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Homework 6 – Econometric Analysis

Part A

$X_i = \alpha + \beta small_i + \Upsilon regaid_i + \varepsilon_i$

Regular class: $E(X_i \mid small = 0, regaid = 0) = \alpha \rightarrow$ regular

Small class: $E(X_i \mid small = 1) = \alpha+\beta$

Regular aid class: $E(X_i \mid regaid = 1) = \alpha+\Upsilon$

α = average value of X_i

Part B

β = difference between a small class and regular class (small – regular)

Υ = difference between a regular aid class and a regular class (regaid – regular)

Part C

- Below is the output for the regression that displays the correlation between the different characteristics of the Small and Regular Aid classes.
- The "_cons" coefficient is the Regular class value. The coefficients under Small and RegAid measure how far off the values are from the constant (Regular) mean
- The second chart displays the means across the class types. 2 is the mean value of the Regular class, which matches the constant in the first chart
- 1 = Small, 2 = Regular, 3 = Regular + Aid (RegAid)

```
. reg freelunch Small RegAid, robust

Linear regression                               Number of obs     =      5,386
                                                F(2, 5383)        =       3.58
                                                Prob > F          =     0.0281
                                                R-squared         =     0.0013
                                                Root MSE          =     .49957

------------------------------------------------------------------------------
             |               Robust
  freelunch |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   -.005986   .0170018    -0.35   0.725    -.0393165    .0273445
      RegAid |   .0349247   .0162611     2.15   0.032     .0030464    .0668029
       _cons |   .4739387   .0115778    40.94   0.000     .4512415     .496636
------------------------------------------------------------------------------
```

ctypek	mean
1	.4679527
2	.4739387
3	.5088634
Total	.4845897

F-Test: 0.0281 → we are 95% confident that we should reject the null hypothesis

R-squared: 0.0013 → model has very little explanatory power

t-test: Small==0.725 → not significant RegAid==0.032 → significant

A 1 unit increase in a Small class causes a -0.00599 decrease in “freelunch”. A 1 unit increase in a Regular Aid class causes a 0.349 increase in “freelunch”.

Based on these two tables from “freelunch”, we see that 46.8% of students in a Small class will receive a free lunch. In the Regular Aid Class, 50.9% of students will receive a free lunch. The Small class has a negative coefficient which means that it has a negative correlation with “freelunch”. The RegAid class coefficient is positive which results in a positive correlation with “freelunch”.

```
. reg whiteorasian Small RegAid, robust

Linear regression                               Number of obs     =      5,405
                                                F(2, 5402)        =       2.81
                                                Prob > F          =     0.0601
                                                R-squared         =     0.0011
                                                Root MSE          =     .47039

------------------------------------------------------------------------------
             |               Robust
whiteorasian |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   .0068031   .0158513     0.43   0.668    -.0242719    .037878
      RegAid |  -.0281983   .0153497    -1.84   0.066    -.0582899    .0018934
       _cons |   .6772118   .0108293    62.53   0.000     .6559819    .6984417
------------------------------------------------------------------------------
```

ctypek	mean
1	.6840149
2	.6772118
3	.6490135
Total	.6691952

F-test: 0.0601 → we are 90% confident that we should reject the null hypothesis

R-squared: 0.0011 → model has very little explanatory power

t-test: Small == 0.668 → not significant RegAid == 0.066 → significant at 90% confidence

A 1 unit increase in a Small class causes a 0.0068 increase in “whiteorasian”. A 1 unit increase in a Regular Aid class causes a decrease in “whiteorasian” by 0.0282.

The chart above shows that 68.4% of students are either white or Asian in a small class and 64.9% in a regular aid class. The Small class coefficient is positive which results in a positive correlation in “whiteorasian” and a Regular Aid class is negative which results in a negative correlation with “whiteorasian”.

```
. reg agein1985 Small RegAid, robust

Linear regression                               Number of obs     =      5,400
                                                F(2, 5397)        =       1.30
                                                Prob > F          =     0.2733
                                                R-squared         =     0.0005
                                                Root MSE          =     .35007

------------------------------------------------------------------------------
             |               Robust
  agein1985 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   .0167942    .011955     1.40   0.160    -.0066424    .0402307
      RegAid |   .0000114   .0113701     0.00   0.999    -.0222786    .0223014
       _cons |   5.428408     .00816   665.24   0.000     5.412411    5.444405
------------------------------------------------------------------------------
```

ctypek	mean
1	5.445202
2	5.428408
3	5.42842
Total	5.433426

F-test: 0.2733 → we should not reject the null hypothesis

R-squared: 0.0005 → model has very little explanatory power, the least of the characteristics

t-test: Small == 0.160 → not significant RegAid == 0.999 → not significant

A 1 unit increase in a Small class causes a 0.0167 increase in “agein1985”. A 1 unit increase in a Regular Aid class causes a 0.000014 increase in “agein1985”.

