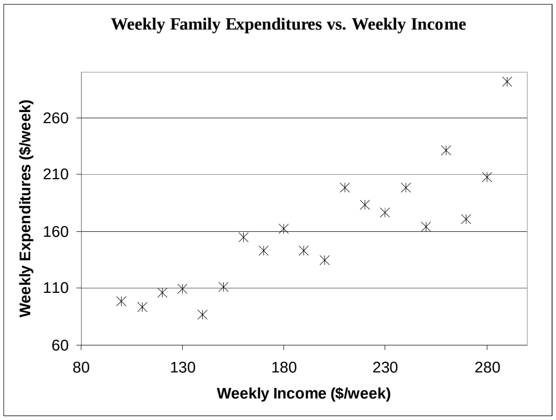
III. Simple Regression.

A. Introduction
B. Population Regression Equation
C. Sample Regression Equation
D. Ordinary Least Squares
E. Classical Regression Model.
F. Properties of OLS Estimators (**BLUE**)
G. Estimator for σ^2
H. Inference
I. Goodness of Fit
J. Forecasting or Prediction

I. Goodness of Fit

1. **Objective** – a summary statistic that tells us how well our model "fits the data."
   - Estimators for E[Y], we now have two. What are they?

2. Measures for the Dependent Variable:
   - Y_i :
   - $\bar{Y}$:
   - $\hat{Y}_i$:



Decomposition in terms of distances (deviations):

- Total Deviation:
- Explained Deviation:
- Unexplained Deviation:

These deviations always add-up:

3. Sums of Squares
   - We want to know how we did on average.
   - But, summing deviations always gives zero.
   - Square them! Then sum:

The Sums of Squared Deviations always add-up:

4. R^2 a measure of Goodness of Fit.

- What we have: ***TSS = ESS + RSS***
- Form a ratio:
- Interpretation:
- Range of possible R^2 values:

J. Prediction or Forecasting

1. Predicting or Forecasting Population Values. (Estimation)
   - What two population values for Y could we predict?

2. Estimators – what estimator do we have for each of these population values?
   - Mean prediction: $E[Y \mid X_0] = \beta_0 + \beta_0 X_0$
   - Estimator: $\hat{Y}_0 = \hat{\beta}_0 + \hat{\beta}_0 X_0$
   - Standard Error:

$$s_{\hat{Y}_0} = \sqrt{\hat{\sigma}^2 \left[\frac{1}{n} + \frac{(X_0 - \bar{X})^2}{\sum x_i^2} \right]}$$

   - Individual Prediction: $Y \mid X_0 = \beta_0 + \beta_0 X_0 + u_0$
   - Estimator: $\hat{Y}_0 = \hat{\beta}_0 + \hat{\beta}_0 X_0$

$$s_{Y_0} = \sqrt{\hat{\sigma}^2 \left[1 + \frac{1}{n} + \frac{(X_0 - \bar{X})^2}{\sum x_i^2} \right]}$$