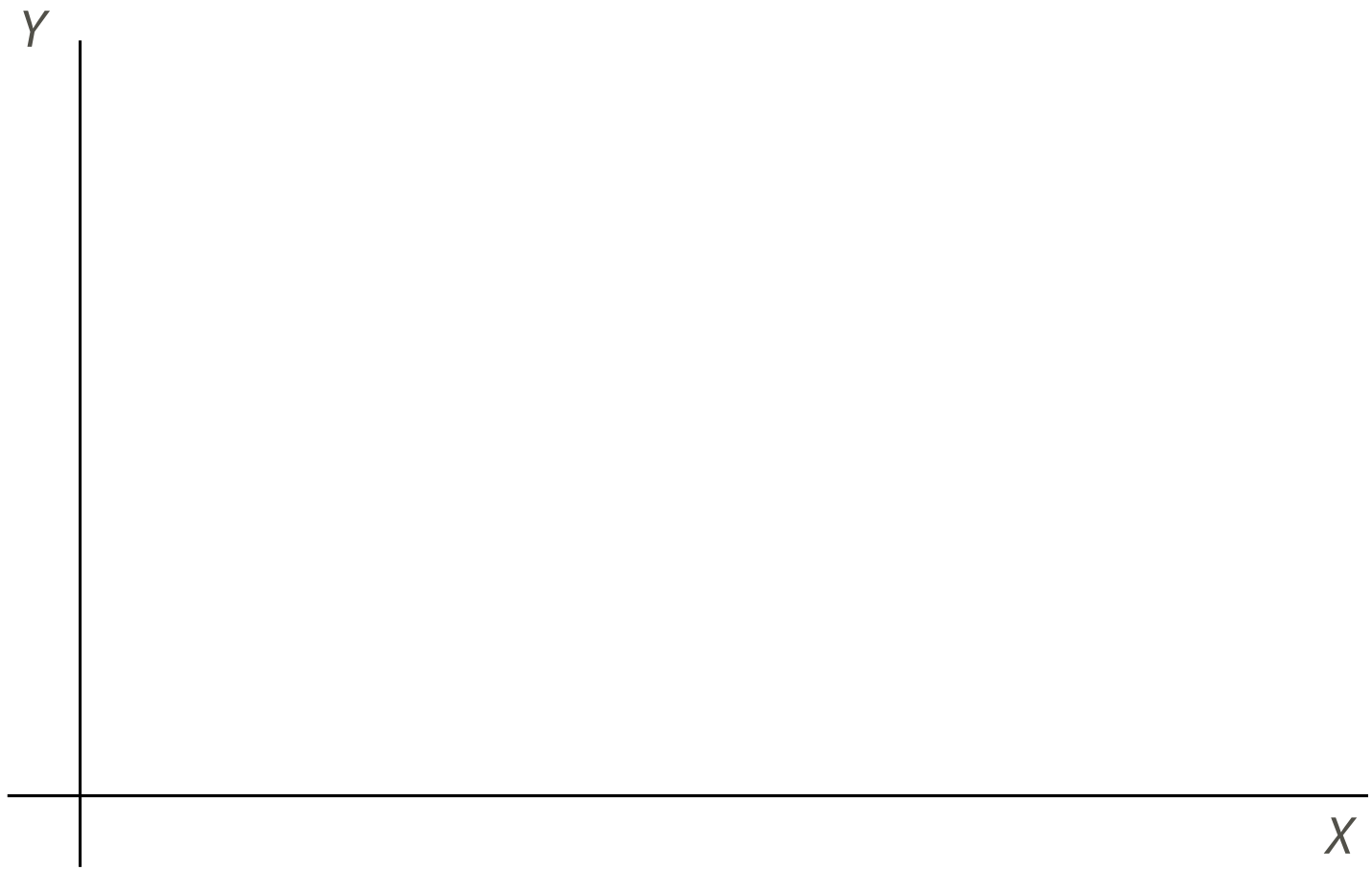
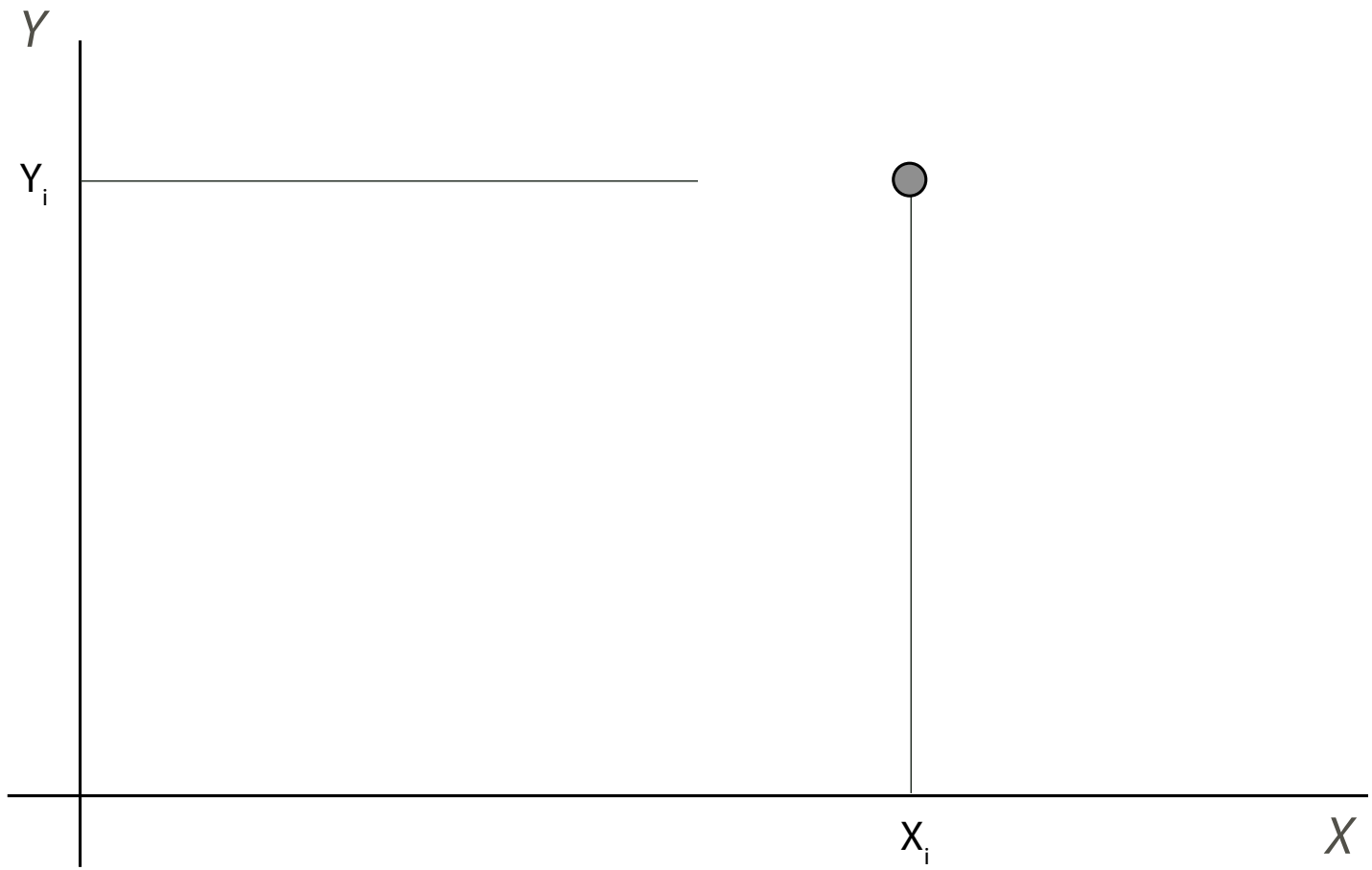
Key to R^2: Breakdown of Variation of Y



