

EC203 – Applied Econometrics

Term 2, Week 7

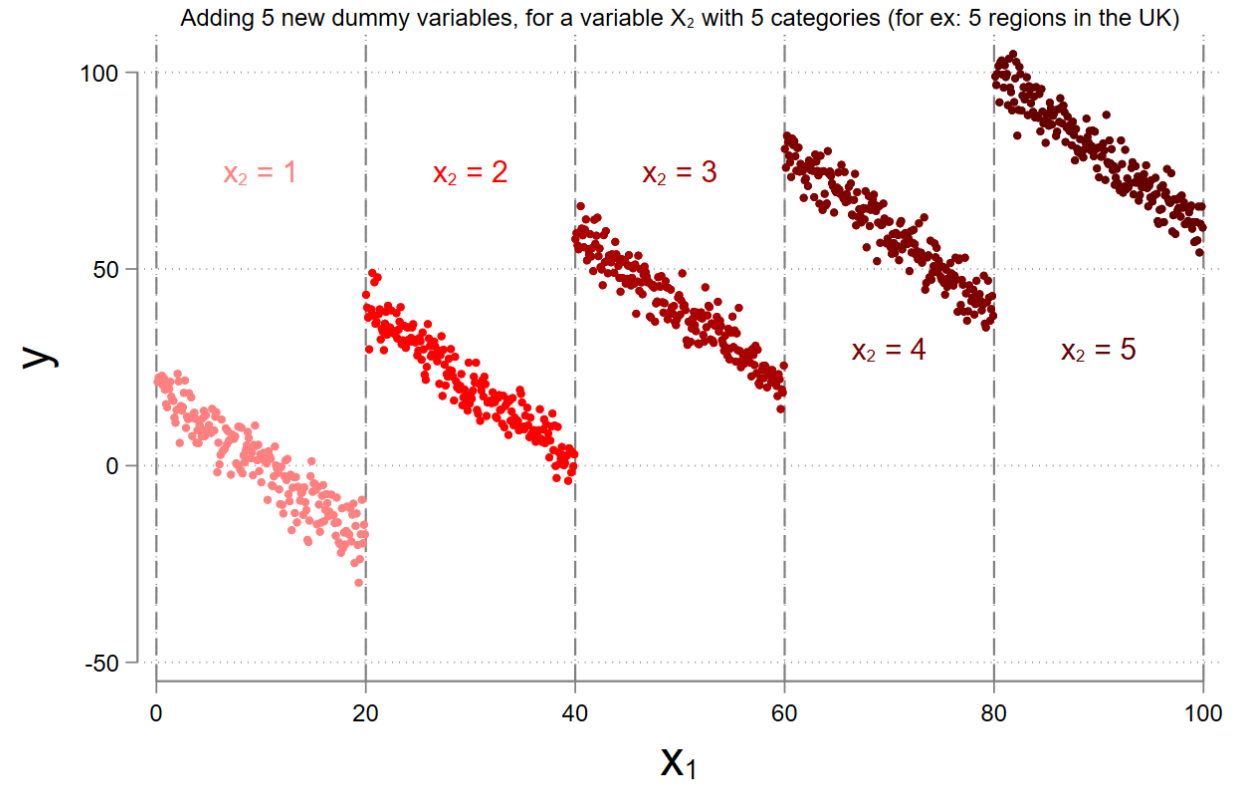
