EC203 – Applied Econometrics

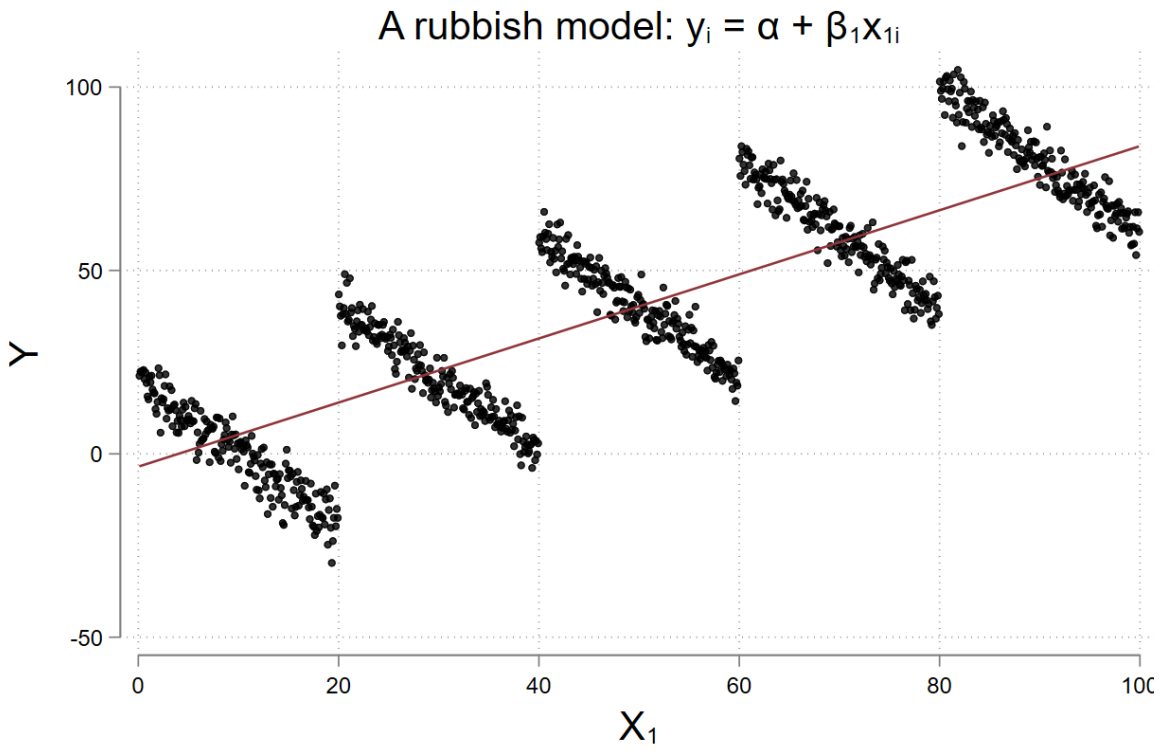
Term 2, Week 7

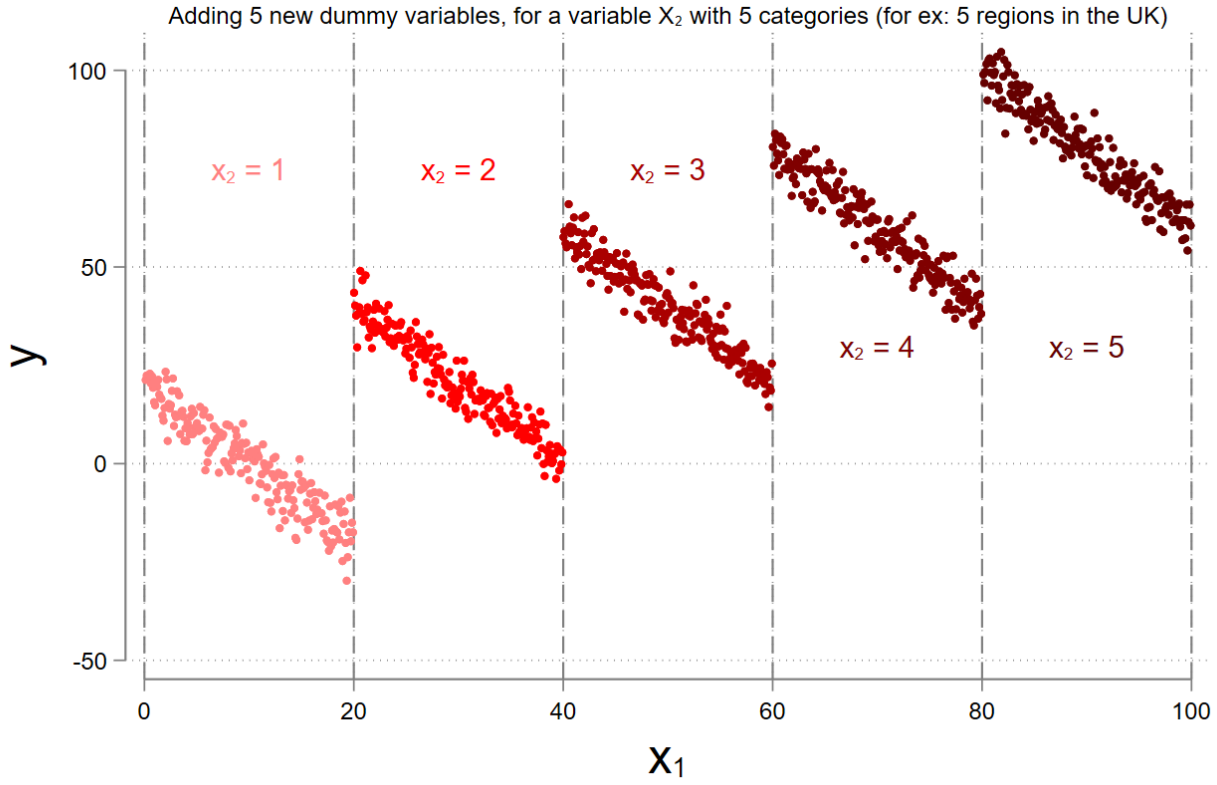
