4.2 The Rubin Causal Model

Friday, September 24, 2021 10:39 AM

Counter Factual Framework

	Yes Coffee	No Coffee	Treatment Effect (Yes - No)	Ta	Yes	No	TT	TU
Hail	89	75	14	1	89		14	
Gus	87	91	-4	0		91		-4
Jake	91	26	65	0		26		65
Kori	84	57	27	1	84		27	
Nicole	92	94	-2	1	92		-2	
Graham	84	90	-6	0		90		-6
Maverick	89	40	49	1	89		49	
		ATE	20.4286		88.500	69.0000		
				OSD	19.5			
						ATT	22	
						ATU		18.3333

	Yes Coffee	No Coffee	Treatment Effect (Yes - No)	Ta	Yes	No		TT	TU	T	Score
Hail	89	75	14	1	89			14		1	89
Gus	87	91	-4	0		91			-4	0	91
Jake	91	26	65	1	91			65		0	26
Kori	84	57	27	1	84			27		1	84
Nicole	92	94	-2	0		94			-2	1	92
Graham	84	90	-6	0		90			-6	0	90
Maverick	89	40	49	1		89		49		1	89
		ATE	20.4286							Combs	35
				OSD	88.25	91.6667	ATT	38.75			
					-3.4167		ATU		-4		

$E(Y^1|T=1)$ obs $\quad T \in (0,1)$

$E(Y^1|T=0)$ unobs

$E(Y^0|T=1)$ unobs

$E(Y^0|T=0)$ obs

$$OSD = E(y^1|T=1) - E(Y^0|T=0)$$

$$OSD = E(Y^1|T=1) - E(Y^0|T=1) + E(y^0|T=1) - E(Y^0|T=0)$$
$$= ATT + \text{selection bias}$$

$$ATE = \frac{n^1}{n} ATT + \frac{n^0}{n} ATU$$

$$\frac{n^1}{n} ATT = ATE - \frac{n^0}{n} ATU$$

$$ATT = \frac{n^0+n^1}{n^1} ATE - \frac{n^0}{n^1} ATU = ATE + \frac{n^0}{n^1}(ATT - ATU)$$

$$OSD = ATT + \text{selection bias} + \frac{n_0}{n_1}(ATT - ATU)$$
Heterogeneity

Fisher's Sharp Null

- exact test
- exact p-value

H_0: No causal effect
H_a: Causal effect