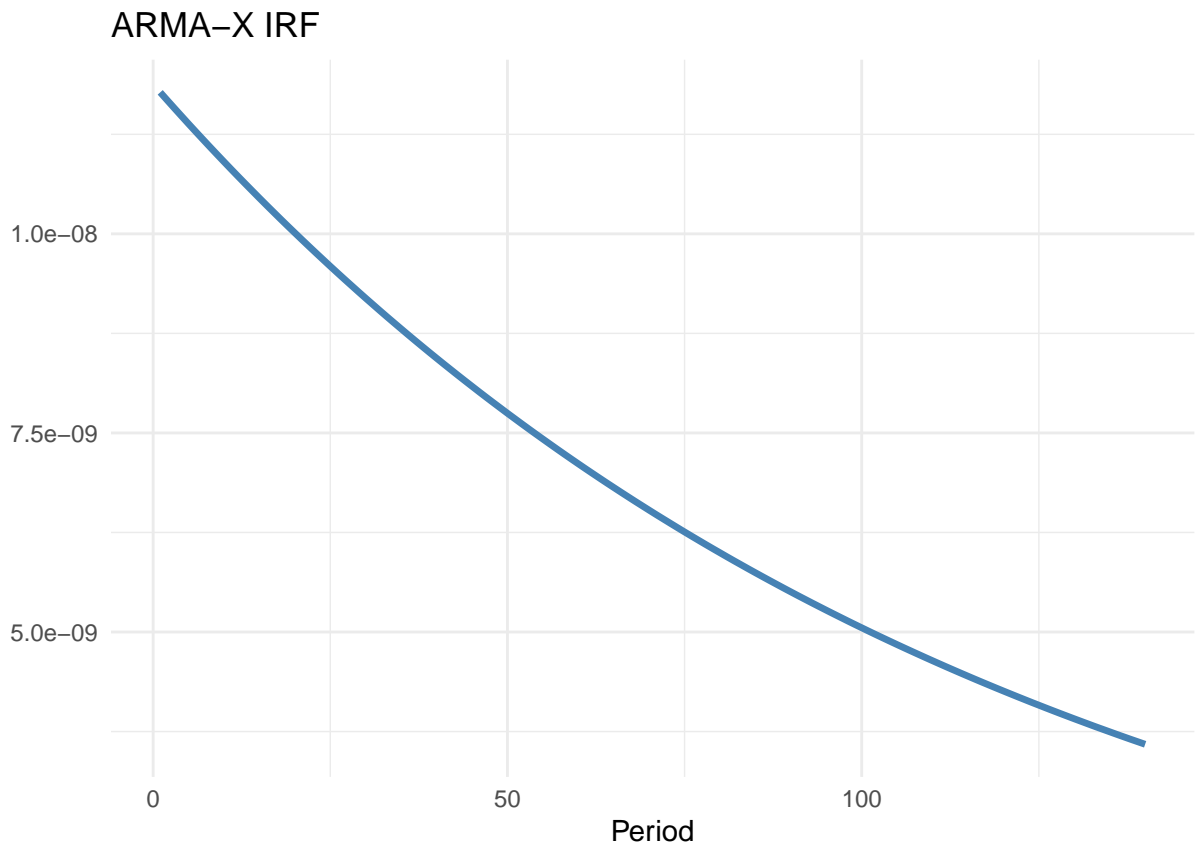
Table 15: ARMAX selected by AIC



```
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=T, max.p = 6, max.q = 6, max.d=0)
```

```
#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=T)
```

```
#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=T)
```

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

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

	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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 16: ARMAX Model Results