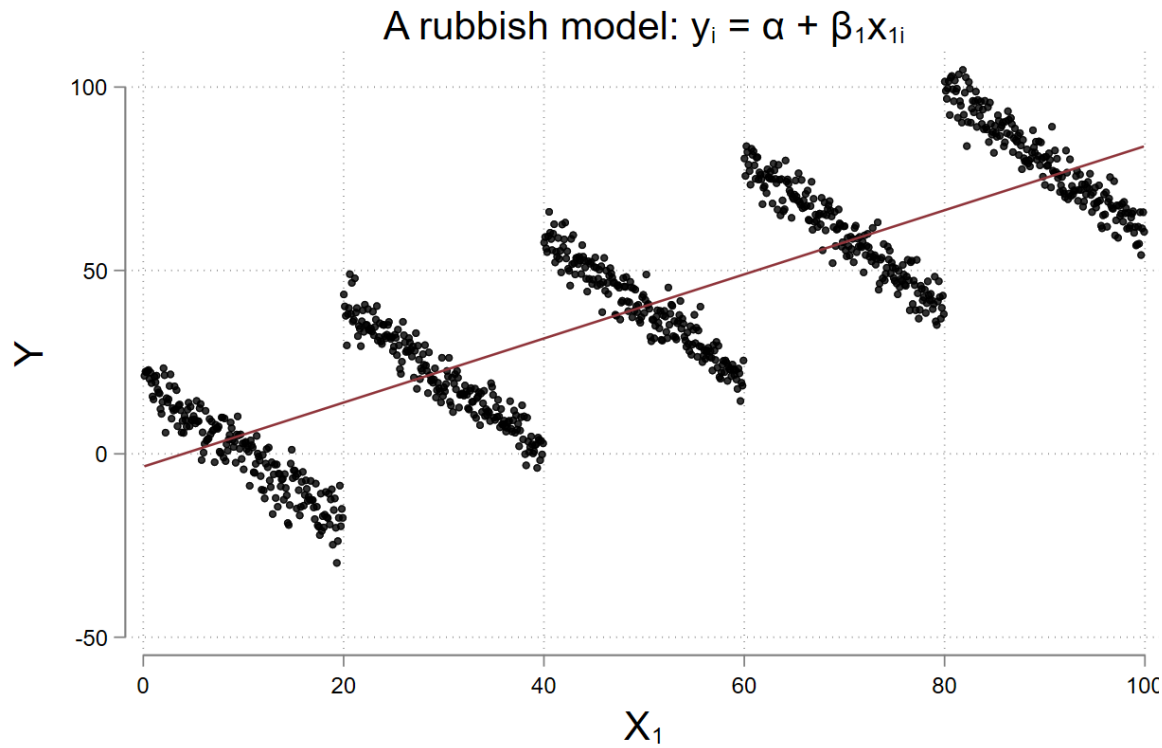
Sushil Mathew