Sushil Mathew

Types of endogeneity

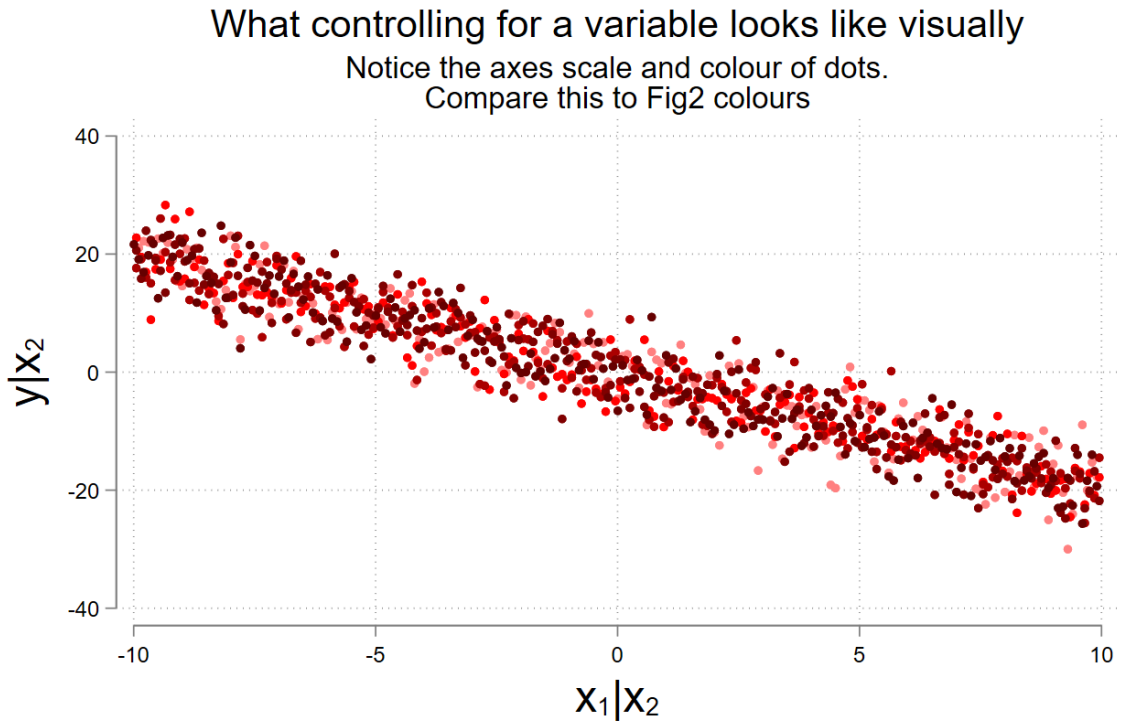
…and ways to fix them