The average age of a student in 1985 in a small class is 5.45 years old. In a regular aid class, the average age is 5.43 years old. The values are evenly distributed. We can also see that both coefficients are positive, which means that there is a positive correlation between the coefficients and “agein1985”.

```
. reg Twhiteorasian Small RegAid, robust

Linear regression                               Number of obs     =      5,408
                                                F(2, 5405)        =       2.79
                                                Prob > F          =     0.0614
                                                R-squared         =     0.0010
                                                Root MSE          =     .47039

------------------------------------------------------------------------------
             |               Robust
Twhiteoras~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   .0060338   .0158457     0.38   0.703    -.0250302    .0370977
      RegAid |  -.0285441   .0153435    -1.86   0.063    -.0586235    .0015353
       _cons |   .6775576   .0108205    62.62   0.000      .656345    .6987701
------------------------------------------------------------------------------
```

ctypek	mean
1	.6835913
2	.6775576
3	.6490135
Total	.6691938

F-test: 0.0614 → we are 90% confident that we should reject the null hypothesis

R-squared: 0.0010 → model has little explanatory power

t-test: Small == 0.703 → not significant RegAid == 0.063 → significant at 90% confidence

A 1 unit increase in a Small class causes a 0.006 increase in “Twhiteorasian”. A 1 unit increase in a Regular Aid class causes a 0.0285 decrease in “Twhiteorasian”.

68.4% of teachers in a small class are white or Asian. 64.9% of teachers in a regular aid class are white or Asian. The Small class coefficients is positive which results in a positive correlation with “Twhiteorasian”. The RegAid coefficient, on the other hand, is negative which results in a negative correlation with “Twhiteorasian”.

```
. reg totexpk Small RegAid, robust

Linear regression                               Number of obs     =      5,408
                                                F(2, 5405)        =      17.58
                                                Prob > F          =     0.0000
                                                R-squared         =     0.0088
                                                Root MSE          =     7.7412

------------------------------------------------------------------------------
             |               Robust
    totexpk  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |  -.0944397   .1959972    -0.48   0.630    -.4786732    .2897938
      RegAid |   1.472654   .2713866     5.43   0.000     .9406272    2.004681
       _cons |   9.113016   .1319698    69.05   0.000     8.854302    9.371729
------------------------------------------------------------------------------
```

ctypek	mean
1	9.018576
2	9.113016
3	10.58567
Total	9.609283

F-test: 0.0000 → we are 99% confident that we should reject the null hypothesis

R-squared: 0.0088 → this model has more explanatory power than the others in **Part C**

t-test: Small == 0.630 → not significant RegAid == 0.000 → significant at 99% confidence

A 1 unit increase in a Small class causes a 0.094 decrease in “totexpk”. A 1 unit increase in a Regular Aid class causes a 1.47 increase in “totexpk”.

For total years of experience, the average tenure is 9.02 years for a small class and 10.59 years for a regular aid class. This proves that the teachers in a regular aid class have more experience when instructing children with disabilities. The negative coefficient for a Small class results in a negative correlation with “totexpk” and the positive coefficient from RegAid results in a positive correlation with “totexpk”.

Part D

If the P-Value falls below 0.05, the value is significant. We will then reject the null hypothesis.

Free Lunch (freelunch)

P-Value(Small) == 0.725 → NOT SIGNIFICANT

P-Value(RegAid) == 0.032 → SIGNIFICANT at 95% confidence

P-Value(_cons) == 0.000 → SIGNIFICANT

White or Asian students (whiteorasian)

P-Value(Small) == 0.668 → NOT SIGNIFICANT

P-Value(RegAid) == 0.066 → SIGNIFICANT at 90% confidence

P-Value(_cons) == 0.000 → SIGNIFICANT

Age in 1985 (agein1985)

P-Value(Small) == 0.160 → NOT SIGNIFICANT

P-Value(RegAid) == 0.999 → NOT SIGNIFICANT

P-Value(_cons) ==0.000 → SIGNIFICANT

White or Asian Teachers (Twhiteorasian)

