ASAP Assignment 2

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September 23rd, 2022

1 Difference in Difference

1.1 Task 1: Derive Diff-In-Diff Coefficients

$(1-1)$ $y_{it} = \beta_0 + \beta_1 D_i + \beta_2 T_t + \beta_3 D_i T_t + \epsilon_{it}$

Considering the canonical difference-in-difference equation expressed in regression form (1-1), the individaul outcome of y_{it} is defined by five terms:

1. β_0; constant - will be cancelled out in later part
2. $\beta_1 D_i$; treatment indicator - whether the subject is treated or not represented by either (D= 1|D = 0)
3. $\beta_2 T_t$; independent of the subject, the "event study" contains pre- and post-test measurements indicator for each subject
4. $\beta_3 D_i T_t$; the interaction effect of the treatment indicator and the time indicator displays the assumed effect of the change from pre to post test in T_t for an individual in the treatment or control - in case of treatment, this term falls out as the general assumtion of diff-in-diff pertains to the control being the same as the treatment.
5. ϵ_{it}; contains the disturbances

The terms in 2, 3, & 4 are relevant in describing the potential outcome assumption in difference in difference analysis. Difference in difference suggests that we compare the difference between treatment and control before and after the treatment introduction (t = 0), shown as:

$(1-2)$ $[E(y_{T=1}|D=1) - E(y_{T=0}|D=1)] - [E(y_{T=1}|D=0) - E(y_{T=0}|D=0)]$

Subsequetnly, the four outcomes described in (1-2) yield the following outcomes:

- $E = (y_{T=1}|D=1)$; Becasue we are observing the outcome for the post-(treatment) test for treatment group, this yields β_0, β_1, β_2, β_3
- $E = (y_{T=0}|D=1)$; Because we are observing the outcome of the pre-(intervention) test for the treatment, this will yield β_0, β_1
- $E = (y_{T=1}|D=0)$; Becasue we are observing the outcome for the post-(treatment) test for the control group, this yields β_0, β_2
- $E = (y_{T=0}|D=0)$; Because we are observing the outcome of the pre-(intervention) test for the control, this will yield β_0

Note that the disturbance term is left out as it is assumed to be independent of the treatment selection etc.; as such we will ignore it here. Additionally, the constant is present in all four outcomes; thus, it also cncels out in the following equation. This originates from the assumption that the covariates measurments in pre and post test yield the same results for both treatment and control subjects. Equivalently, by substitution the aforementioned outcomes into (1-2), the following results can be deduced:

$(1-3)$ $E(y_{it}) = [E(y_{T=1}|D=1) - E(y_{T=0}|D=1)] - [E(y_{T=1}|D=0) - E(y_{T=0}|D=0)]$

$(=)$ $E(y_{it}) = [(\beta_1 + \beta_2 + \beta_3) - (\beta_1)] - [(\beta_2)]$

$(=)$ $E(y_{it}) = (\beta_2 + \beta_3) - \beta_2 = \beta_3$

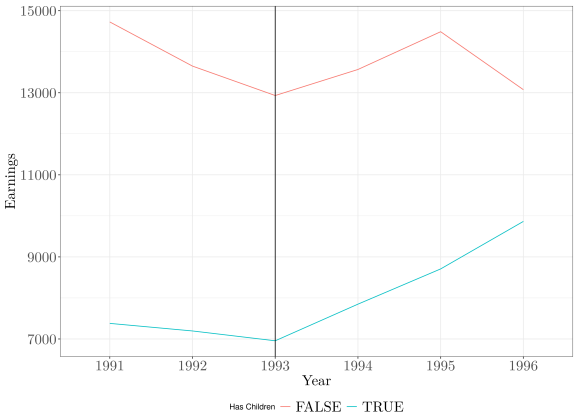
NOte possibly delete duplicates

Important: we canot identify the monthrs; so If they become mothers at some point, we will assume that these are taken out!