	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

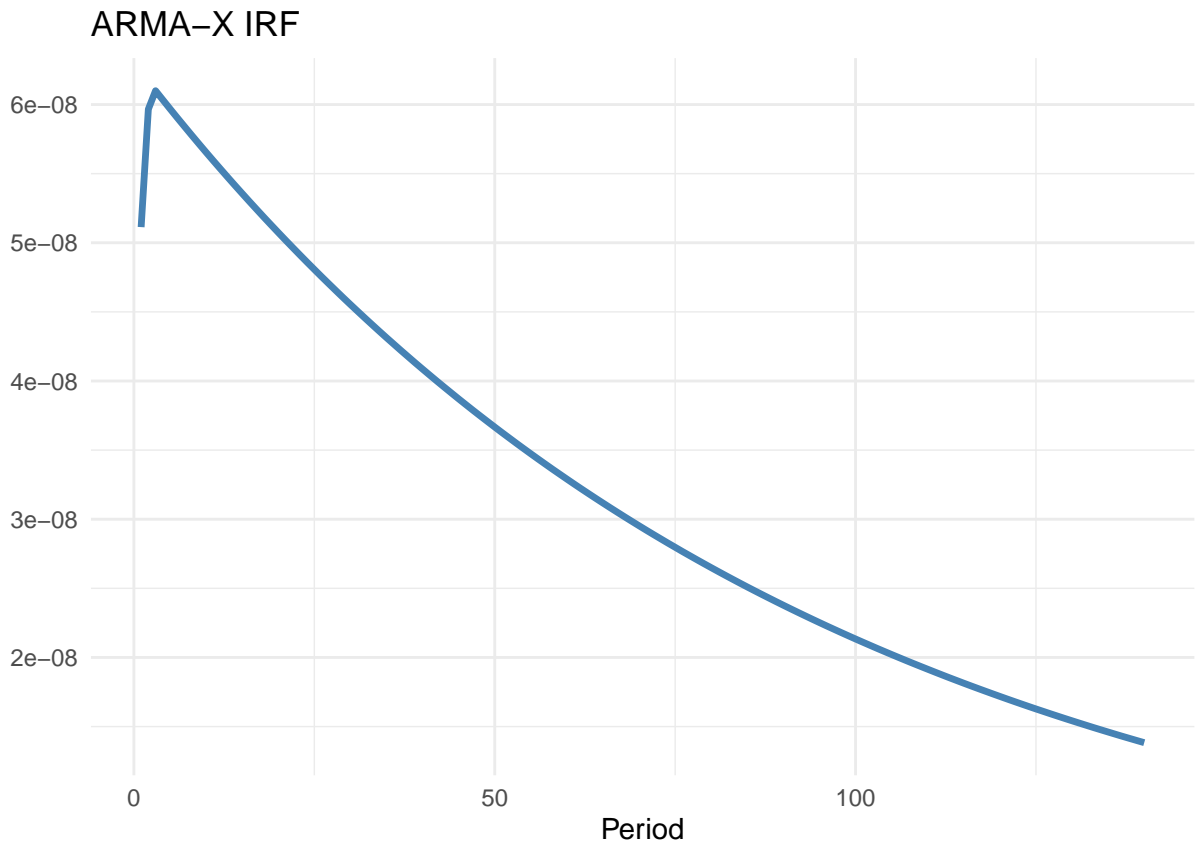
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 17: ARMAX Model Results

