#### Suppose we fit

$$Y = \beta_0 + \beta_1 x + \epsilon$$
 (for data with  $x \le 550$ )  
 $Y = \beta_2 + \beta_3 x + \epsilon$  (for data with  $x > 550$ )

#### What's wrong with this approach?

- A Nothing
- B It uses only about half the data to fit each line
- C The "for data  $\dots$ " makes the model nonlinear in the  $eta_j$
- D The slope changes
- E The two lines above are functionally independent, whereas they should be functionally dependent.



$$Y = \beta_0 + \beta_1 x + \epsilon$$
 (for data with  $x \le 550$ )  
 $Y = \beta_2 + (\beta_1 + \beta_3)x + \epsilon$  (for data with  $x > 550$ ),

where the two lines join at 
$$x = \kappa_1 = 550$$
, i.e.,

$$\beta_0 + \beta_1 \times 550 = \beta_2 + (\beta_1 + \beta_3) \times 550$$

Rewrite this linear dependency in the form  $\beta_2 = \dots$ 

A 
$$\beta_2 = 0$$

$$\beta_2 = \beta_0 - \beta_3 \times 550$$

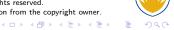
C 
$$\beta_2 = -\beta_0 + \beta_3 \times 550$$

D 
$$\beta_2 = \beta_0 - \beta_3 x$$

$$\mathsf{E} \ \beta_2 = \beta_0 \times 550 - \beta_3.$$

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$$Y = \beta_0 + \beta_1 x + \epsilon$$
 (for data with  $x \le 550$ )  
 $Y = \beta_0 + \beta_1 x + \beta_3 (x - 550) + \epsilon$  (for data with  $x > 550$ )

In the **X** matrix, what is the formula that gives the third column (corresponding to  $\beta_3$ )?

- A x
- $B x^2$
- Cx 550
- D |x 550| (absolute value)
- E max(0, x 550) (max is applied to each element of x separately).





Recall that to simplify the activity, we suppose x only takes the values

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Numerically, what is the last column of the **X** matrix?

- A (400, 450, 500, 550, 600, 650, 700)<sup>T</sup>
- B  $(150, 100, 50, 0, 50, 100, 150)^T$
- $(-150, -100, -50, 0, 50, 100, 150)^T$
- $D(0,0,0,550,600,650,700)^T$
- $E(0,0,0,0,50,100,150)^T$ .



$$R^2 = 0.9242 (K = 5)$$

$$R^2 = 0.9247 \ (K = 10)$$

Which model predicts better?

- A It's impossible to say
- B K = 10 because it has the larger  $R^2$  value
- C K = 5 because it has the smaller  $R^2$  value
- D K = 10 because it is more flexible
- $\mathsf{E} \ \mathsf{K} = \mathsf{5} \ \mathsf{because} \ \mathsf{it} \ \mathsf{is} \ \mathsf{simpler}.$