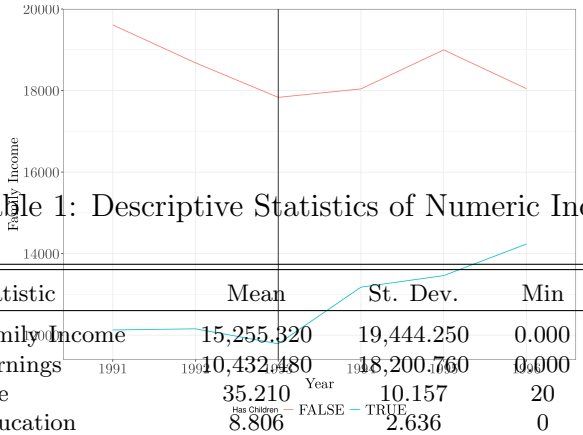
1.2 Task 2: Provide graphic as on slide 55

1. Describe each picture and what you can see; but also note that this is based on averages and not statistically true
2. IMPORTANT: you should look at the grading grid of the previous assignment to see what their requirements are for these

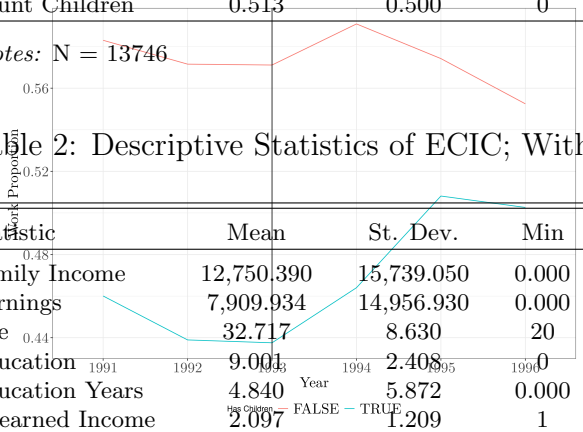
IMPORTANT: ALSO MENTION THE CATEGORICAL VARIABLES!!!



(a) Annual Earnings by Females with(out) Children



(b) Family Earnings by Females with(out) Children



(c) Work Participation by Females with(out) Children

Figure 1: Pre-Post Intervention of EICT Credit for Women with(out) Children

NOTES: This "visoual" proof is no real proove; this is just visual confirmation of what we assume; but does this really pertain to the case that the TAX credit is the real cause? What about the case of subsections of the population? and we still do not know whether this is really causal and not like the economy heating up¡ Predictor is WHETHER YOU HAVE CHILD OR NOT

1.3 Task 3: Summary Statistics for data

1. dont forget to mention the categorical variables and how they distribute; you did this well during assignment 1
2. better only keep the table with overall stats and not the subcategories
3. add skew and median!!

Table 1: Descriptive Statistics of Numeric Indepdenent and Dependent Varaible

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Family Income	15,255.320	19,444.250	0.000	5,123.418	9,636.664	18,659.180	575,616.800
Earnings	10,432.480	18,200.760	0.000	0.000	3,332.180	14,321.220	537,880.600
Age	35.210	10.157	20	26	34	44	54
Education	8.806	2.636	0	7	10	11	11
Education Years	4.823	7.123	0.000	0.000	2.973	6.864	134.058
Unearned Income	1.193	1.382	0	0	1	2	9
Count Children	0.513	0.500	0	0	1	1	1

Notes: N = 13746

Table 2: Descriptive Statistics of ECIC; With Children

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Family Income	12,750.390	15,739.050	0.000	4,652.465	8,425.197	15,218.720	410,507.600
Earnings	7,909.934	14,956.930	0.000	0.000	1,110.727	11,107.270	366,095.500
Age	32.717	8.630	20	25	32	39	54
Education	9.001	2.408	0	7	10	11	11
Education Years	4.840	5.872	0.000	0.071	3.761	7.070	102.958
Unearned Income	2.097	1.209	1	1	2	3	9
Count Children	0.466	0.499	0	0	0	1	1

Notes: N = 7819

1.4 Task 4: Matrix Diff in Diff

NOte: by taking the average of the periods we have two small problems: 1) the AFTER period is longer; so should we really do that?

1. report the same insight as you did during class!