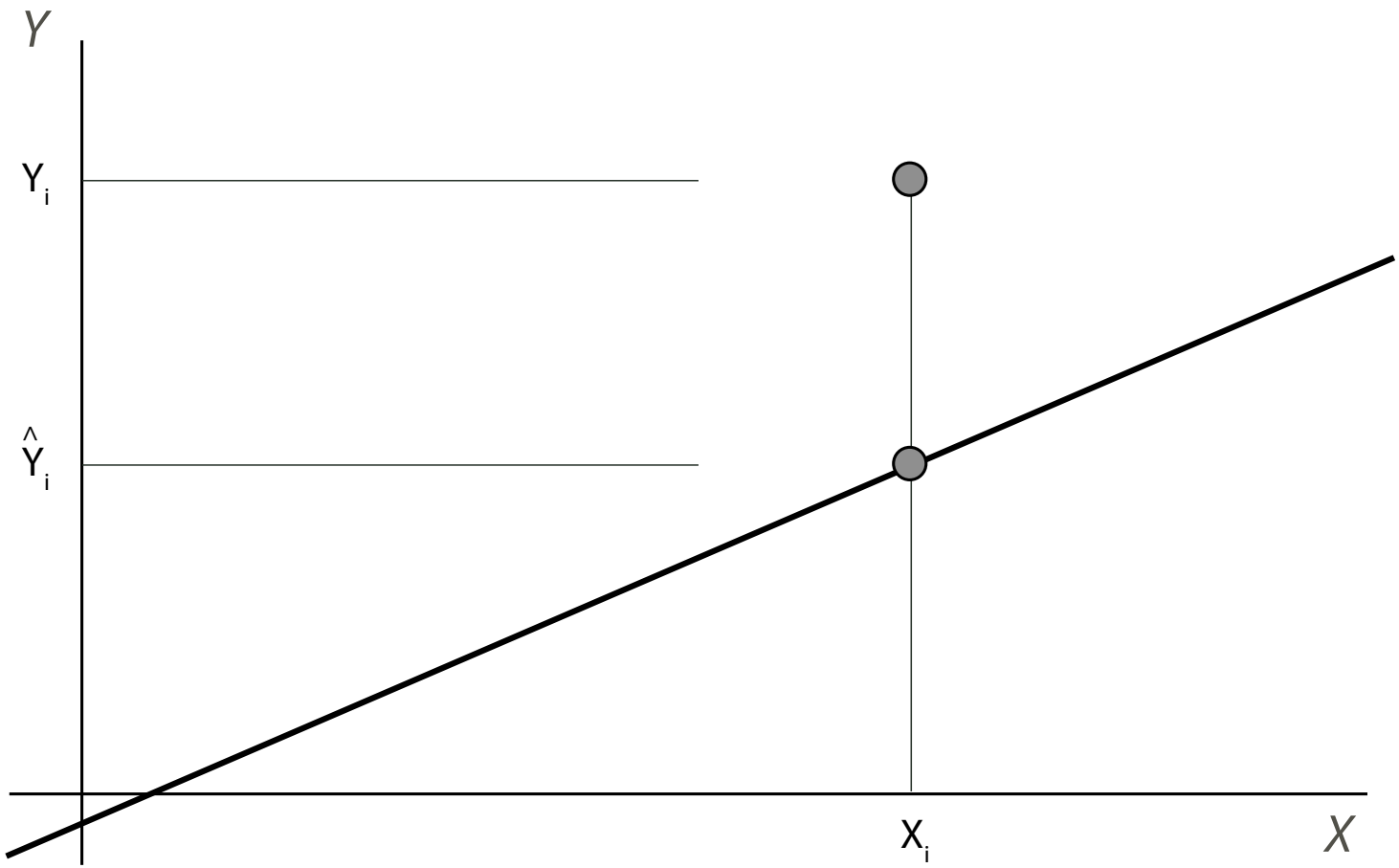
Axes for Response Variable Y and Predictor Variable X

