**Exercise Chapter 2: The Linear Regression Model and the OLS Estimator**

Consider the model

where *y* = ln[value-added per worker], *x* = ln[capital per worker],  and  are scalars, and *u* is a residual. Data on 22 firms produce the following:

1. Below is the template for regression results as reported by Stata. Complete the table by computing the numbers to enter the cells [a]-[z], [aa]-[ab].

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| Source | SS | df | MS |  Number of observations | [a] |
| Model | [b] | [c] | [d] |  F( [u], [v])  | [x] |
| Residual | [e] | [f] | [g] |  Prob > F | [y] |
|  |  |  |  |  R-squared  | [z] |
| Total | [h] | [i] | [j] |  Adj R-squared  | [aa] |
|  |  |  |  |  Root MSE  | [ab] |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Y | Coef. | Std. Err. | t | P>|t| | [95% Conf. Interval] |
| X | [k] | [l] | [m] | [n] | [o] |
| \_cons | [p] | [q] | [r] | [s] | [t] |
|  |  |  |  |  |  |

2. Test the hypothesis that . Motivate your decision to accept or reject the null hypothesis.

3. Now impose the restriction  and re-estimate . How does the resulting estimate compare to that obtained in (1)? Explain intuitively, perhaps using a graph, why this estimate of  is different. Comment on the validity and meaning of imposing the restriction.

Solutions

Part 1:

 Source | SS df MS Number of obs = 50

-------------+------------------------------ F( 1, 48) = 177.56

 Model | 38.9939236 1 38.9939236 Prob > F = 0.0000

 Residual | 10.5412747 48 .219609889 R-squared = 0.7872

-------------+------------------------------ Adj R-squared = 0.7828

 Total | 49.5351983 49 1.01092241 Root MSE = .46863

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 y | Coef. Std. Err. t P>|t| [95% Conf. Interval]

-------------+----------------------------------------------------------------

 x | .8248283 .0619001 13.33 0.000 .7003699 .9492867

 \_cons | 4.75665 .1423917 33.41 0.000 4.470352 5.042947

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Part 2:

t = (.825-.3)/.062 = 8.47. We can reject the null hypothesis that beta=0.3 when tested against the alternative hypothesis that beta is not equal to 0.3.

Part 3: Estimating the model without intercept yields:

 Source | SS df MS Number of obs = 50

-------------+------------------------------ F( 1, 49) = 357.53

 Model | 1865.03156 1 1865.03156 Prob > F = 0.0000

 Residual | 255.608433 49 5.21649863 R-squared = 0.8795

-------------+------------------------------ Adj R-squared = 0.8770

 Total | 2120.63999 50 42.4127998 Root MSE = 2.284

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 y | Coef. Std. Err. t P>|t| [95% Conf. Interval]

-------------+----------------------------------------------------------------

 x | 2.655 .1404142 18.91 0.000 2.372827 2.937173

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Clearly this is a very misleading estimate of the coefficient on x: allowing for an intercept results in an estimate of the intercept equal to 4.76 (highly statistically significant) and a much lower estimate of beta.