Types of endogeneity

...and ways to fix them

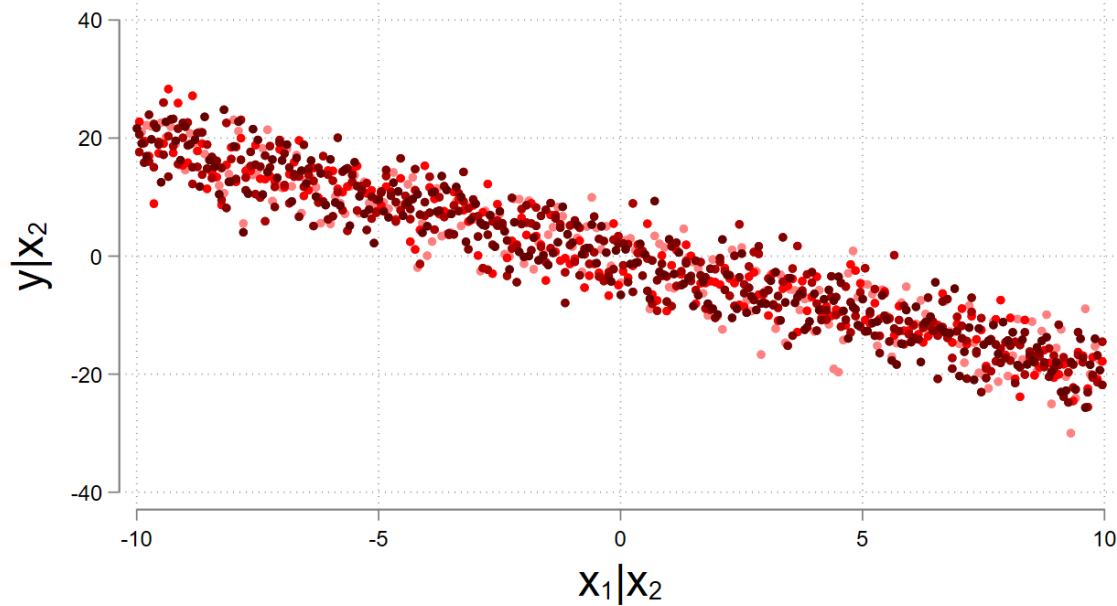
Problem 1: Omitted variable bias



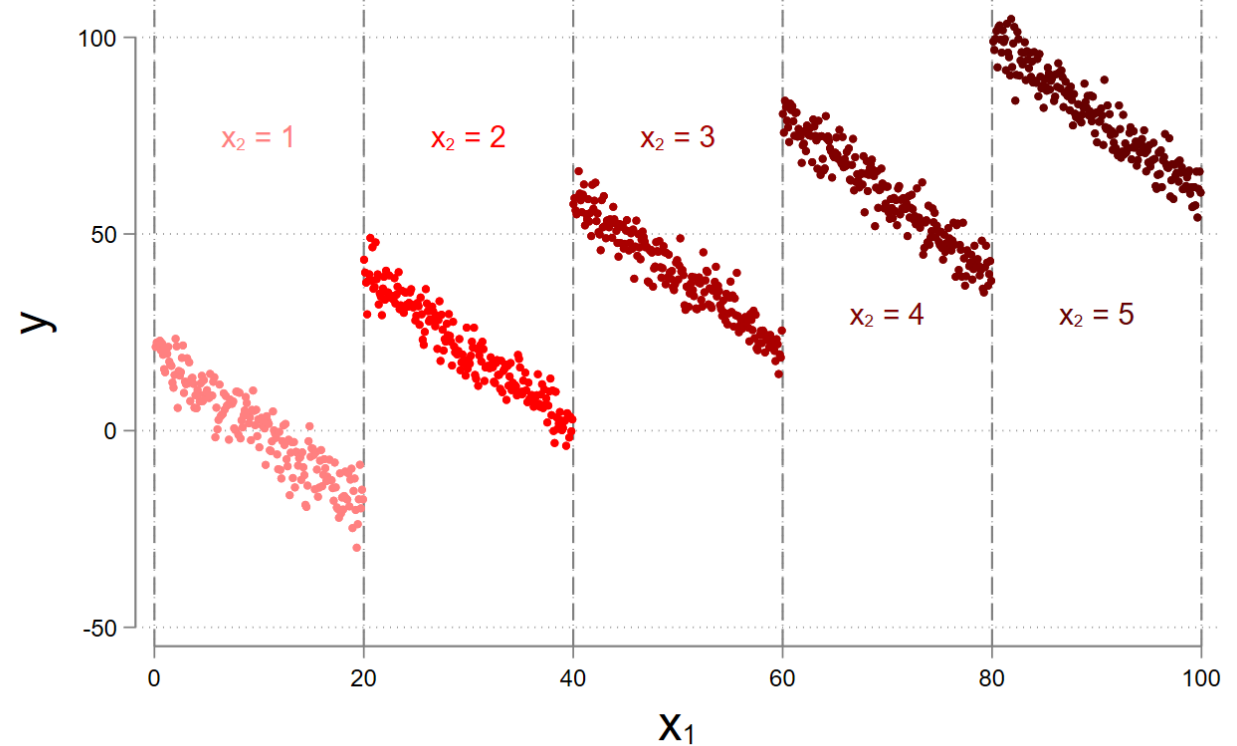
Solution 1.1: Adding variables to a regression is good