P-Value(Small) == 0.703 → NOT SIGNIFICANT

P-Value(RegAid) == 0.063 → SIGNIFICANT at 90% confidence

P-Value(_cons) == 0.000 → SIGNIFICANT

Total Experience Teaching (totexpk)

P-Value(Small) == 0.630 → NOT SIGNIFICANT

P-Value(RegAid) == 0.000 → SIGNIFICANT at 99% confidence

P-Value(_cons) == 0.000 → SIGNIFICANT

Part E

To distinguish the significant values, we can use the "test" command to compare the significance of the small and regular aid classes. The "test" command runs an F-test and the F-test of the overall significance indicates whether your regression model provides a better fit to the data than a model that contains no independent variables. Also, the F-test appears on output chart. You can do either. I will post the output below.

Free Lunch (freelunch)

```
. test Small RegAid

 ( 1)  Small = 0
 ( 2)  RegAid = 0

       F(  2,  5383) =    3.58
            Prob > F =    0.0281
```

White or Asian Students (whiteorasian)

```
. test Small RegAid

 ( 1)  Small = 0
 ( 2)  RegAid = 0

       F(  2,  5402) =    2.81
            Prob > F =    0.0601
```

Age in 1985 (agein1985)

```
. test Small RegAid

 ( 1)  Small = 0
 ( 2)  RegAid = 0

       F(  2,  5397) =    1.30
            Prob > F =    0.2733
```

White or Asian Teachers (Twhiteorasian)

```
. test Small RegAid

 ( 1)  Small = 0
 ( 2)  RegAid = 0

       F(  2,  5405) =    2.79
            Prob > F =    0.0614
```

Total Experience of Teachers (totexpk)

```
. test Small RegAid

 ( 1)  Small = 0
 ( 2)  RegAid = 0

       F(  2,  5405) =   17.58
            Prob > F =    0.0000
```

Part F

The regression for the following charts is based off of the variable "_Ischidk*" and the characteristics shown in **Part C**.

*For all of these tables below, I initially received all of the coefficients of the dummy variables. I screenshotted the dummy variables out to make the chart look neat. I included "_cons" but I had to take a separate screenshot for it.

Free Lunch (freelunch)

```
. reg freelunch Small RegAid _Ischidk*, robust
note: _Ischidk_14 omitted because of collinearity

Linear regression                               Number of obs     =      5,386
                                                F(80, 5305)       =     214.25
                                                Prob > F          =     0.0000
                                                R-squared         =     0.3052
                                                Root MSE          =     .41973

------------------------------------------------------------------------------
             |               Robust
   freelunch |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   .0012137   .0147077     0.08   0.934    -.0276195    .0300469
      RegAid |   .0180767   .0137331     1.32   0.188    -.0088459    .0449993
             |
       _cons |   .9199356    .048922    18.80   0.000     .8240283    1.015843
------------------------------------------------------------------------------
```

F-test: 0.0000 → 99% confident that we should reject the null hypothesis

R-squared: 0.3052 → this model has explanatory power

t-test: Small == 0.934 → not significant RegAid == 0.188 → not significant

A 1 unit increase in a small class causes a 0.0012 increase in "freelunch". A 1 unit increase in a regular aid class causes a 0.181 increase in "freelunch".

R-squared says that 30.52% of the variation in "freelunch" is explained by small and regular aid classes. The other 69.48% is not explained (error). Both coefficients are positive which means that they are positively correlated with "freelunch".

White or Asian Students (whiteorasian)

```
. reg whiteorasian Small RegAid _Ischidk*, robust
note: _Ischidk_65 omitted because of collinearity

Linear regression                               Number of obs     =      5,405
                                                F(80, 5324)       >   99999.00
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7378
                                                Root MSE          =     .24273

------------------------------------------------------------------------------
             |               Robust
whiteorasian |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |  -.0077297    .00829    -0.93   0.351    -.0239815    .0085221
      RegAid |  -.0091348   .007905    -1.16   0.248    -.0246317    .0063622
             |
       _cons |   .9530454   .0369332    25.80   0.000     .8806412     1.02545
------------------------------------------------------------------------------
```

F-test: 0.0000 → we are 99% confident that we should reject the null hypothesis

R-squared: 0.7378 → model has a lot of explanatory power, good model

t-test: Small == 0.351 → not significant RegAid == 0.248 → not significant

A 1 unit increase in a small class causes a 0.0077 decrease in “whiteorasian”. A 1 unit increase in a regular aid class causes a 0.0091 decrease in “whiteorasian”.