Table 3: Descriptive Statistics of ECIC; Without Children

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Family Income	18,559.860	23,041.780	0.000	5,793.092	11,912.950	24,391.010	575,616.800
Earnings	13,760.260	21,301.400	0.000	0.000	7,664.014	19,447.610	537,880.600
Age	38.498	11.046	20	28	40	49	54
Education	8.549	2.889	0	7	10	11	11
Education Years	4.800	8.496	0.000	0.000	1.248	6.528	134.058
Unearned Income	0.000	0.000	0	0	0	0	0
Count Children	0.574	0.494	0	0	1	1	1

Notes: N = 5927

2. IMPORTANT: CHECK AND CALCULATE THE TABLE CONTENTS AGAIN! THERE MIGHT BE SOME NUMBERS OFF!!

Table 4: Diff-in-Diff Matrix

		Earning		Family Income		Work Participation	
	dperiod	Childless	Has Child	Childless	Has Child	Childless	Has Child
Before	1	14,203.900	7,290.380	19,159.190	12,140.900	0.580	0.450
After	2	13,507.900	8,277.200	18,218.950	13,111.690	0.570	0.480
Difference		-696.000	986.810	-940.240	970.800	-0.010	0.030

Notes: N = 5927 Childless; N = 7819 Has one or more Children

1.5 Task 5: Analyze the DiD effect with appropriate regression models for the three dependent variables

1. ADD A LITTLE THEORY WHY YOU ADD EACH CONTROL VAIRABLE into each model for each dependent variable! this is important: so put some effort into arguing why to include eg UNEMPLOYMENT rate into the equation of earnings (a good arugment would be: high unemployment means more people searching jobs means wage suppression ; a simple demand and suply rule)

2. create an example table that reports exactly the same as that one above, but here the SEs are robust!!! for clustered on state and white; they will not really differ so also report the breusch pagan test here

3. RUN BREUSCH PAGAN OFR EACH MODEL

NOTE STANDARDIZED COEFFICIENTS ARE NOT REPORTED AS THEY ARE USELESS IN THIS CONTEXT; WE ARE NOT LOOKIGN FOR EFFECT SIZE BUT RATHER THE CASE OF

Note:standardized coefficinets will NOT be included as they are of no interpretable interest here and there is no real effect size we want to estimate in the first place.

Also: give a short theroy for why control variables were included! LOOK AT PQRM QUANTITATIVE CORUSE AT UVA; THEY CALLED IT SOMETHING SPECIAL!

IMPORTANT: EXPLAIN WHY IN CERTAIN MODELS THE CONTROL VARIABLES WORK AND WHY THEY DONT WORK IN OTHER MODELS!! Build a theory in this regard

NOTE ROBUST STANDARD ERROS MIGHT NOT EVEN BE NEEDED IN THIS CASE DUE TO THE THEORY BEHIND DIFF IN DIFF

NOTE: WRITE A THEORY FOR EACH CONTROL VARIBALE REGARDING EACH DEPEDNET: EG THE urate may not ahve a controllign effect on earnings but it may have on family income

Table 5: Non-Robust Regression Results Part 3

	Dependent variable:					
	earn		finc		work	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	14,899.900***	12,958.640***	20,099.430***	16,218.430***	0.582***	0.532***
	(828.375)	(1,550.012)	(886.522)	(1,655.347)	(0.023)	(0.043)
has_children1	−8,596.327***	−8,394.973***	−8,929.330***	−8,269.567***	−0.159***	−0.150***
	(1,093.444)	(1,096.506)	(1,170.197)	(1,171.022)	(0.030)	(0.030)
dperiod	−695.997	−536.491	−940.239*	−515.553	−0.005	−0.024*
	(485.413)	(500.046)	(519.486)	(534.028)	(0.013)	(0.014)
age		22.555		78.717***		0.002***
		(15.922)		(17.004)		(0.0004)
urate		133.948		372.861***		−0.018***
		(114.614)		(122.403)		(0.003)
ed		66.337		−125.305**		0.017***
		(59.579)		(63.628)		(0.002)
nonwhite1		−1,255.622***		−2,438.387***		−0.043***
		(326.237)		(348.408)		(0.009)
has_children1:dperiod	1,682.810***	1,722.360***	1,911.035***	2,006.060***	0.031*	0.033*
	(642.099)	(641.893)	(687.171)	(685.515)	(0.018)	(0.018)
R^2	0.026	0.027	0.022	0.028	0.012	0.027
Adjusted R^2	0.026	0.027	0.022	0.027	0.012	0.026
Residual Std. Error	17,965.670	17,956.450	19,226.750	19,176.730	0.497	0.493
F Statistic	121.691***	54.794***	105.245***	56.166***	54.906***	54.374***

Note: N = 13746. Non Robust Standard Errors applied. "White" is reference category for "non-White" categorical variable.

