See syllabus

(see syllabus)

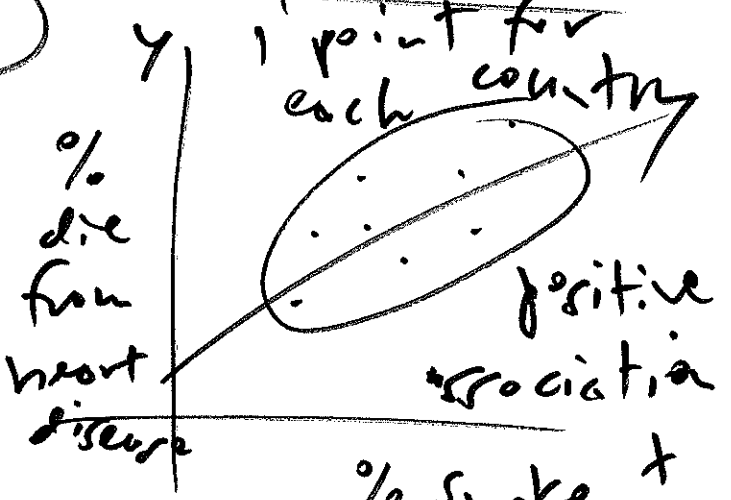
AMS 131
16 April 19

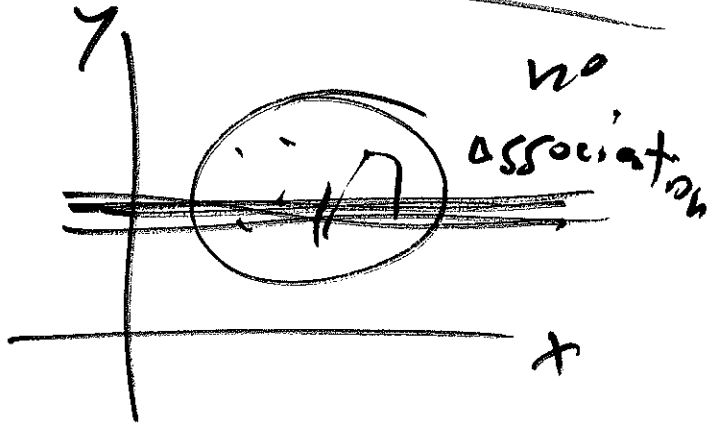
2×2 contingency table (1)

DP?	DW?
no	no

top table

$n = 326$





Y = (outcome)

$= \begin{cases} DP \\ \text{not } DP \end{cases}$

$X = \begin{cases} DW \\ \text{not } DW \end{cases}$

observational study

2

Among: potential (PCFs)

$Z = \begin{cases} VW \\ \text{not } VW \end{cases}$

Disc. Sec. 3

AMS 131
8 Aug 17

case study: death penalty

(effect)
outcome variable (Y): { 1 if death penalty (DP)
0 not

(cause)
predictor variable (X): { 1 if defendant white (DW)
0 not (DB) ← defendant black

basic design: observational study

threat to validity: bias from potential confounding factors (PCFs) $Z_1, \ldots, Z_k$

one possible PCF (Z): { 1 if victim white (VW)
0 not (VB) ← victim black

as Z changes from VB to VW, quite possible that P(DP) ↑

as Z changes from VB to VW, quite possible that P(DW) ↑

so Z (ethnicity of victim) is a PCF; control for it by holding it constant.

study relationship between DP imposition and ethnicity of defendant separately for VB and VW (bottom table) (middle table)

naive analysis based only on top (aggregate) table:

if a murder is charged at random

$P(DP) = \frac{36}{326} \doteq 11.0\%$

$P(DP|DW) = \frac{19}{160} \doteq 11.9\%$

$P(DP|DB) = \frac{17}{166} \doteq 10.2\%$

it appears that white defendants receive the death penalty more often than black defendants, which is a surprise

analysis of middle table (VW)

$P(DP|VW) = \frac{30}{214} \doteq 14.0\%$

$P(DP|VW, DW) = \frac{19}{151} \doteq 12.6\%$

$P(DP|VW, DB) = \frac{11}{63} \doteq 17.5\%$

holding ethnicity of victim constant at White, the rate of imposition of the death penalty rises (!), from 11.0% (top table) to 14.0%, and now Black defendants get the DP more often than White defendants.

$P(DP \mid VB) = \frac{6}{112} = 5.4\%$	holding ethnicity of victim constant at Black, the rate of imposition of the death penalty
$P(DP \mid VB, DW) = \frac{0}{9} = 0\%$	
$P(DP \mid VB, DB) = \frac{6}{103} = 5.8\%$	

falls (!), from 11.0% (top table) to 5.4%, and (again) now Black defendants get the DP more often than White defendants.

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so: overall, in the aggregate (top table), as ethnicity of defendant moves from Black to White, P(DP) goes up, but separately for each of VW (middle table) and VB (bottom table), as ethnicity of defendant moves from Black to White, P(DP) goes down (i.e., the relationship reverses direction): this is a Simpson's Paradox (called) and there's nothing paradoxical going on.

Why did this happen?

① Murder victims typically know their murderer. ④

② In the U.S., white people tend to hang out with white people, and Black with Black.

③ Therefore white defendants are mostly murdering white victims.

④ Judges & juries in the U.S. impose the death penalty more often when the victim is White than when the victim is Black.

Homework for you, not to turn in:

show that ethnicity of victim is indeed a PCF here, by computing and comparing

P(DP)	P(DW)
P(DP | VB)	P(DW | VB)
P(DP | VW)	P(DW | VW)