Economics 471: Econometrics

University of Alabama

Department of Economics, Finance and Legal Studies

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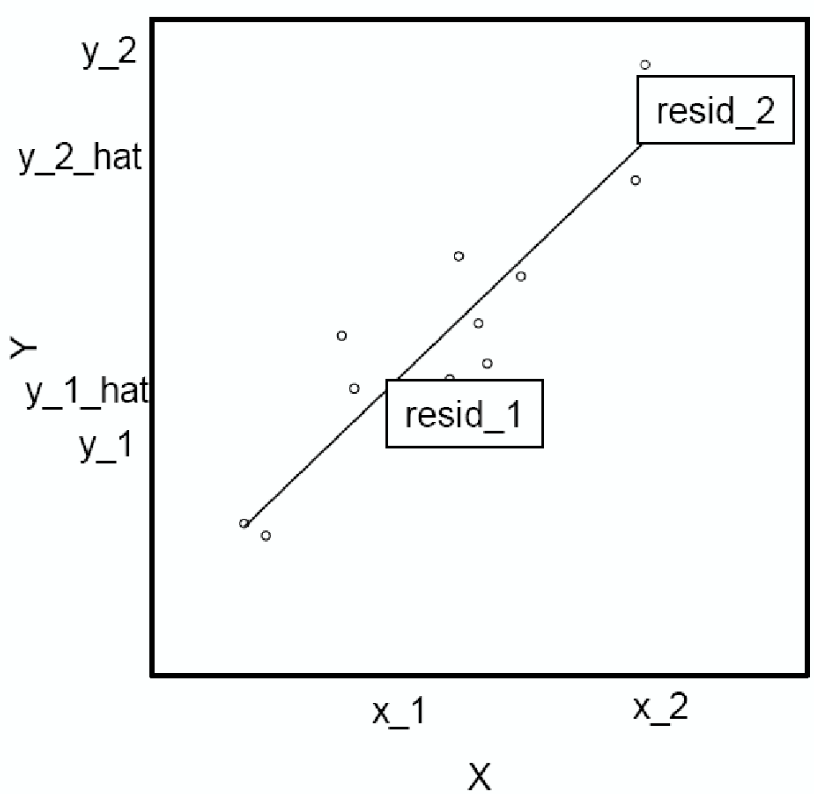
Midterm I – Answers

1. (a) $\sum_{i=1}^{n} \widehat{v}_i = \sum_{i=1}^{n} y_i - \widehat{\phi} - \widehat{\gamma} x_i = \sum_{i=1}^{n} y_i - (\overline{y} - \widehat{\gamma}\overline{x}) - \widehat{\gamma} x_i = n\overline{y} - n\overline{y} + \widehat{\gamma} n\overline{x} - \widehat{\gamma} n\overline{x} = 0$

   (b) $\sum_{i=1}^{n} \widehat{v}_i x_i = \sum_{i=1}^{n} \left(y_i - \widehat{\phi} - \widehat{\gamma} x_i\right) x_i = \sum_{i=1}^{n} \left[y_i - (\overline{y} - \widehat{\gamma}\overline{x}) - \widehat{\gamma} x_i\right] x_i = \sum_{i=1}^{n} \left[(y_i - \overline{y}) - \widehat{\gamma}(x_i - \overline{x})\right] x_i = \sum_{i=1}^{n} \left[(y_i - \overline{y}) - \widehat{\gamma}(x_i - \overline{x})\right](x_i - \overline{x}) = \sum_{i=1}^{n} \left[(y_i - \overline{y})(x_i - \overline{x}) - \widehat{\gamma}(x_i - \overline{x})^2\right] = \sum_{i=1}^{n} (y_i - \overline{y})(x_i - \overline{x}) - \widehat{\gamma} \sum_{i=1}^{n} (x_i - \overline{x})^2 = \sum_{i=1}^{n} (y_i - \overline{y})(x_i - \overline{x}) - \frac{\sum_{i=1}^{n} (y_i - \overline{y})(x_i - \overline{x})}{\sum_{i=1}^{n} (x_i - \overline{x})^2} \sum_{i=1}^{n} (x_i - \overline{x})^2 = \sum_{i=1}^{n} (y_i - \overline{y})(x_i - \overline{x}) - \sum_{i=1}^{n} (y_i - \overline{y})(x_i - \overline{x}) = 0$

2.



3. (a) 52.43538. This can be obtained by taking multiplying the t-Statistic by the standard error $c(1) = (t - stat) \times se(c(1)) = 334.8851 \times 0.156577$. The more direct way is to recognize that the coefficient when there is no regressor is the mean of the dependent variable (listed in the table) as 52.43538.

   (b) The intuition behind this result is that if you don't have any regressors, your best guess of the test score is the average.

   (c) Given that homework does not come into the model, an additional hour of homework has no impact on the test scores.

   (d) One way to determine this is to look at the formula for R^2. We know that $R^2 = SSE/SST$. For now, all we need to show is the numerator. $SSE = \sum_{i=1}^{n} (\widehat{y}_i - \overline{y})^2$. As we noted above, the coefficient on $c(1)$ is simply the mean of y ($\overline{y}$). Therefore, the fitted value $\widehat{y}_i = \overline{y}$ for all i. Hence, $SSE = 0$ and thus $R^2 = 0$.

   (e) R^2 is a measure of how well the x explains the y. If there is no x in the model, then it cannot explain y.