Key to R^2: Breakdown of Variation of Y



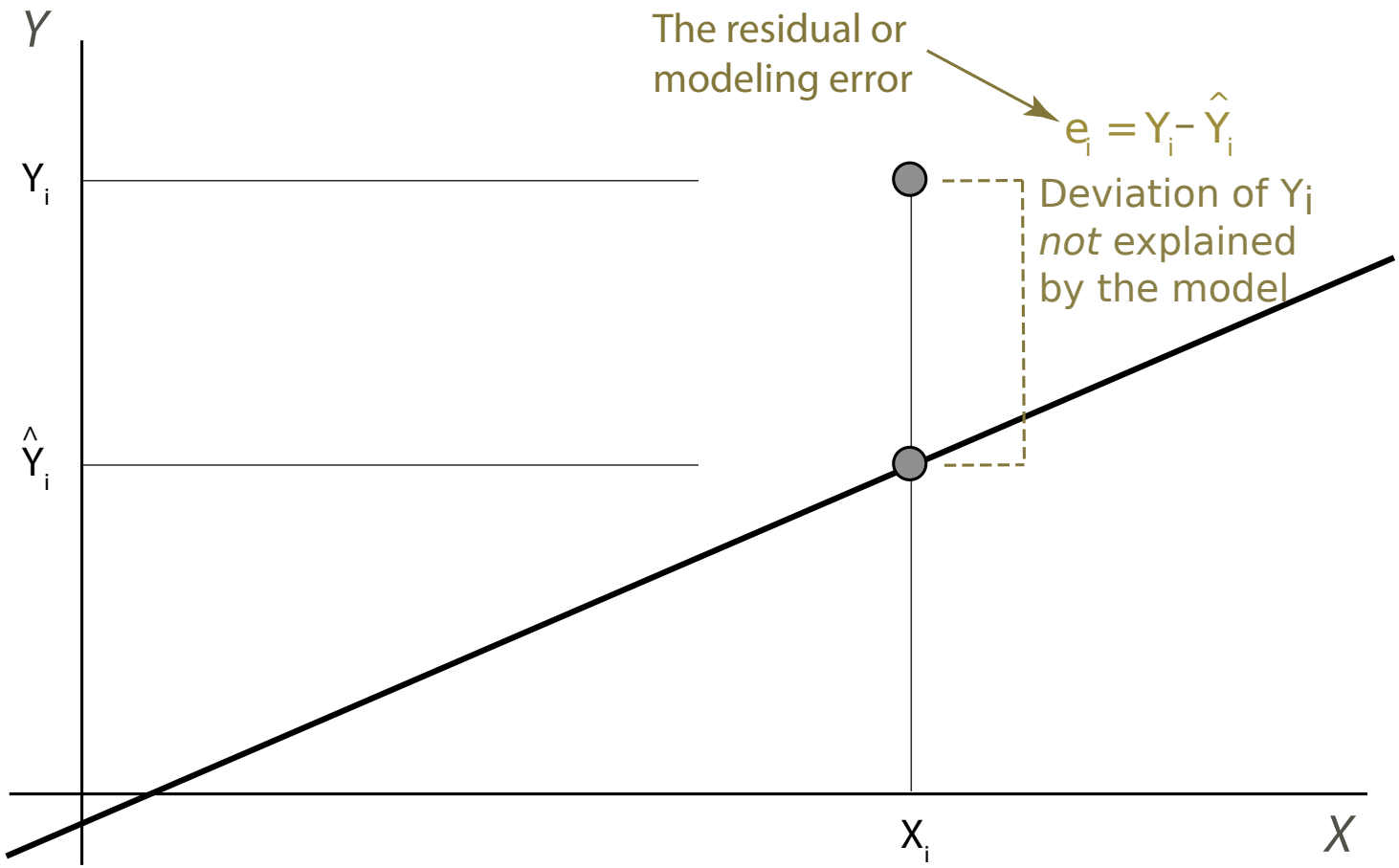
Paired data values for i^{th} row, $< X_i, Y_i >$, a single point