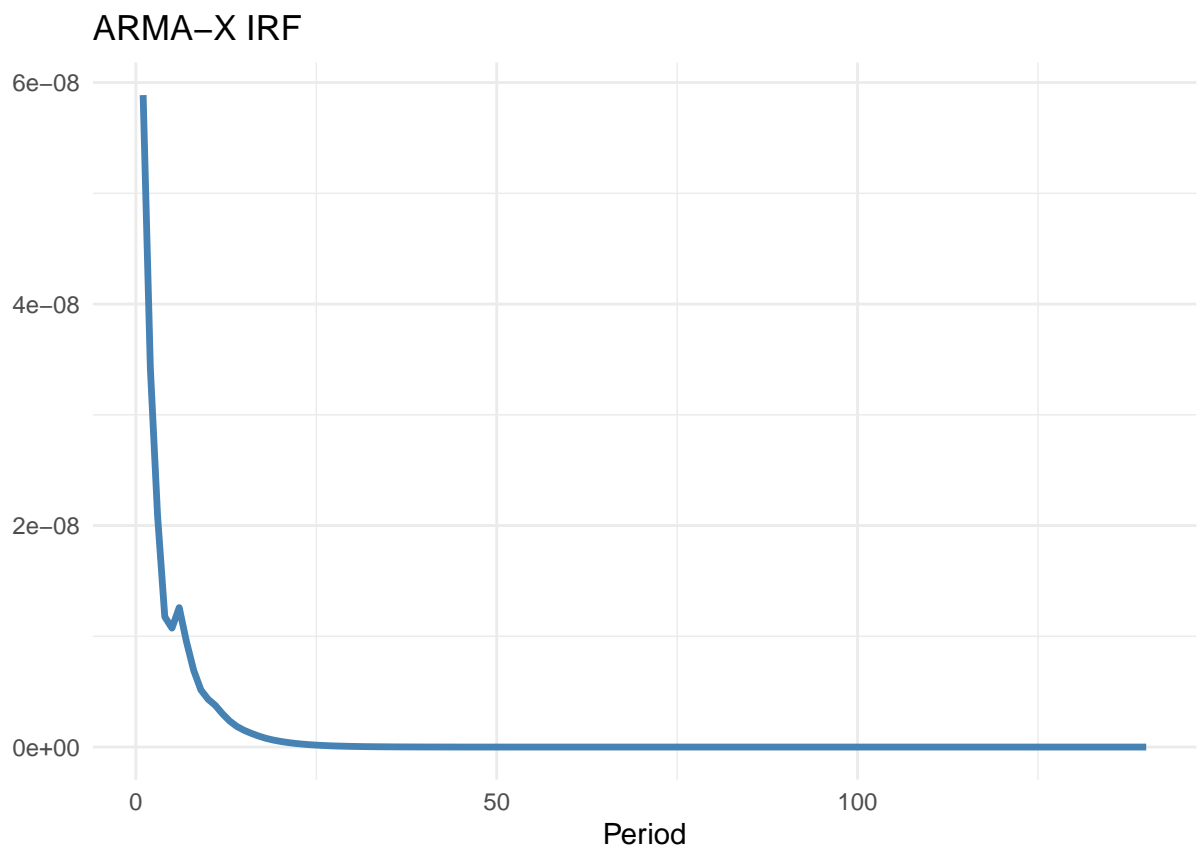
	Model 1
ar1	0.9910*** (0.0014)
ma1	-0.7463*** (0.0072)
ma2	-0.1410*** (0.0087)
ma3	-0.0438*** (0.0073)
intercept	0.0001*** (0.0000)
prop_positive_lag_0	0.0001*** (0.0000)
AIC	-256208.9107
AICc	-256208.9050
BIC	-256153.5964
Log Likelihood	128111.4553
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

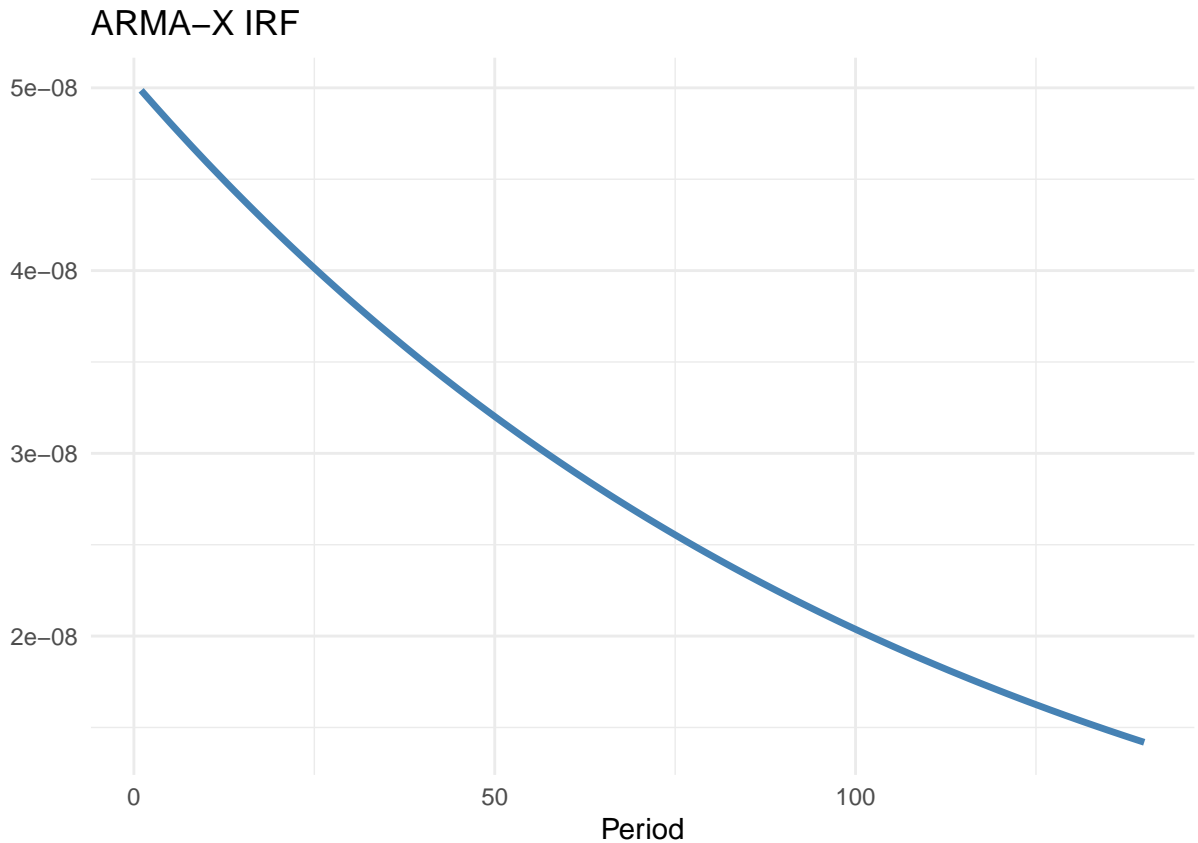
Table 18: ARMAX selected by AIC




```
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=T, max.p = 6, max.q = 6, max.d=0)
```

```
#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=T)
```

```
#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=T)
```

