Time-series Lab 2

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Lab #2 – Temporal Processes

1.

(a) Run an OLS regression, including at least one independent variable and a time variable (as dummies). Explain how you think your independent variable relates to your dependent variable. Interpret your results. Did you find what you expected to find?

I decided to look at ***rellife*** (Do you strongly agree, agree, disagree, or strongly disagree: I try hard to carry my religious beliefs over into all my other dealings in life) and ***toofast*** (Do you strongly agree, agree, disagree, or strongly disagree: Science makes our way of life change too fast). These were recoded so that ratings increase with number value (1,S.disagree -> 4,S.agree). I wanted to see if there was a relation between "excessive" engagement with religious beliefs and whether an individual thinks science is making life too fast. As such, I asked:

> If you're more inclined to agree with the statement, "I try hard to carry my religious beliefs over into all my other dealings in life", does that make you more inclined to agree with the statement, "science makes our way of life change too fast"?

Table 1: The coefficient on ***rellife*** is 0.13 and is statistically significant (P<0.001), meaning, on average, and net of ***panelwave***, for each category level more agreeable with the statement, "I try hard to carry my religious beliefs over into all my other dealings in life",

there is a 0.13 point increase on the scale in their agreement with the statement, "science makes our way of life change too fast". R-sq is 0.25, meaning this model explains about 25% of the variation.

This is the direction I expected in the relationship between ***rellife*** and ***toofast***, however, I did not actually expect a statistically significant result.

Table 1:

```
## lm(formula = Toofast ~ Rellife + as.factor(panelwave), data = lab)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.6856 -0.5412 -0.2374  0.5014  1.7626
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)             2.10688    0.05728  36.783  < 2e-16 ***
## Rellife                 0.13056    0.01832   7.125 1.44e-12 ***
## as.factor(panelwave)2   0.05645    0.04098   1.378    0.169
## as.factor(panelwave)3   0.04259    0.04833   0.881    0.378
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.767 on 2014 degrees of freedom
##   (3982 observations deleted due to missingness)
## Multiple R-squared:  0.02598,    Adjusted R-squared:  0.02453
## F-statistic:  17.9 on 3 and 2014 DF,  p-value: 1.812e-11
```

(b) Then run a fixed effect model version of that OLS model. Interpret your results. Did you find what you expected to find? Why? Why not?

Table 2: The coefficient on ***rellife*** is 0.0399 and is NOT statistically significant. Though the direction of the effect is consistent with expectation and the simple OLS model results, the

results are not statistically significant and therefore we cannot make any real comments on the relationship between changes in agreement on ***relief*** and changes in agreement on ***toofast,*** net of any particular person, across 3 ***panelwaves.*** It seems this model is more in line with my expectations.

Table 2:

```
## Oneway (individual) effect Within Model
## Call:
## plm(formula = Toofast ~ Rellife + as.factor(panelwave), data = lab,
##     model = "within", index = c("idnum", "panelwave"))
##
## Unbalanced Panel: n = 1250, T = 1-3, N = 2018
##
## Residuals:
##     Min.  1st Qu.   Median  3rd Qu.     Max.
## -1.68972 -0.02088  0.00000  0.02088  1.68537
##
## Coefficients:
##                        Estimate Std. Error t-value Pr(>|t|)
## Rellife                0.039880   0.034066  1.1707   0.2421
## as.factor(panelwave)2 0.041759   0.037048  1.1271   0.2600
## as.factor(panelwave)3 0.014349   0.044611  0.3217   0.7478
##
## Total Sum of Squares:    255.33
## Residual Sum of Squares: 254.48
## R-Squared:      0.003354
## Adj. R-Squared: -1.6278
## F-statistic: 0.858148 on 3 and 765 DF, p-value: 0.46245
```

(c) Then include an additional predictor in your fixed effects model that you think might account for the initial relationship you found between your X and your Y. What effect does that new independent variable have in your new regression?

I decided to include ***educ*** as a predictor, as, presumably, education could account for a bulk of where an average American's scientific awareness may originate.