R-squared states that 73.78% of the variation in “whiteorasian” is explained by small and regular aid classes. The other 26.22% is not explained (error). Both coefficients are negative which means that small and regular aid classes are negatively correlated with “whiteorasian”.

Age in 1985 (agein1985)

```
. reg agein1985 Small RegAid _Ischidk*, robust
note: _Ischidk_14 omitted because of collinearity

Linear regression                               Number of obs     =      5,400
                                                F(80, 5319)       =       2.13
                                                Prob > F          =     0.0000
                                                R-squared         =     0.0309
                                                Root MSE          =     .34722

------------------------------------------------------------------------------
             |               Robust
   agein1985 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |   .0139545   .0119959     1.16   0.245    -.0095624    .0374713
      RegAid |   .0039446   .0116571     0.34   0.735    -.0189081    .0267972
             |
       _cons |   5.369787   .0638351    84.12   0.000     5.244644     5.49493
------------------------------------------------------------------------------
```

F-test: 0.0000 → we are 99% confident that we should reject the null hypothesis

R-squared: 0.0309 → little explanatory power

t-test: Small == 0.245 → not significant RegAid == 0.735 → not significant

A 1 unit increase in a small class causes a 0.014 increase in “agein1985”. A 1 unit increase in a regular aid class causes a 0.0039 increase in “agein1985”.

R-squared states that 3.09% of the variation in “agein1985” is explained by small and regular aid classes. The other 96.91% is not explained (error). Both coefficients are positive which means that small and regular aid classes are positively correlated with “agein1985”.

White or Asian Teachers (Twhiteorasian)

```
. reg Twhiteorasian Small RegAid _Ischidk*, robust
note: _Ischidk_65 omitted because of collinearity

Linear regression                               Number of obs     =      5,408
                                                F(80, 5327)       >   99999.00
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7371
                                                Root MSE          =     .24309

------------------------------------------------------------------------------
             |               Robust
Twhiteoras~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |  -.0085143   .0083032    -1.03   0.305    -.0247919    .0077634
      RegAid |  -.0098849   .0079219    -1.25   0.212     -.025415    .0056452
             |
       _cons |    .953547   .0369404    25.81   0.000     .8811286    1.025965
------------------------------------------------------------------------------
```

F-test: 0.0000 → we are 99% confident that we should reject the null hypothesis

R-squared: 0.7371 → model has a lot of explanatory power

t-test: Small == 0.305 → not significant RegAid == 0.212 → not significant

A 1 unit increase in a small class causes a 0.0085 decrease in “Twhiteorasian”. A 1 unit increase in a regular aid class causes a 0.0099 decrease in “Twhiteorasian”.

R-squared states that 73.71% of the variation in “Twhiteorasian” is explained by small and regular aid classes. The other 26.29% is not explained (error). Both coefficients are negative which means that both small and regular aid classes are negatively correlated with “Twhiteorasian”.

Total Experience of Teachers (totexpk)

```
. reg totexpk Small RegAid _Ischidk*, robust
note: _Ischidk_65 omitted because of collinearity

Linear regression                               Number of obs     =      5,408
                                                F(80, 5327)       =     115.25
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2599
                                                Root MSE          =     6.7377

------------------------------------------------------------------------------
             |               Robust
    totexpk |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       Small |  -.0650954   .2025013    -0.32   0.748    -.4620808     .33189
      RegAid |    1.56631   .2168953     7.22   0.000     1.141106    1.991513
             |
       _cons |   10.80329   .5167507    20.91   0.000     9.790244    11.81633
------------------------------------------------------------------------------
```

F-test: 0.0000 → we are 99% confident that we should reject the null hypothesis

R-squared: 0.2599 → model has explanatory power

t-test: Small == 0.748 → not significant RegAid == 0.000 → significant at 99%

R-squared states that 25.99% of the variation in "totexpk" is explained by small and regular aid classes. The other 74.01% is not explained (error). The small class coefficient is negative which means that it is negatively correlated with "totexpk" and the RegAid class coefficient is positive which means that there is a correlation between regular aid classes and "totexpk".

Part G

Based off of the estimates, **Part F** DOES support the notion that the class types were randomly assigned conditional on the schools. There is a huge difference in the R-Squared values between Part C and Part F. Within any given school, the numbers are evenly distributed across the class types. However, across all of the schools, they are not evenly distributed.