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

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

	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

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 19: ARMAX Model Results

	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

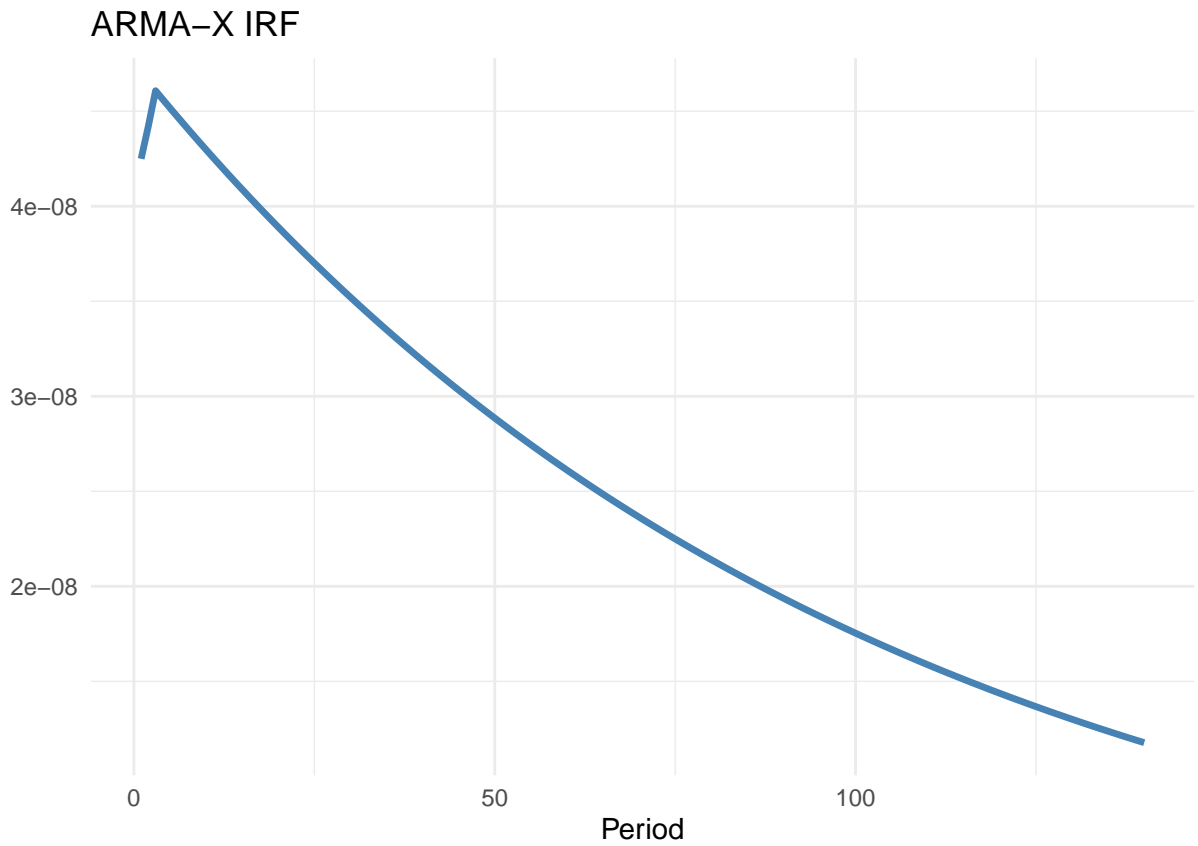
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 20: ARMAX Model Results