What controlling for a variable looks like visually

Notice the axes scale and colour of dots.
Compare this to Fig2 colours



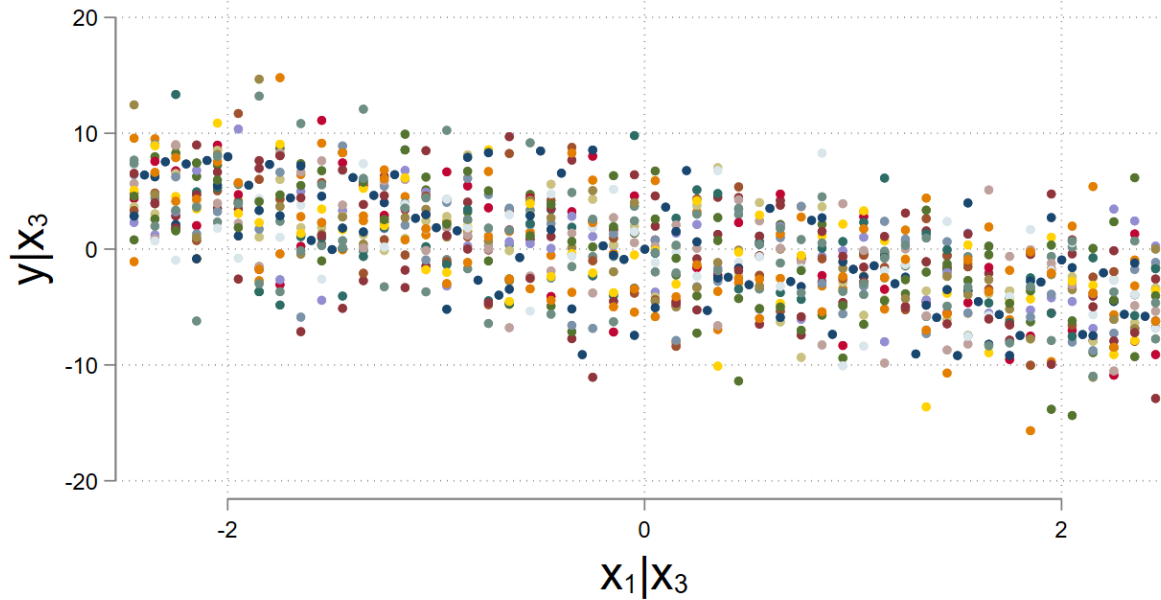
Adding 5 new dummy variables, for a variable X_2 with 5 categories (for ex: 5 regions in the UK)



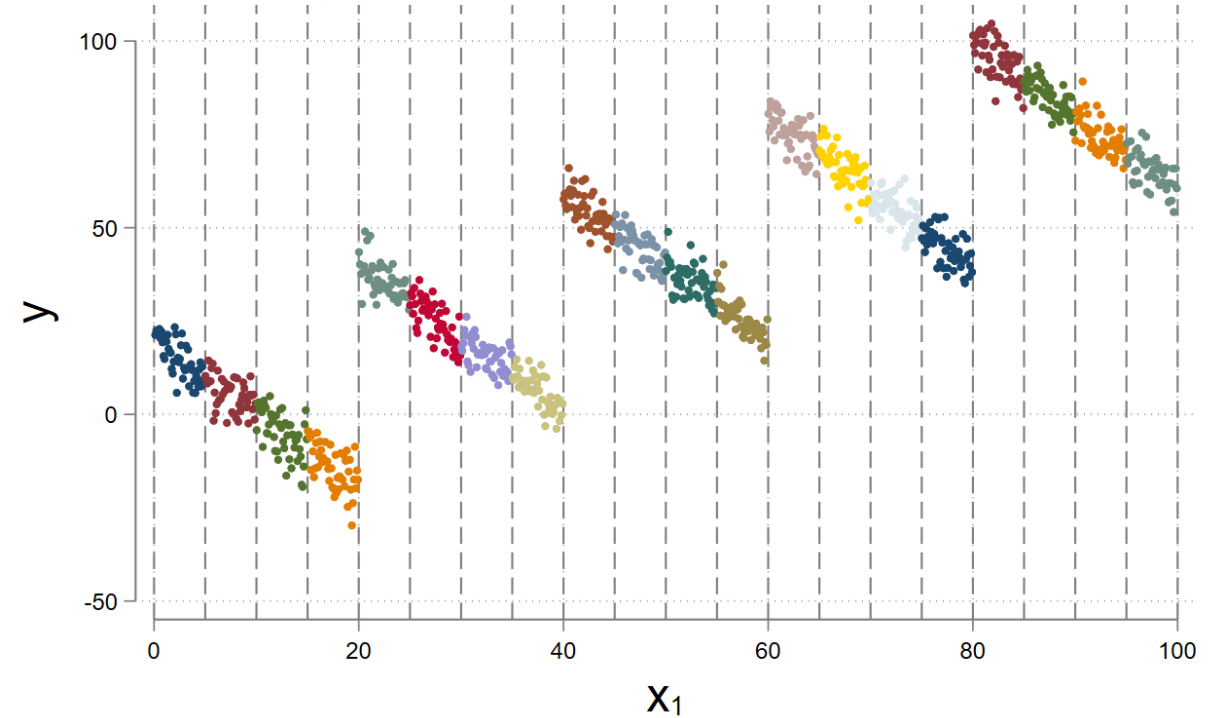
Solution 1.1: Not perfect solution

What controlling for an irrelevant variable looks like visually

The slope is still the same
But the uncertainty in the slope has increased
Also compare scale of y and x axis with fig3