Table 3: The entire model remains statistically NON-significant. The coefficient on ***rellife*** is 0.046 and the coefficient on ***educ*** is- 0.009 and both are NOT statistically significant. Again, the direction of the effect for ***rellife*** is consistent with expectation and the simple OLS model results, however as noted, both variable results are not statistically significant and therefore we cannot make any real comments on the relationship between changes in agreement on ***rellife*** and changes in agreement on ***toofast,*** net of any particular person or ***educ,*** across 3 ***panelwaves.*** It seems as there is no real change on the coefficient for ***rellife*** when we include ***educ*** as a control. Interesting to note is that ***educ*** seems to have a mitigating direction of effect for ***toofast.***

Table 3:

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = Toofast ~ Rellife + educ + as.factor(panelwave),
##     data = lab, model = "within", index = c("idnum", "panelwave"))
##
## Unbalanced Panel: n = 1248, T = 1-3, N = 2014
##
## Residuals:
##      Min.   1st Qu.    Median   3rd Qu.      Max.
## -1.691651 -0.019902  0.000000  0.019902  1.681485
##
## Coefficients:
##                          Estimate Std. Error t-value Pr(>|t|)
## Rellife                 0.0459955  0.0342189  1.3442   0.1793
```

```
## educ                   -0.0096605  0.0183879 -0.5254   0.5995
## as.factor(panelwave)2   0.0398031  0.0370541  1.0742   0.2831
## as.factor(panelwave)3   0.0143125  0.0447344  0.3199   0.7491
##
## Total Sum of Squares:    254.33
## Residual Sum of Squares: 253.3
## R-Squared:      0.0040784
## Adj. R-Squared: -1.631
## F-statistic: 0.78011 on 4 and 762 DF, p-value: 0.53825
```

(d) Then run a random effects model equivalent to your fixed effects model in step (b). Interpret the results.

Table 4: The coefficient on ***rellife*** is 0.11 and is statistically significant (P<0.001), meaning, on average, net of any particular person, across 3 ***panelwaves***, for every positive change in category level on ***rellife,*** there is a 0.11 point positive change on their score regarding feeling that "science makes our way of life change too fast". The second ***panelwave*** (2008), seems to have accrued some statistical significance but not yet reaching P<0.05. R-sq is 0.11, meaning this model explains 11% of the variation.

Table 4:

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = Toofast ~ Rellife + as.factor(panelwave), data = lab,
##     model = "random", index = c("idnum", "panelwave"))
##
## Unbalanced Panel: n = 1250, T = 1-3, N = 2018
##
## Effects:
##                  var std.dev share
## idiosyncratic 0.3326  0.5768 0.566
```

```
## individual    0.2548  0.5048 0.434
## theta:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.2475  0.2475  0.3716  0.3498  0.3716  0.4494
##
## Residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -1.68361 -0.37919 -0.14038 -0.00173  0.37330  1.52305
##
## Coefficients:
##                       Estimate Std. Error z-value  Pr(>|z|)
## (Intercept)           2.159268   0.058872 36.6775 < 2.2e-16 ***
## Rellife               0.114882   0.018914  6.0739 1.248e-09 ***
## as.factor(panelwave)2 0.056868   0.033784  1.6833   0.09232 .
## as.factor(panelwave)3 0.033717   0.040552  0.8314   0.40572
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    763.92
## Residual Sum of Squares: 676.01
## R-Squared:      0.11565
## Adj. R-Squared: 0.11433
## Chisq: 40.2201 on 3 DF, p-value: 9.5698e-09
```

(e) Run a Hausman test to compare your fixed effects and your random effects models. What do you conclude?

Table 5: After running the Hausman test, our p-value is 0.03211, meaning, we can reject the null that they are essentially the same coefficients (P<0.05). This null rejection implies that we use the Fixed Effects model over the Random Effects model. The Fixed Effects model also attempts to directly deal with the omitted variables of the model so that's a positive. Unfortunately, the Fixed Effects model was the model that returned non-significant results. Again, the direction of the effect is consistent with expectation and the

results of the simple OLS and Random Effects models. The Fixed Effects model does not return statistically significant results and therefore we cannot make any real comments on the relationship between changes in agreement on ***rellife*** and changes in agreement on ***toofast,*** net of any particular person, across 3 ***panelwaves.***

Table 5:

```
##
##  Hausman Test
##
## data:  Toofast ~ Rellife + as.factor(panelwave)
## chisq = 8.7976, df = 3, p-value = 0.03211
## alternative hypothesis: one model is inconsistent
##
## Regression Results
## ================================================================
##                                       Toofast
##                             Fixed Effects    Random Effects
## ----------------------------------------------------------------
## Rellife                        0.040           0.115***
##                               (0.034)          (0.019)
## 2010                           0.042            0.057*
##                               (0.037)          (0.034)
## as.factor(panelwave)3          0.014            0.034
##                               (0.045)          (0.041)
## ----------------------------------------------------------------
## Observations                   2,018            2,018
## R2                             0.003            0.116
## Adjusted R2                   -1.628            0.114
## F Statistic           0.858 (df = 3; 765)   40.220***
## ================================================================
## Note:                         *p<0.1; **p<0.05; ***p<0.01
```