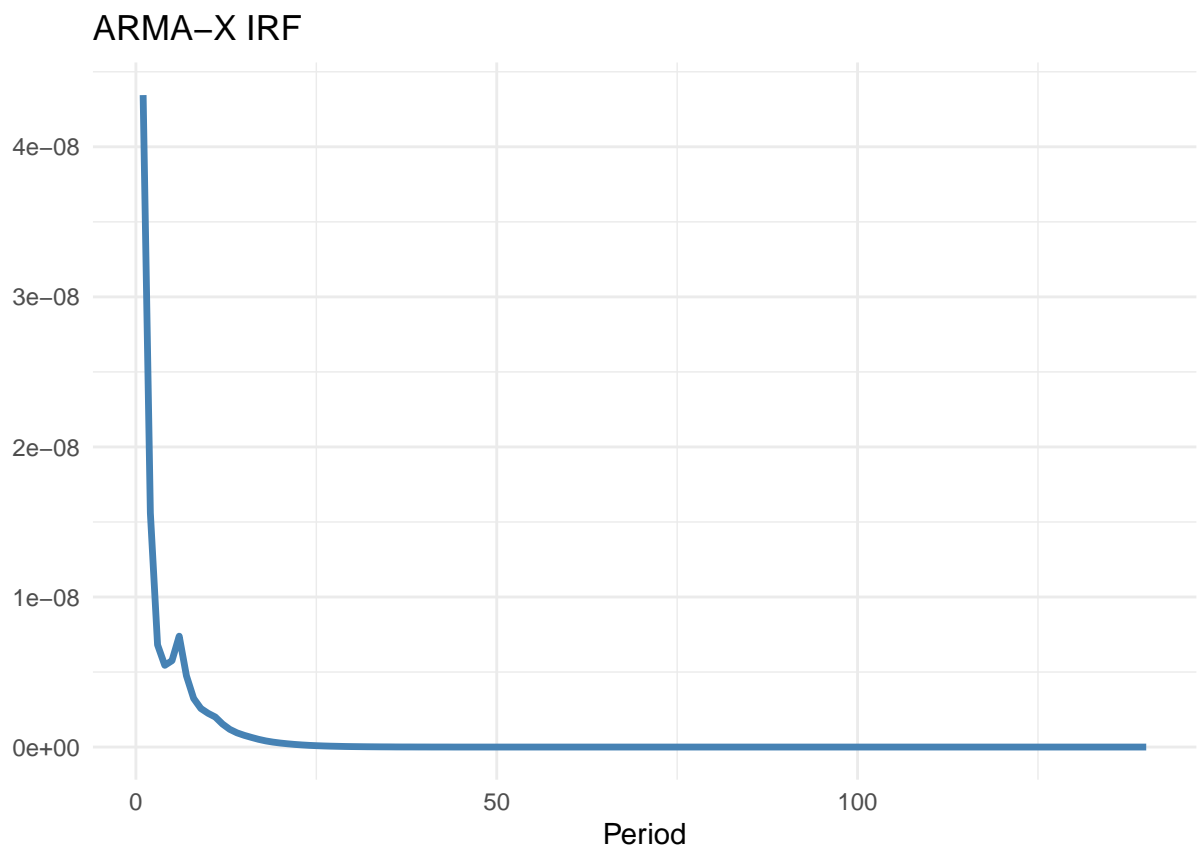
	Model 1
ar1	0.9915*** (0.0013)
ma1	-0.7488*** (0.0072)
ma2	-0.1400*** (0.0087)
ma3	-0.0440*** (0.0073)
intercept	0.0001*** (0.0000)
prop_negative_lag_0	0.0001*** (0.0000)
AIC	-256073.7682
AICc	-256073.7625
BIC	-256018.4539
Log Likelihood	128043.8841
Num. obs.	19971

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 21: ARMAX selected by AIC



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



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