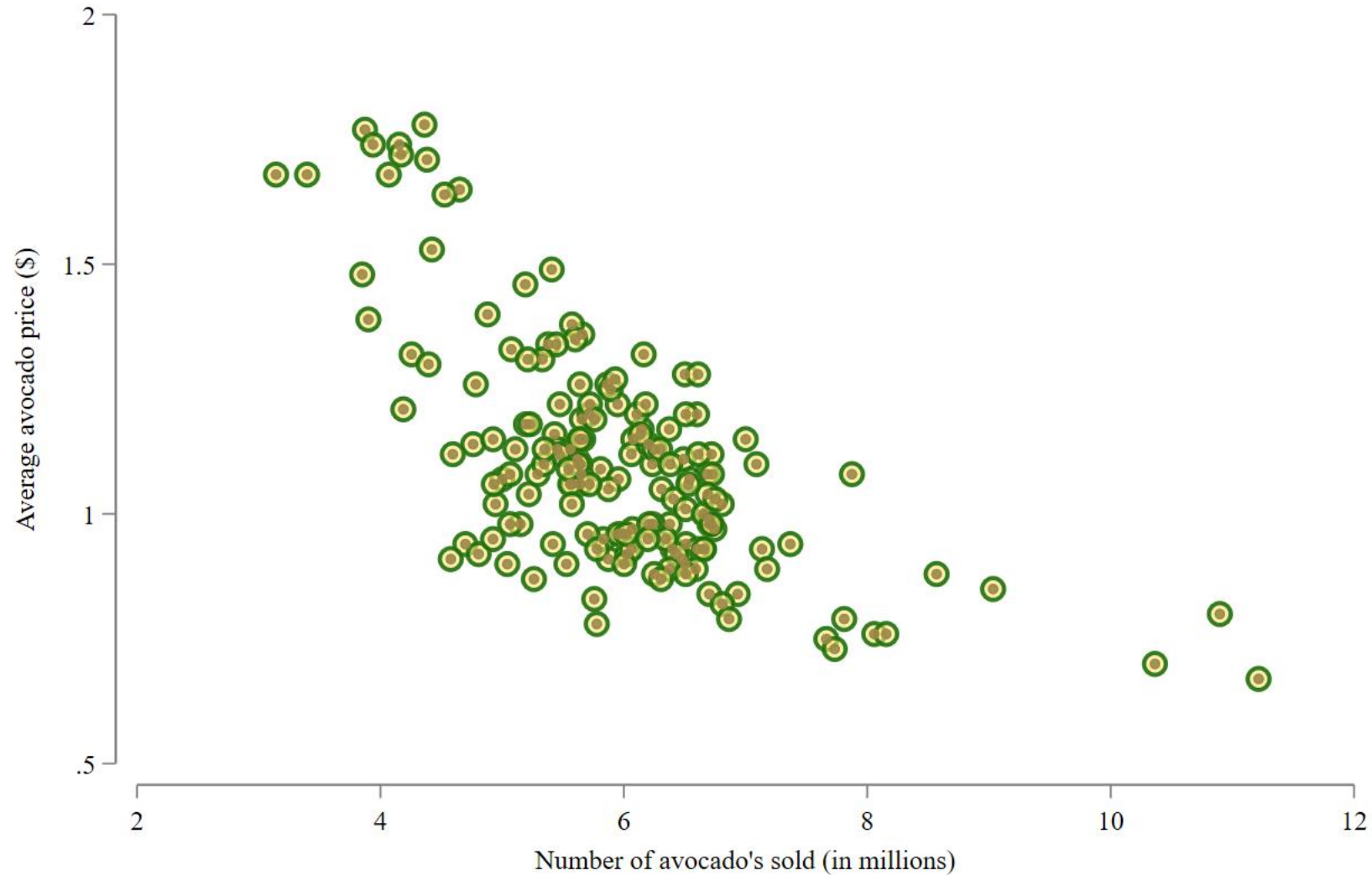
Adding a variable X_3 with 20 (irrelevant) categories