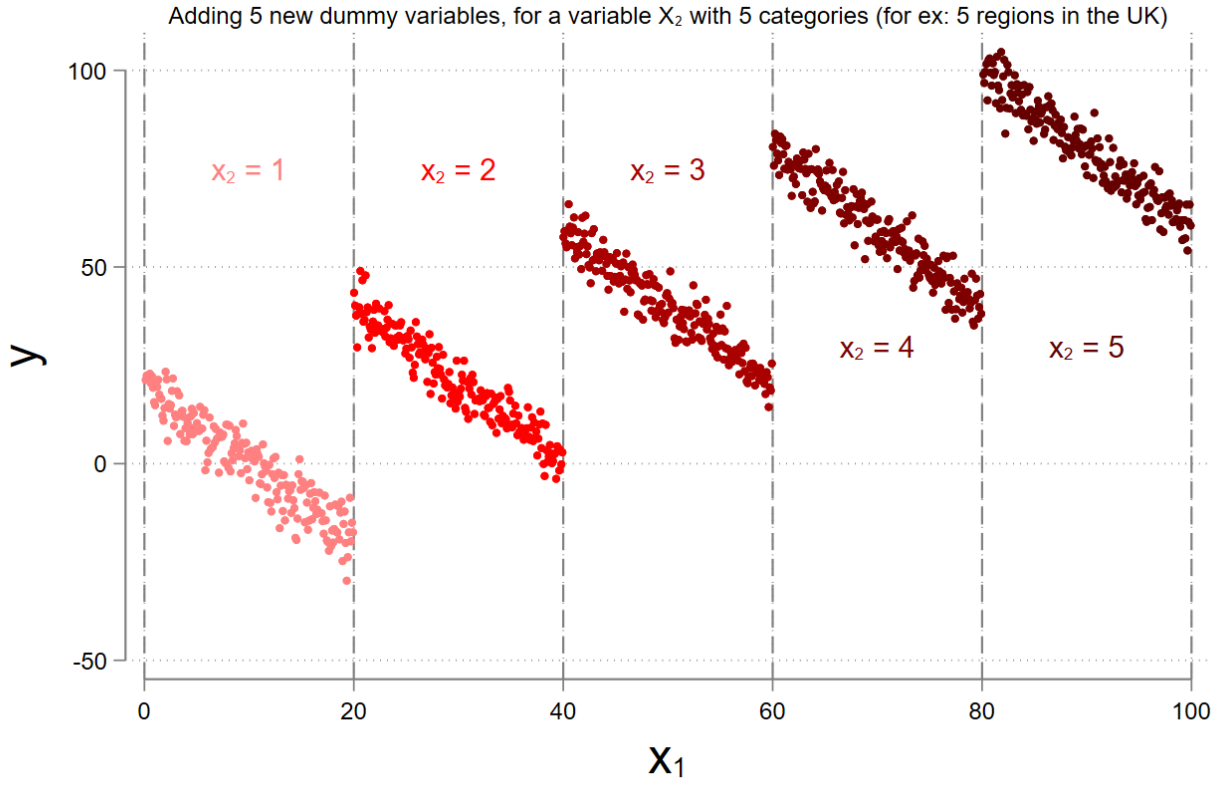
Problem 1: Omitted variable bias



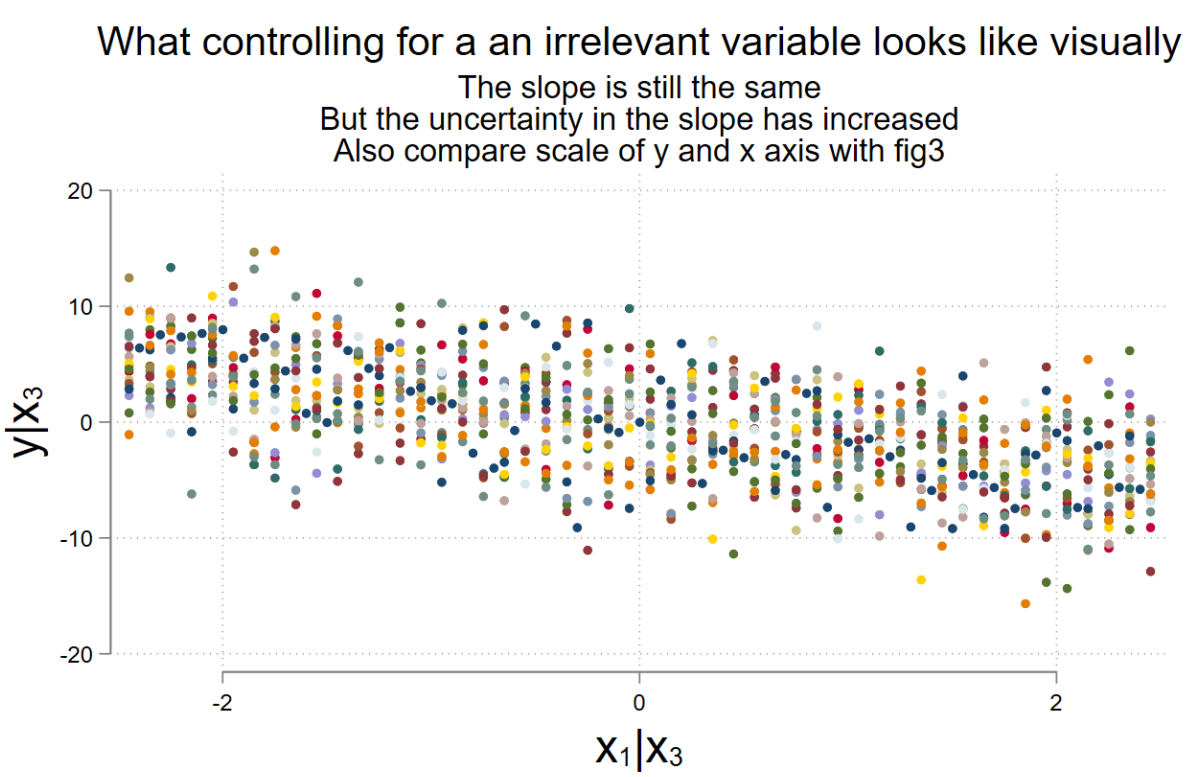