Key to R^2: Breakdown of Variation of Y



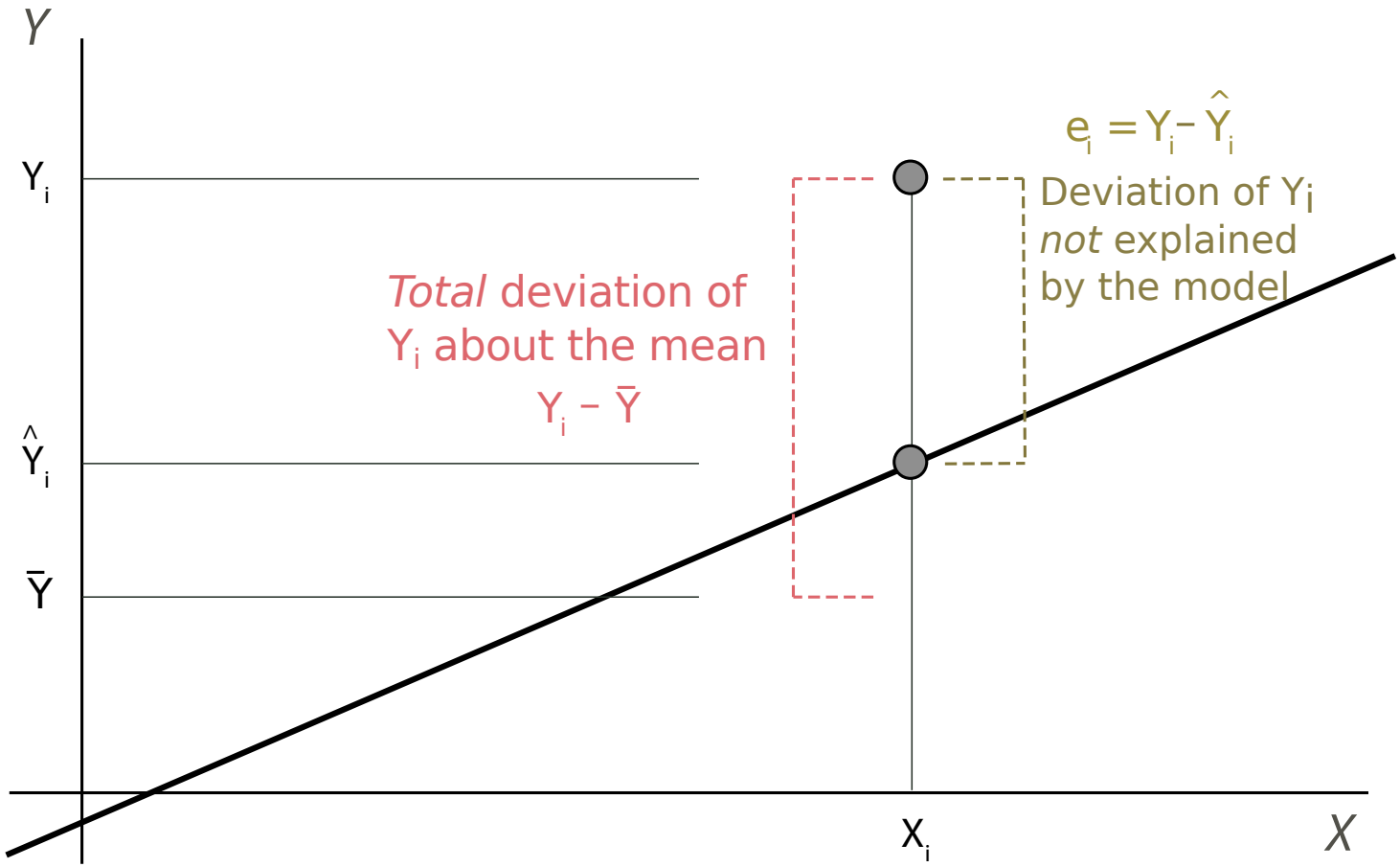
Consider the regression line and fitted value of Y_i, $\hat{Y}_i$