IMPORTANT: RUN BREUSCH PAGAN OFR EACH MODEL

1.6 Task 6: Subset analysis

NOTE: IN THIS CASE WE USE THE SUBSET ANALYSIS and not use interactions due to the efficeincy; if we were to use interactions, the analysis would have a higher statistical power, but the problem is: it would be really difficult to discern

NOTE WE STILL USE DIFF IN DIFF BECAUSE WE STILL WANT TO SEE THE EFFECT OF THE POLICY INTERVATION JUST HERE SUBSECTIONED BY DIFFERENT VARIABLES

GENERAL ASSUMTION: ALL WOMEN ARE SINGLE WOMEN IN THE DATA SET

WE ARE LOOKING AT THE POLICY EFFECT OF INTROUDCING THE TAX CREDIT WHEN CONSIDERING THE SUBSET OF WOMEN WITH CHILDREN and SUBsection HIGH vs low eduction

IMPORTANT: UPDATE THE TABLES AS YOU DID NOT UPDATE THE STARGAZER AFTER THAT ONE!!!

1.6.1 Women with Children compared based on high & low education levels

1. report the same insight as you did during class!
2. IMPORTANT: CHECK AND CALCULATE THE TABLE CONTENTS AGAIN! THERE MIGHT BE SOME NUMBERS OFF!!

1.6.2 Women with and without Children compared keeping education level (low) constant

Table 6: Subsection Analysis Single Women with Children for alternating low/ high education levels

	Dependent variable:					
	earn		finc		work	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5,316.131***	1,448.297	10,126.090***	1,096.734	0.424***	0.533***
	(701.736)	(1,409.668)	(738.891)	(1,473.471)	(0.023)	(0.047)
edu_lvllow	3,427.529***	3,177.416**	3,629.042***	3,079.124**	−0.002	−0.006
	(1,311.705)	(1,306.105)	(1,381.156)	(1,365.220)	(0.044)	(0.044)
dperiod	1,241.689***	1,368.092***	1,308.968***	1,799.017***	0.032**	0.010
	(413.039)	(432.758)	(434.908)	(452.345)	(0.014)	(0.014)
age		174.206***		272.964***		0.004***
		(20.082)		(20.991)		(0.001)
urate		−34.414		261.583**		−0.025***
		(127.034)		(132.784)		(0.004)
nonwhite1		−2,547.489***		−3,380.644***		−0.061***
		(368.752)		(385.442)		(0.012)
edu_lvllow:dperiod	−871.461	−951.502	−1,166.212	−1,345.136*	−0.021	−0.019
	(773.065)	(767.593)	(813.996)	(802.335)	(0.026)	(0.026)
Observations	7,819	7,819	7,819	7,819	7,819	7,819
R^2	0.005	0.020	0.004	0.033	0.002	0.016
Adjusted R^2	0.004	0.020	0.003	0.033	0.001	0.016
Residual Std. Error	14,923.420	14,810.030	15,713.570	15,480.340	0.499	0.495
F Statistic	12.717***	26.977***	9.460***	44.915***	4.884***	21.557***

Note: N = 7819 Single Women have Children. N = 5593 high education (years of eduction >= 9 years); N = 2226 low education (years of eduction < 9 years); Non Robust Standard Errors applied. "White" is reference category for "non-White" categorical variable.

Table 7: Subsection Analysis Single Women with/ without Children for constant (low) education levels

	Dependent variable:					
	earn		finc		work	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	11,066.700***	4,281.758	17,494.530***	8,507.214***	0.501***	0.441***
	(1,457.343)	(2,602.848)	(1,534.185)	(2,735.084)	(0.038)	(0.068)
has_children1	−2,323.038	−2,402.722	−3,739.399*	−3,267.950	−0.080	−0.087
	(2,026.514)	(2,030.169)	(2,133.367)	(2,133.311)	(0.053)	(0.053)
dperiod	783.677	1,378.102	322.393	1,127.629	−0.004	−0.007
	(858.662)	(882.127)	(903.937)	(926.943)	(0.023)	(0.023)
age		29.868		83.479***		0.001
		(29.856)		(31.373)		(0.001)
urate		651.163***		845.832***		−0.002
		(216.731)		(227.742)		(0.006)
nonwhite1		332.812		−2,403.220***		0.081***
		(664.392)		(698.146)		(0.017)
has_children1:dperiod	−413.449	−475.403	−179.637	−152.761	0.015	0.012
	(1,194.473)	(1,193.612)	(1,257.455)	(1,254.253)	(0.031)	(0.031)
Observations	4,311	4,311	4,311	4,311	4,311	4,311
R^2	0.006	0.009	0.010	0.016	0.003	0.008
Adjusted R^2	0.006	0.008	0.009	0.015	0.002	0.007
Residual Std. Error	18,962.540	18,944.100	19,962.390	19,906.540	0.498	0.497
F Statistic	9.304***	6.559***	14.690***	11.920***	4.494***	6.121***