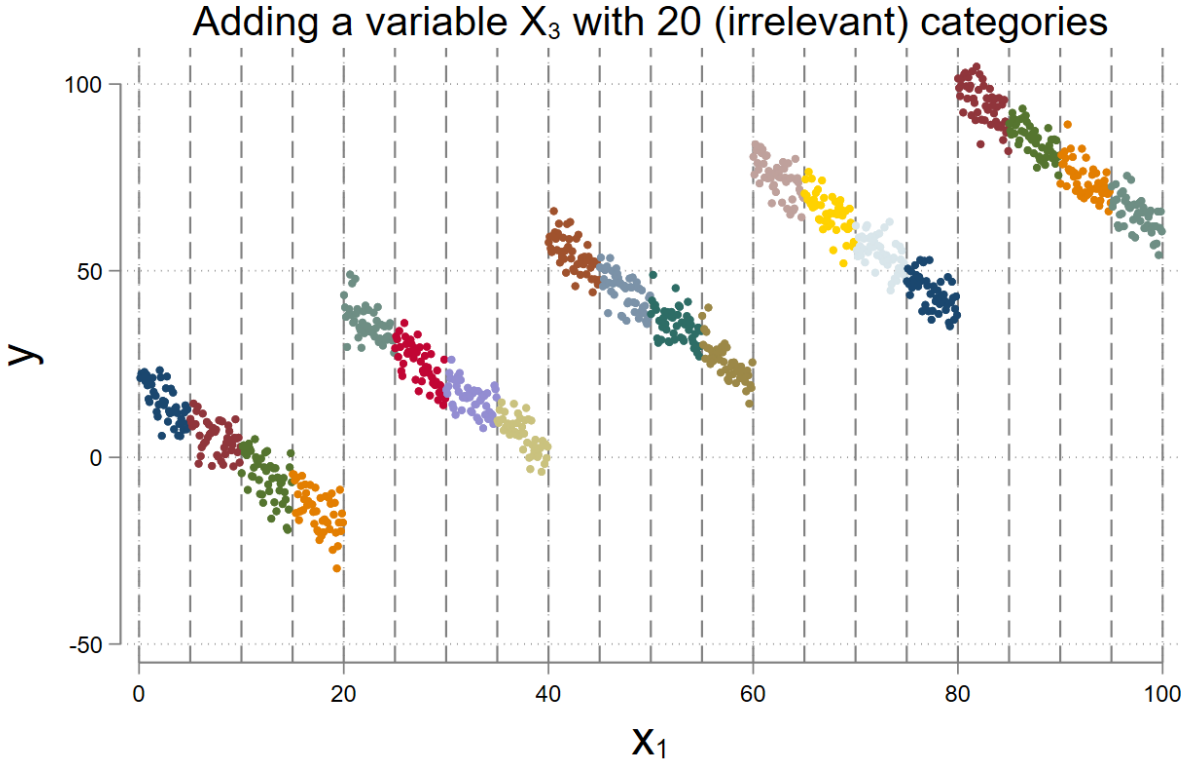
Solution 1.1: Adding variables to a regression is good