Key to R^2: Breakdown of Variation of Y



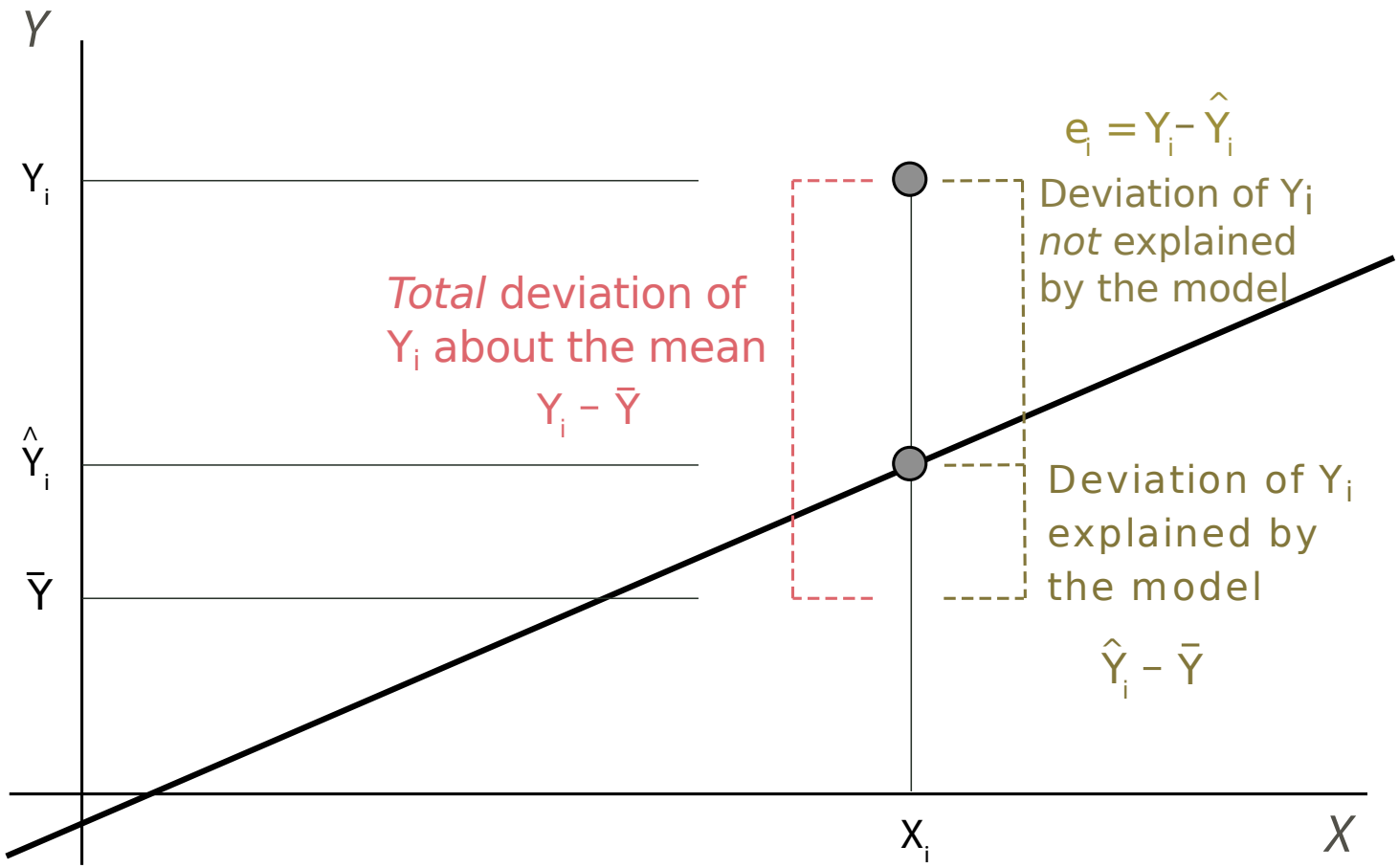
Modeling error is distance of Y_i from $\hat{Y}_i$

Key to R^2: Breakdown of Variation of Y



Consider also the total deviation of Y, $Y_i - \bar{Y}_i$

Key to R^2: Breakdown of Variation of Y



total deviation = explained deviation + unexplained deviation

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term

Key to R^2: Breakdown of Variation of Y

Explained and unexplained variation

- Express the result from the previous figure as an equation
- Express the total deviation in Y_i in terms of what is explained and what is not explained by the model
- The relation is additive
- Begin with the total deviation about the mean: $Y_i - \bar{Y}$
- $Y_i - \bar{Y} = Y_i - \bar{Y}$
- Now just add $-\hat{Y} + \hat{Y} = 0$ to the right side of the equation
- $Y_i - \bar{Y} = (Y_i - \hat{Y}) + (\hat{Y} - \bar{Y})$
- Total deviation =
  Unexplained deviation + Explained deviation
- This result generalizes to the computation of the corresponding sum of squared deviations for each term