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Homework 6 – Econometric Analysis

Part A

$$X_i = \alpha + \beta \text{small}_i + \gamma \text{regaid}_i + \varepsilon_i$$

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

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

Regular aid class: $E(X_i \mid \text{regaid} = 1) = \alpha + \gamma$

α = average value of X_i

Part B

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

γ = 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)

<pre>. reg freelunch Small RegAid, robust</pre>							
Linear regression		Number of obs		=	5,386		
		F(2, 5383)		=	3.58		
		Prob > F		=	0.0281		
		R-squared		=	0.0013		
		Root MSE		=	.49957		
						ctypek	mean
						1	.4679527
						2	.4739387
						3	.5088634
freelunch	Coef.	Robust 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	Total
							.4845897

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

R-squared: 0.0013 \rightarrow model has very little explanatory power

t-test: Small==0.725 \rightarrow not significant RegAid==0.032 \rightarrow 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	ctypek	mean
		F(2, 5402)		=	2.81		
		Prob > F		=	0.0601		
		R-squared		=	0.0011		
		Root MSE		=	.47039		
whiteorAsian	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	1	.6840149
Small	.0068031	.0158513	0.43	0.668	-.0242719 .037878	2	.6772118
RegAid	-.0281983	.0153497	-1.84	0.066	-.0582899 .0018934	3	.6490135
_cons	.6772118	.0108293	62.53	0.000	.6559819 .6984417	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	ctypek	mean
		F(2, 5397)	=	1.30		
		Prob > F	=	0.2733		
		R-squared	=	0.0005		
		Root MSE	=	.35007		
agein1985					1	5.445202
					2	5.428408
					3	5.42842
					Total	5.433426
	Coef.	Robust 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

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	ctypek	mean
		F(2, 5405)	=	2.79		
		Prob > F	=	0.0614		
		R-squared	=	0.0010		
		Root MSE	=	.47039		
Twhiteoras-n					1	.6835913
					2	.6775576
					3	.6490135
					Total	.6691938
	Coef.	Robust 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

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 coefficient 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
							ctypek	mean
							1	9.018576
							2	9.113016
							3	10.58567
							Total	9.609283
totexpk	Coef.	Robust 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		

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

freelunch	Coef.	Robust 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

whiteorasian	Coef.	Robust 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

agein1985	Coef.	Robust 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

TwhiteorAsian	Coef.	Robust 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

totexpk	Robust		t	P> t	[95% Conf. Interval]	
	Coef.	Std. Err.				
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.