Solution 1.1: Not perfect solution





Solution 1.2: Instrumental variables

Problem 2: Reverse causality or simultaneity

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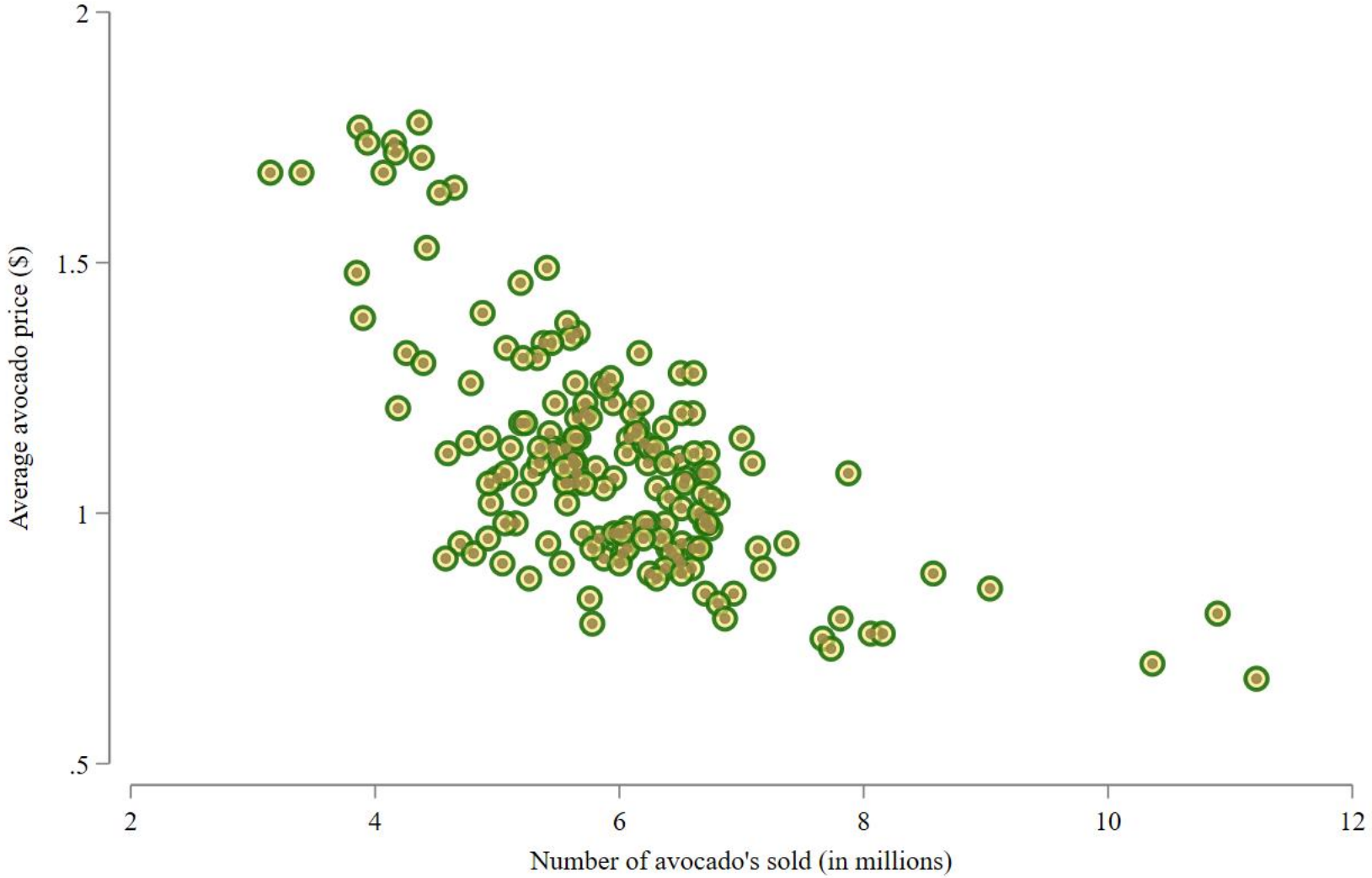
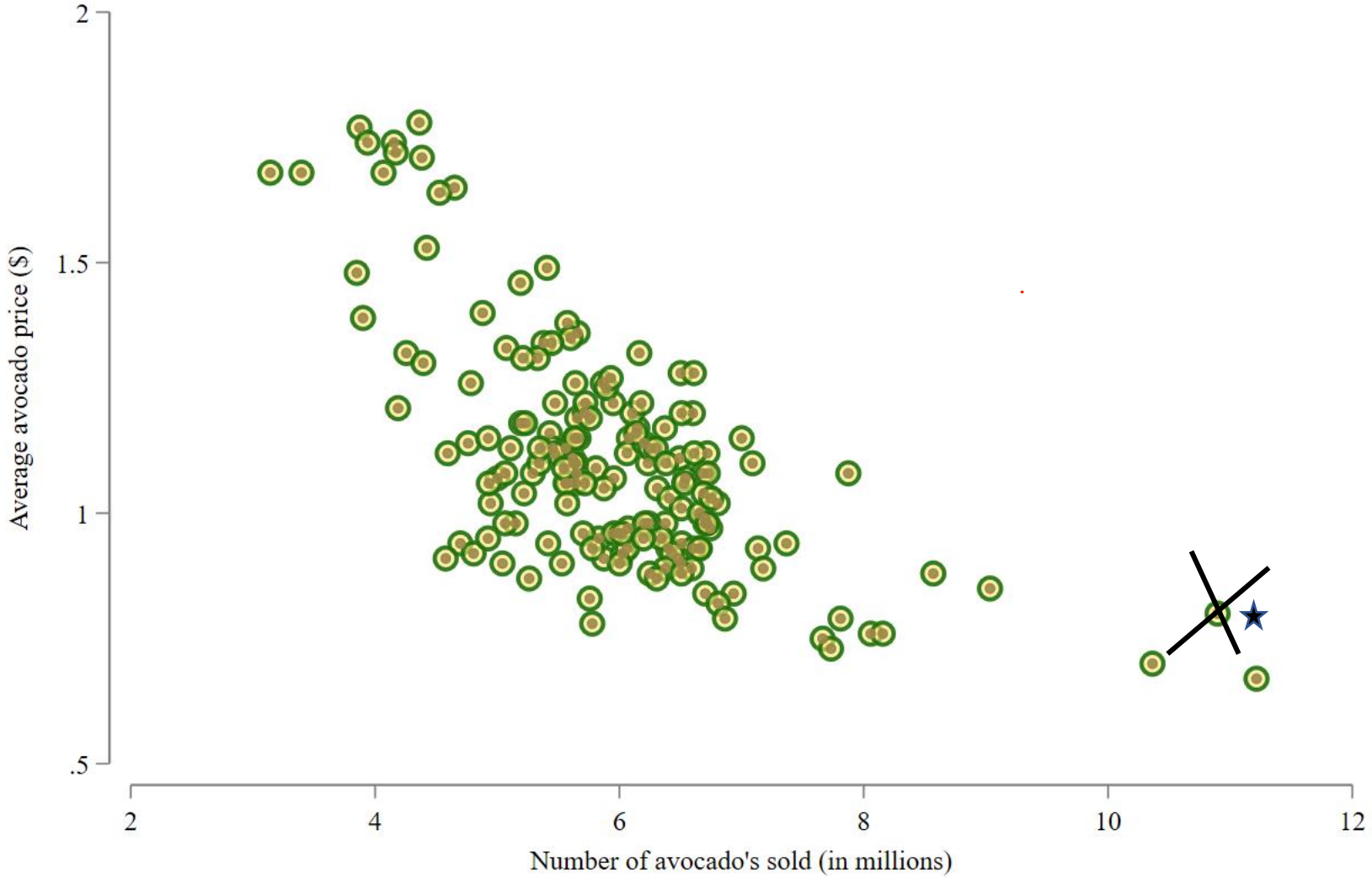