Note: N = 4311 Single Women have Children (years of eduction < 9 years). N = 2085 has no children; N = 2226 has children; Non Robust Standard Errors applied. "White" is reference category for "non-White" categorical variable.

2 Tart 2 Instrumental Variable approach

Notes: - Effect of cumpulsory schooling on wages

Generaly: the quality and quantitiy of education in modern societies is on a steady rise; but it is difficult how much education contributes to future earnings on the labor market.. meansing: how much does one year of additional education add in earnings

This is because of unobserved factors that are to the detrimetn of assumtion 3 (mean independence) biasing any OLS estimate of wages on years of eduction (ommitted variables and confounders).

Here the solution: instruments to circumvent these biases; combining to characteristics: –¿ Minimum legal school dropout age (which can be 16, 17, or 18 years) –¿ and the annual quarter of birth of a person

Rational behind these choices: all students born in the sam year are admitted to school in the same cohort (the same class). BUT A student born in eg January reaches the leagal school dropout age earlier than a student born in September 8eg).

–¿ as such, the instruments function as if; we randomize school exposure to students, assuming that in each year, a constant fraction of students drops out of school adn this dorpout pattern is unrelated to when a students is born.

MAIN TASK: Estimate the effect of the yerars of education on the LOG scaled wages

2.1 Task 1: Explain wHY ols is biased here - A3

1. see slide 67;
2. mention that this is a 1930s during the great depression!
3.
4.

mention why Years of education is endogenous

We therefore use geographical proximity to a college when growing up as an exogenous instrument for education

INCLUDE EXOGENEOUS VARIABLES AS WELL IN THE INSTRUMENTAL PART!!!

SLIDE 67 ff IMPORTANT SEE SLIDES 7 ff!!!. –¿ IMPORTANT: ALSO INCLDUE 1) THE METHOD OF IV being different than least squares (it is a method look up in notes) and 2) mention the two requirements for a good Instrument: a) cleanliness no impact on outcome causally only through the biased independent varaible and b) the relevance which is high correlcion with the independent varaibvles that are instrumentalized

In this exercies give two examples of conditions that could bias the estimated education effect if only OLS is used; This means: give examples how the variable YEARSOFEDUCATION is a biased estimator becasue mean independece is violated –¿ the example given was: students preference for education may influence how long they stay in school and how much they earn on the labor market which is simply their ambition; other factors might be: family background and societal status/ socioeconomic status which means something like teen pregnancy OR IN THE 1930s during the great depression just the need to support the family during time of need so you could not go to school

eg IQ is a good thing

2.2 Task 2: Summary statistics for this task

1. remember to describe categorical variables in text
2. add skew and median!!

relevant quantiative variables age, educ (years of education), lnwage(weekly earnings), marrital status; quarter of birth of the recorded child; SMSA: categorical variable where someone lives (urban vs not urban); yob year of birth which is also categorical

–¿ possibly retransform lnwage to just wage by reversing the log scaling

Table 8: Instrumental Vairable Approach Descriptive Statistics of Numeric Indepdenent and Dependent Varaible

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Age	44.645	2.940	40	42	45	47	50
Years of Education	12.770	3.281	0	12	12	15	20
Ln(Wage)	5.900	0.679	−2.342	5.637	5.952	6.257	10.532

Notes: N = 13746; Wage is backwards transformed from lnWage

2.3 Task 3: Diagnositcs of Year Of Birth as instrument: is it any good?

see slide 88; 82

1. here already use the regression outputs from task 4 and also the a correlation table
2. add a plot!!!
3. partial f test for relevance/ strength of the instrument!
4. summary(rslt2SLS.B, diagnostics = TRUE) –¿ see the things in tutorial 2 there I descibe all of it; also the slides are relevant

A good instrument possesses two specifications: it is clean and it is relevant

Cleanlieness: means that the Instrument only has an impact on the outcome through the Indepdendent variable (the to be "instrumentalized" variable); this assumption cannot be tested but is rather grounded in theory (meaning that the instrument is exogeneous – obviously you cannot test exogineity)

