

## Autocorrelation Example from POE

```

. use "C:\DATA\stata\poe\bangla.dta", clear
. gen time = _n
. tsset time, yearly
    time variable:  time, 1 to 34
                   delta: 1 year

. gen lp = log(p)
. gen la = log(a)

. regress la lp

```

| Source   | SS         | df | MS         |                 |        |  |
|----------|------------|----|------------|-----------------|--------|--|
| Model    | .741225795 | 1  | .741225795 | Number of obs = | 34     |  |
| Residual | 3.03157079 | 32 | .094736587 | F( 1, 32) =     | 7.82   |  |
| Total    | 3.77279658 | 33 | .114327169 | Prob > F =      | 0.0087 |  |
|          |            |    |            | R-squared =     | 0.1965 |  |
|          |            |    |            | Adj R-squared = | 0.1714 |  |
|          |            |    |            | Root MSE =      | .30779 |  |

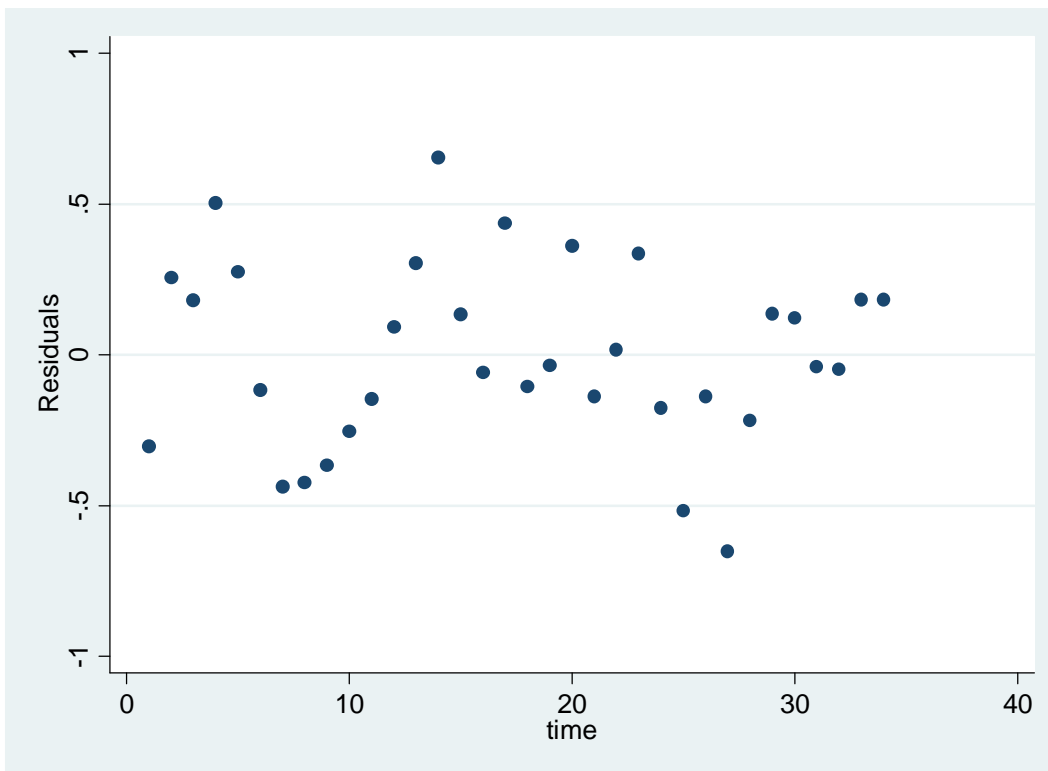
  

|       | Coef.    | Std. Err. | t     | P> t  | [95% Conf. Interval] |          |
|-------|----------|-----------|-------|-------|----------------------|----------|
| lp    | .7761187 | .2774673  | 2.80  | 0.009 | .2109364             | 1.341301 |
| _cons | 3.893256 | .0613451  | 63.46 | 0.000 | 3.7683               | 4.018212 |

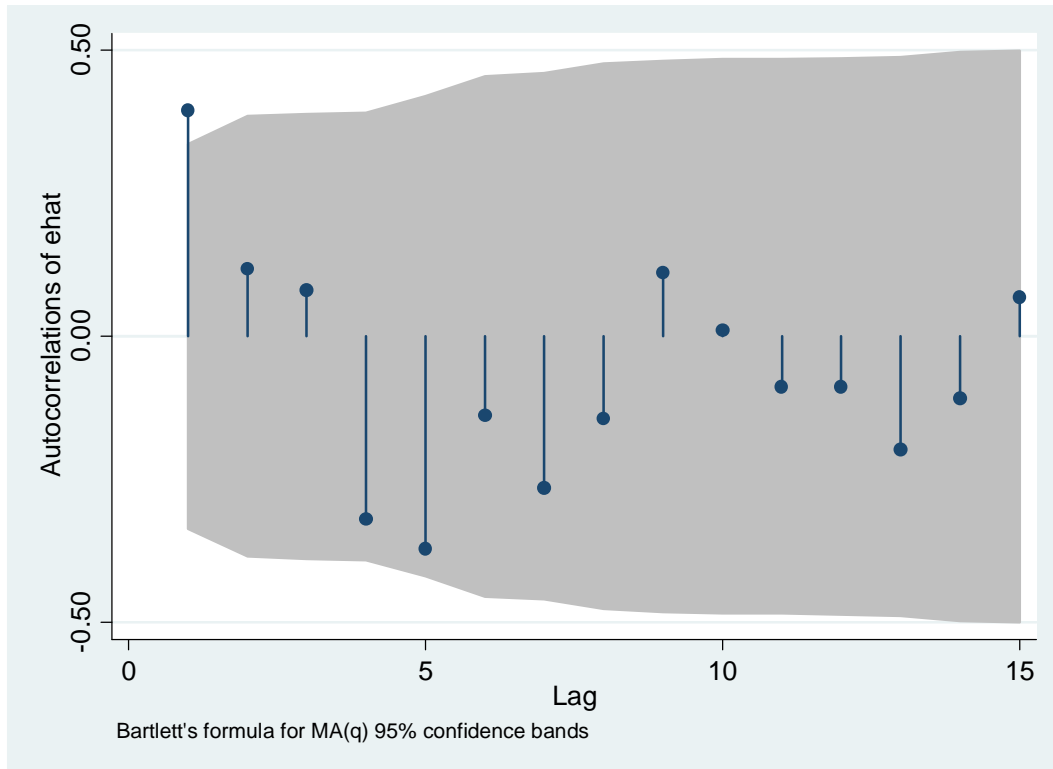
```

. predict ehat, residual
. twoway (scatter ehat time)

```



. ac ehat



```

. * -----
. * Correlation between least squares residuals
. * -----

```

```

. gen ehat_1 = ehat[_n-1]
(1 missing value generated)

```

```

. correlate ehat ehat_1
(obs=33)

```

|        | ehat   | ehat_1 |
|--------|--------|--------|
| ehat   | 1.0000 |        |
| ehat_1 | 0.4040 | 1.0000 |

```

. * -----
. * regression with HAC standard errors
. * B is the computed bandwidth (which = 3)
. * -----

```

```

. scalar B = round(4*(e(N)/100)^(2/9))

```

```

. scalar list B
      B =          3

```

```

. newey l a l p, lag(3)

```

```

Regression with Newey-West standard errors
maximum lag: 3

```

```

Number of obs =      34
F( 1, 32) =      4.21
Prob > F =      0.0484

```

| l a   | Coef.    | Newey-West<br>Std. Err. | t     | P> t  | [95% Conf. Interval] |
|-------|----------|-------------------------|-------|-------|----------------------|
| l p   | .7761187 | .3782067                | 2.05  | 0.048 | .0057369 1.546501    |
| _cons | 3.893256 | .0624443                | 62.35 | 0.000 | 3.766061 4.020451    |

```

. * -----
. * Nonlinear least squares of AR(1) regression model
. * -----

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```

. gen la_1 = L.la
(1 missing value generated)

```

```

. gen lp_1 = L.lp
(1 missing value generated)

```

```

. nl (la = {b1}*(1-{rho}) + {b2}*lp + {rho}*la_1 - {rho}*{b2}*(lp_1)), variables(lp la la_1 lp_
> 1)
(obs = 33)

```

```

Iteration 0: residual SS = 20.65079
Iteration 1: residual SS = 2.924755
Iteration 2: residual SS = 2.444089
Iteration 3: residual SS = 2.443578
Iteration 4: residual SS = 2.443575
Iteration 5: residual SS = 2.443575
Iteration 6: residual SS = 2.443575
Iteration 7: residual SS = 2.443575

```

| Source   | SS         | df | MS         |
|----------|------------|----|------------|
| Model    | .939834353 | 2  | .469917176 |
| Residual | 2.4435749  | 30 | .081452497 |
| Total    | 3.38340925 | 32 | .105731539 |

```

Number of obs = 33
R-squared = 0.2778
Adj R-squared = 0.2296
Root MSE = .2853988
Res. dev. = 7.749443

```

| la   | Coef.    | Std. Err. | t     | P> t  | [95% Conf. Interval] |
|------|----------|-----------|-------|-------|----------------------|
| /b1  | 3.898771 | .0921651  | 42.30 | 0.000 | 3.710545 4.086998    |
| /rho | .4221386 | .1660475  | 2.54  | 0.016 | .0830244 .7612527    |
| /b2  | .8883697 | .259299   | 3.43  | 0.002 | .3588105 1.417929    |

Parameter b1 taken as constant term in model & ANOVA table

```

. * -----
. * FGLS estimation of AR(1) regression model, 2-step PW
. * -----

```

```

. prais la lp, twostep

```

```

Iteration 0: rho = 0.0000
Iteration 1: rho = 0.3992

```

Prais-Winsten AR(1) regression -- twostep estimates

| Source   | SS         | df | MS         |
|----------|------------|----|------------|
| Model    | 1.32217413 | 1  | 1.32217413 |
| Residual | 2.50012363 | 32 | .078128863 |
| Total    | 3.82229776 | 33 | .115827205 |

```

Number of obs = 34
F( 1, 32) = 16.92
Prob > F = 0.0003
R-squared = 0.3459
Adj R-squared = 0.3255
Root MSE = .27952

```

| la    | Coef.    | Std. Err. | t     | P> t  | [95% Conf. Interval] |
|-------|----------|-----------|-------|-------|----------------------|
| lp    | .9460065 | .2407504  | 3.93  | 0.000 | .4556139 1.436399    |
| _cons | 3.873888 | .0819516  | 47.27 | 0.000 | 3.706958 4.040818    |
| rho   | .3992413 |           |       |       |                      |

```

Durbin-Watson statistic (original) 1.168987
Durbin-Watson statistic (transformed) 1.859068

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. * -----
. * FGLS estimation of AR(1) regression model, iterated PW
. * -----
. prais la lp, nolog

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Prais-Winsten AR(1) regression -- iterated estimates

| Source   | SS         | df | MS         | Number of obs = | 34     |
|----------|------------|----|------------|-----------------|--------|
| Model    | 1.49591777 | 1  | 1.49591777 | F( 1, 32) =     | 19.18  |
| Residual | 2.49534794 | 32 | .077979623 | Prob > F =      | 0.0001 |
| Total    | 3.99126571 | 33 | .120947446 | R-squared =     | 0.3748 |
|          |            |    |            | Adj R-squared = | 0.3553 |
|          |            |    |            | Root MSE =      | .27925 |

| la    | Coef.    | Std. Err. | t     | P> t  | [95% Conf. Interval] |
|-------|----------|-----------|-------|-------|----------------------|
| lp    | .9561701 | .2383577  | 4.01  | 0.000 | .4706514 1.441689    |
| _cons | 3.872848 | .0859255  | 45.07 | 0.000 | 3.697824 4.047873    |
| rho   | .4329136 |           |       |       |                      |

Durbin-Watson statistic (original) 1.168987  
Durbin-Watson statistic (transformed) 1.920066

```

. * -----
. * ML estimation of AR(1) regression model
. * -----
. arima la lp, arima(1,0,0)

```

(setting optimization to BHHH)  
Iteration 0: log likelihood = -4.2233215  
Iteration 1: log likelihood = -4.0051368  
Iteration 2: log likelihood = -3.9664723  
Iteration 3: log likelihood = -3.9483772  
Iteration 4: log likelihood = -3.9462383  
(switching optimization to BFGS)  
Iteration 5: log likelihood = -3.9445535  
Iteration 6: log likelihood = -3.9442446  
Iteration 7: log likelihood = -3.9442366  
Iteration 8: log likelihood = -3.9442361  
Iteration 9: log likelihood = -3.944236

ARIMA regression

Sample: 1 - 34  
Log likelihood = -3.944236  
Number of obs = 34  
Wald chi2(2) = 24.62  
Prob > chi2 = 0.0000

| la     | Coef.    | OPG Std. Err. | z     | P> z  | [95% Conf. Interval] |
|--------|----------|---------------|-------|-------|----------------------|
| la     |          |               |       |       |                      |
| lp     | .9545943 | .2152254      | 4.44  | 0.000 | .5327604 1.376428    |
| _cons  | 3.873007 | .0948182      | 40.85 | 0.000 | 3.687167 4.058847    |
| ARMA   |          |               |       |       |                      |
| ar L1. | .4275173 | .2081654      | 2.05  | 0.040 | .0195205 .8355141    |
| /sigma | .2709288 | .043113       | 6.28  | 0.000 | .1864288 .3554288    |