Problem 2: Reverse causality or simultaneity



Solution 2.1: Instrumental variables

Problem 3: Measurement Error

https://twitter.com/simonhhess/status/1590366800687992832

Solution 3.1: Instrumental variables

Endogeneity can be due to

- Omitted variable bias
- Reverse causality/simultaneity
- Measurement error in the x variable.

Endogeneity can be due to

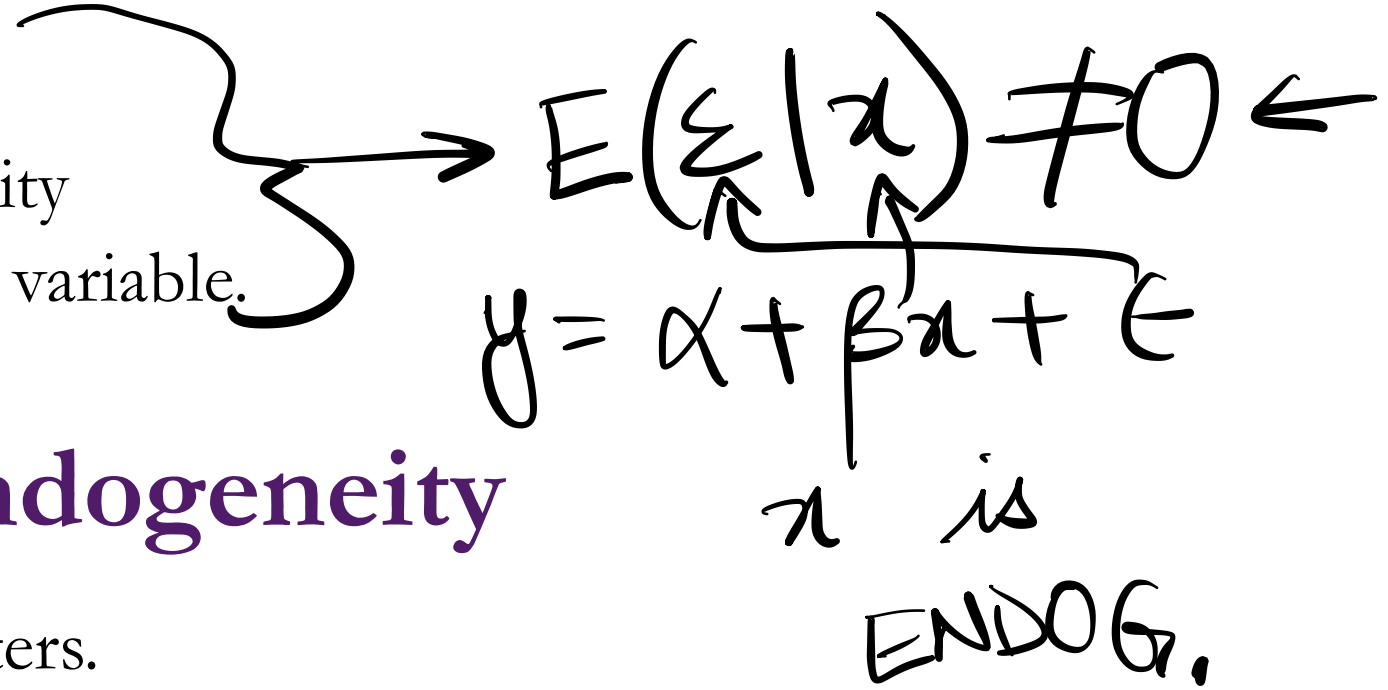
- Omitted relevant variable
- Reverse causality/simultaneity
- Measurement error in the x variable.

