

Disc.  
Sec.  
3

case study: death penalty

AMS 131  
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(effect)  
outcome variable (E):  $\begin{cases} 1 & \text{if death} \\ 0 & \text{not} \end{cases}$  penalty (1)

(cause)  
predictor variable (X):  $\begin{cases} 1 & \text{if defendant white} \\ 0 & \text{not} \end{cases}$  (DB) or (OW)  
defendant black

basic design:  
observational  
study

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

one possible

PCF (Z):  $\begin{cases} 1 & \text{if victim white (VW)} \\ 0 & \text{not (VB)} \end{cases}$   
← victim black

as Z changes from VB to VW, quite possible that  $P(DP) \uparrow$

from VB to VW, quite possible that  $P(DW) \uparrow$

so Z (~~is~~ <sup>ethnicity</sup> of victim) is

a PCF; control for it by holding it constant.

study relationship between DP imposition<sup>(2)</sup> and ethnicity of defendant separately for

VB and VW  
↑  
(bottom table) (middle table)

naïve 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.

## analysis of bottom table (VB) ③

$$P(DP | VB) = \frac{6}{112} = 5.4\%$$

$$P(DP | VB, DW) = \frac{0}{9} = 0\%$$

$$P(DP | VB, DB) = \frac{6}{103} = 5.8\%$$

holding ethnicity of victim constant at Black, the rate of imposition of the death penalty

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

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, and ~~there's~~ nothing paradoxical going on.

Why did this happen?

① Murder victims typically know their murderer.

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<sub>n</sub> of victim is indeed a PCF here, by computing and comparing

$P(DP)$

$P(DP | VB)$

$P(DP | VW)$

$P(DW)$

$P(DW | VB)$

$P(DW | VW)$