Relevantce: Contrarily, this assumption can be tested: it states that the instrument used for the "to be instrumentalize" variable is strong, meaning that there is a relevant correlation between the instrument and the independent variables. Note: a correlation between the instrument adn the independent variables beyond the baised variable is welcome. It only becomes a problem when the instrument and the dependent varaible are related; btu there will always be some correlation in that regard. To this end, an anova is run on the two stage model in order to conduct the F test, which helps with multiple outputs: Wu-Hausman, Sargan, and F test (the former two are only relevant if the model is overidentified by the instrument)

HOW DO I CONDUCT THESE TESTS? CAN I CONDUCT THEM ON THE NORMAL 2SLS via OLS or should I better use the IVreg model?

2.4 Task 4: Conduct IVreg of the effect of effect of education on log wages, using quarter of birth as the instrument; are robust SE needed?

1. IT IS VERY IMPORTANT TO BUILD A QUICK THEORY AND ALSO EXPLAIN WHY THE CONTROL VARIABLES ARE EXOGENOEUS; SO WHY THERE CONTROLS ARE RELEVANT!!!!!
2. also look at the examples in those links how they didd this !

IMPORTANT: IF YOU INCLUDE CONTROL VARIABLES YOU NEED TO ARGUE WHY THEY ARE EXOGENEOUS OR NOT AS THAT THEY ARE INCLDUED INTO THE EQUATION SLIDE 99 IMPORTANT: USE slide 88 as an argument

IMPORTANT: WHEN YOU SAY HOW CONTROL VARIABLES IMPACT THE INDEPENDENT VARIABLE SAY THE INCLUSION OF THE CONTROL VARIABLES ICNREASE IT INTO A CERTAIN DIRECTIOn; SO DEPEDNING ON THE INSTRUMENT VS NORMAL OLS, the variable was biased eg downwards or upwards

2.5 5 –

1. here we do the parital F test on the IV regression!
2. loot in the notes for this lecture to see the argument begind this f test
3. also analyse the hausman and sargan test on the same models as before; IMPORTANT THESE ARE ONLY FOR OVERIDENTIFICATION!!!

Table 9: IV REGRESSION OUTPUT

	Dependent variable:					
	lnwage					
	OLS			*instrumental variable*		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	4.995***	4.601***	4.633***	3.243***	5.892***	3.790***
	(0.004)	(0.018)	(0.250)	(0.524)	(0.082)	(0.406)
educ	0.071***	0.070***	0.099***	0.159***	0.001	0.123***
	(0.0003)	(0.0003)	(0.020)	(0.034)	(0.006)	(0.027)
age		0.004***		0.009***		0.007***
		(0.0004)		(0.002)		(0.002)
married		0.255***		0.233***		0.242***
		(0.003)		(0.009)		(0.007)
Observations	329,509	329,509	329,509	329,509	329,509	329,509
R^2	0.117	0.134	0.098	−0.049	0.002	0.069
Adjusted R^2	0.117	0.134	0.098	−0.049	0.002	0.069
Residual Std. Error	0.638	0.632	0.645	0.695	0.678	0.655
F Statistic	43,782.560***	17,053.180***				

Note: N = HUUUUGE; so degrees of freedom are not reported for F tests

4. important: perform all these tests like in the tutorial and also part 3/4 already!!!! – report all those tests formally in one table!

IMPORTANT: WE DO NOT INCLUDE THE INSTRUMENTS IN OLS BECASUE WE AUSSME THAT THEY DONT HAVE AN IMPACT on the outcome!!!!!! in OLS; SO DONT INCLDUE THEM IN THE OLS OTHERWISE WE GO AGAINST THE UNDERLYING THEORY SLIDE 105 perform partial F test to see whether IV reg is good or not and if it is good then it is better than OLS!

for overidentificaion run another IVREG WITH MORE insturments see introductiomn; then you can interpret the SARGAN AND HAUSMA TEST THINGI

2.6 6 –

1. not clean insutruments! this would lead to violation of mean independence
2. weak insturments leads to mean indepdence violation as well becasue the indstruments simply do not work as they should
3. google some stuff and see internet

reasons: not clear instrument (or not clean) (make a plot; or if the instrument is not relevant or weak)