Consequence of endogeneity

Bias in the estimated parameters.

Endogeneity can be due to

- Omitted relevant variable
- Reverse causality/simultaneity
- Measurement error in the x variable.



Consequence of endogeneity

Bias in the estimated parameters.

One solution for all these problems

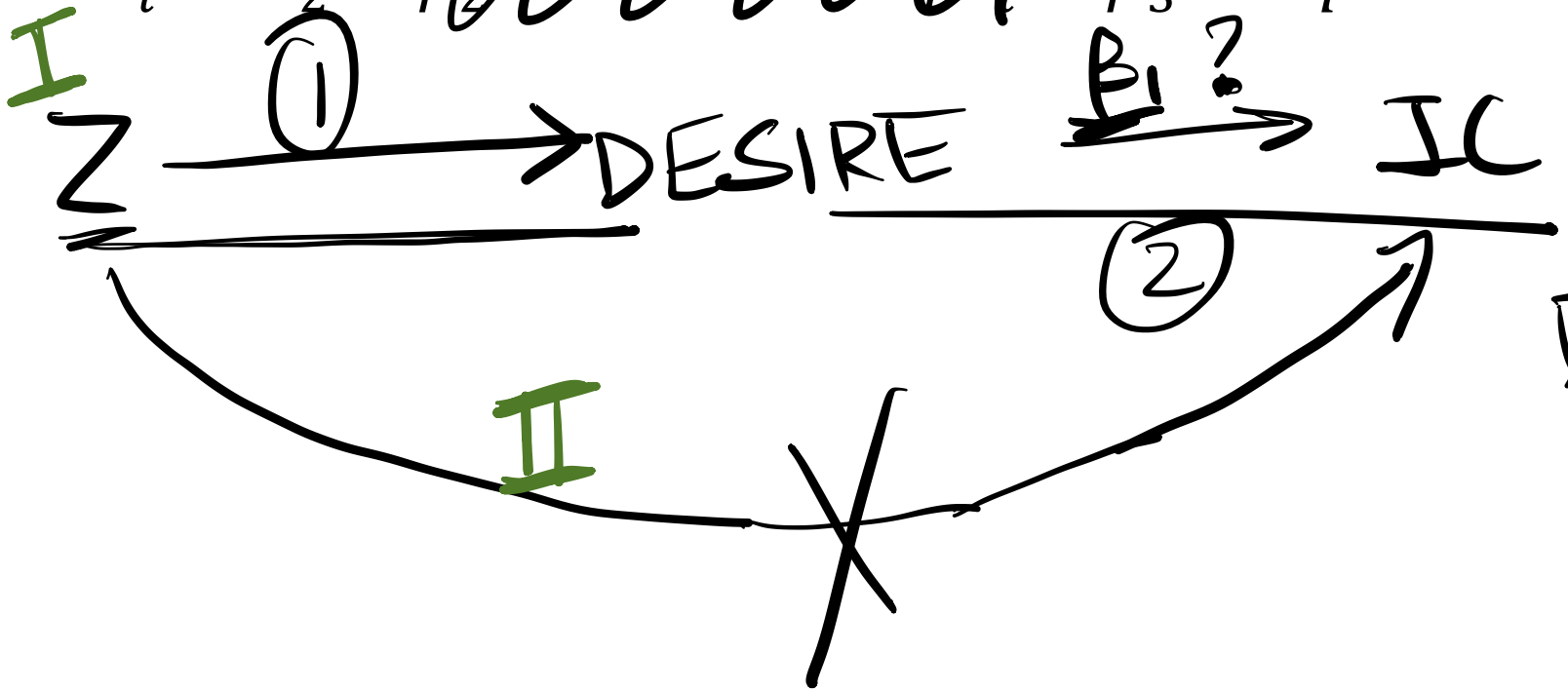
Instrumental variables

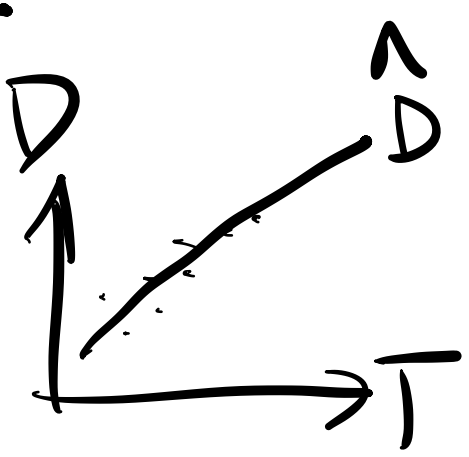
Q1 - 2

Simultaneity/reverse causality

$$IceCreamShops_i = \alpha_1 + \beta_1 Desire_i + \varepsilon_{1i} \quad (A)$$

$$Desire_i = \alpha_2 + \beta_2 IceCreamShops_i + \beta_3 Temperature_i + \varepsilon_{2i} \quad (B)$$





Simultaneity/reverse causality

$$IceCreamShops_i = \alpha_1 + \beta_1 Desire_i + \varepsilon_{1i}$$

$$Desire_i = \alpha_2 + \beta_2 IceCreamShops_i + \beta_3 Temperature_i + \varepsilon_{2i}$$

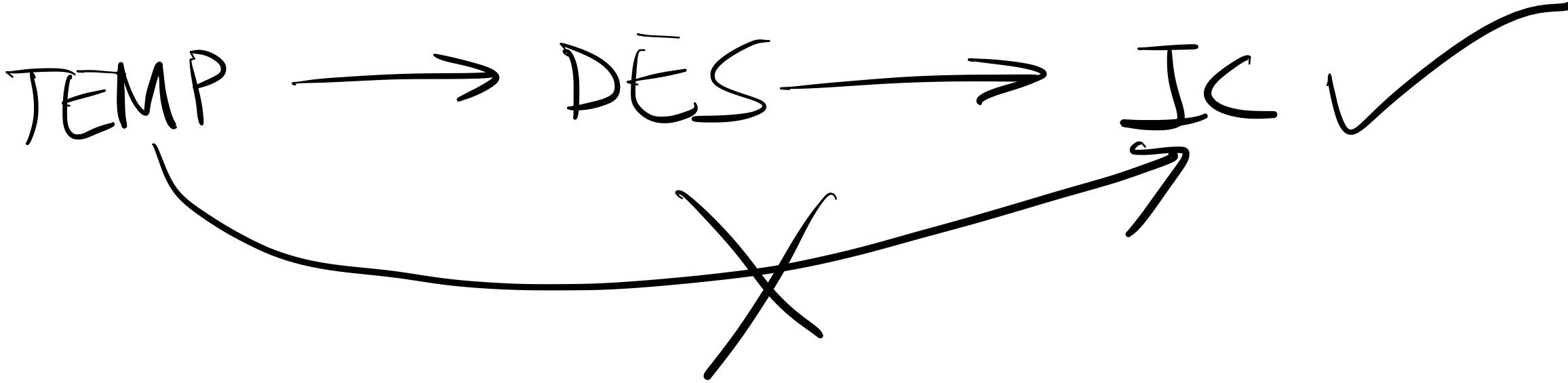
I: RELEVANCE
: $cov(Z, D) \neq 0$

II: IV EXOG.
$cov(Z, \epsilon_1) = 0$

Q1, Q2

$E(\varepsilon_1 \mid \text{Desire}) \neq 0$

$E(\varepsilon_2 \mid \text{Ice Cream Shops}) \neq 0$



Q3

Simultaneity/reverse causality fix

$$IceCreamShops_i = \alpha_1 + \beta_1 Desire_i + \varepsilon_{1i}$$

$$Desire_i = \alpha_2 + \beta_2 IceCreamShops_i + \beta_3 Temperature_i + \varepsilon_{2i}$$

THEOR. MODEL

WE BELIEVE THIS IS TRUE.

$\beta_1 + \left(\beta_1 t_1 \right)$