PROBLEM SET 5

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DUE: TUESDAY MARCH 3RD, 2015 AT THE START OF LECTURE

UNIVERSITY OF BRITISH COLUMBIA

ECONOMICS 326

Problem 1 (Stock and Watson (2009) review question 7.1)**:**

(i) Explain how you would test the null hypothesis that $\beta_1 = 0$ in the multiple regression model
$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + \epsilon_i.$$
(ii) