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Analysis of autoregressive parameters and their impact to the presence of autocorrelation in the model

The data is the same as in homework 1. Dependent variable y – number of deaths, x – fertility rate.

SARAR:

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Coefficients: (asymptotic standard errors)
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) 1.44547855 0.46283419  3.1231   0.00179
Fertlty     0.00160963 0.00037204  4.3265 1.515e-05

Rho: 0.63333
Asymptotic standard error: 0.096562
    z-value: 6.5588, p-value: 5.4242e-11
Lambda: -0.51747
Asymptotic standard error: 0.15681
    z-value: -3.2999, p-value: 0.00096721

LR test value: 23.442, p-value: 8.1221e-06

Log likelihood: -600.0854 for sac model
ML residual variance (sigma squared): 0.9749, (sigma: 0.98737)
Number of observations: 413
Number of parameters estimated: 5
AIC: 1210.2, (AIC for lm: 1229.6)
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- p-value of independent variable is close to 0 meaning that variable is significant
- value of Rho (0.63333) tells that decent amount of causation comes from independent variable
- lambda value tells about negative autocorrelation of the error term
- LR test tells that inclusion of lagged value may improve the model
- AIC: 1210.2

SDM:

```
Coefficients: (asymptotic standard errors)
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) 3.02898137 0.36681108  8.2576  2.22e-16
Fertlty     0.00160594 0.00041309  3.8876 0.0001012
lag.Fertlty 0.00130908 0.00086432  1.5146 0.1298793

Rho: 0.25703, LR test value: 14.374, p-value: 0.00014983
Asymptotic standard error: 0.073457
    z-value: 3.499, p-value: 0.00046705
Wald statistic: 12.243, p-value: 0.00046705

Log likelihood: -602.0817 for mixed model
ML residual variance (sigma squared): 1.0714, (sigma: 1.0351)
Number of observations: 413
Number of parameters estimated: 5
AIC: 1214.2, (AIC for lm: 1226.5)
LM test for residual autocorrelation
test value: 0.90817, p-value: 0.3406
```

- p-value of independent variable is close to 0 meaning that variable is significant
- lag value is not significant
- value of Rho (0.25703) tells that only small amount of causation comes from independent variable
- LM test tells that there exists spatial autocorrelation
- AIC: 1214.2

SDEM:

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Coefficients: (asymptotic standard errors)
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) 4.13673983 0.22352805 18.5066 < 2.2e-16
Fertlty     0.00163560 0.00041534  3.9380 8.215e-05
lag.Fertlty 0.00197908 0.00089980  2.1995   0.02785

Lambda: 0.25987, LR test value: 13.205, p-value: 0.00027923
Asymptotic standard error: 0.077382
    z-value: 3.3583, p-value: 0.00078432
Wald statistic: 11.278, p-value: 0.00078432

Log likelihood: -602.6665 for error model
ML residual variance (sigma squared): 1.0742, (sigma: 1.0364)
Number of observations: 413
Number of parameters estimated: 5
AIC: 1215.3, (AIC for lm: 1226.5)
```

- p-value of independent variable is close to 0 meaning that variable is significant
- in this case lag variable is significant
- lambda value tells about positive autocorrelation of the error term
- LR test tells that inclusion of lagged value may improve the model
- AIC: 1215.3

Conclusion: According to the output from models I think that SARAR best explains variables.
Both p-value of independent variable and Rho tell that X is significant and deals decent amount of causation. LR tells that included lagged value may improve the model which goes in line with what we see in SDEM model.

Also considering 3 AIC criteria:
1) 1210.2
2) 1214.2
3) 1215.3

AIC also tells that SARAR model is best.