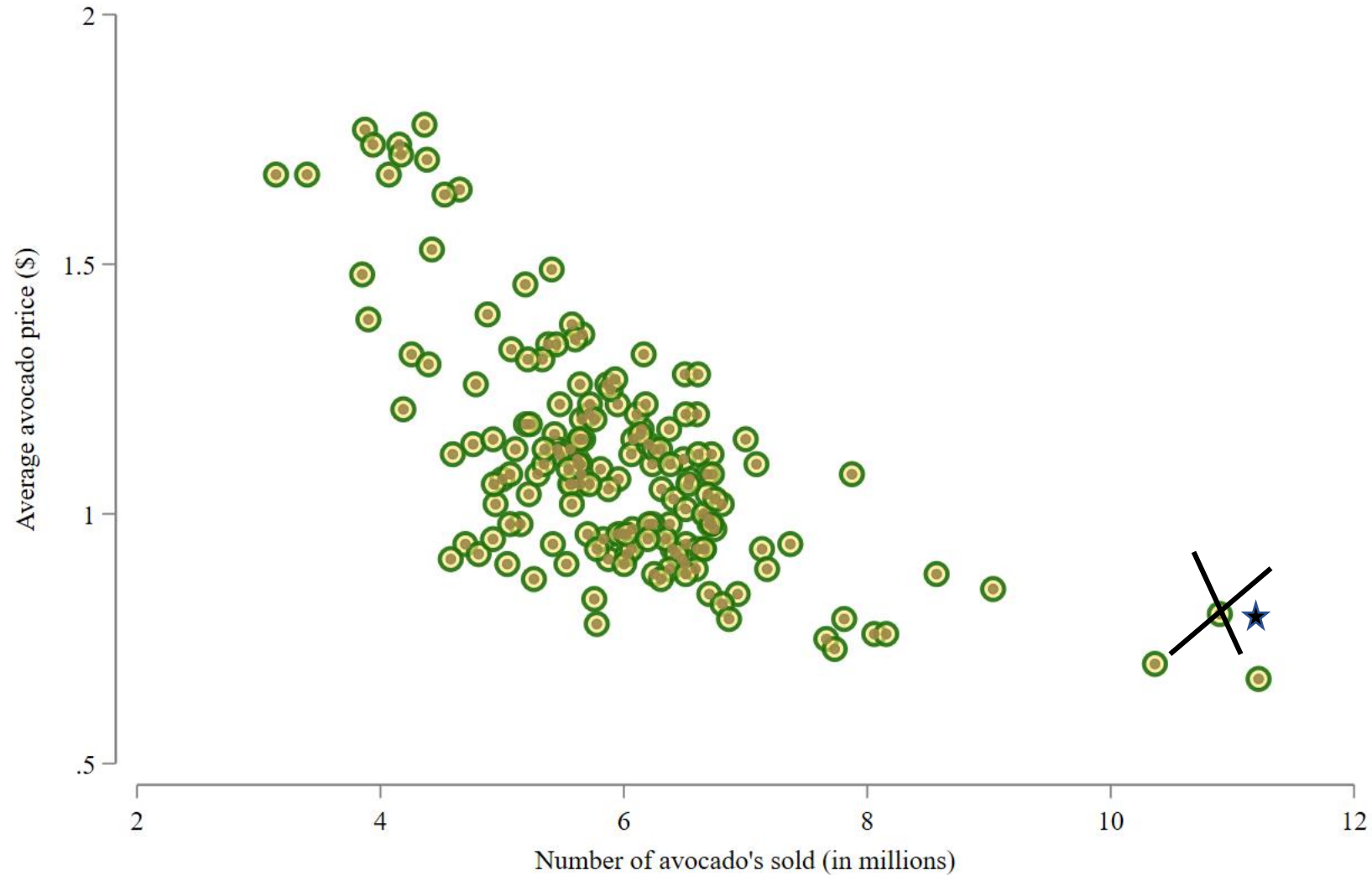
Solution 1.2: Instrumental variables

Problem 2: Reverse causality or simultaneity

Problem 2: Reverse causality or simultaneity



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

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

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

Simultaneity/reverse causality

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

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

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

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

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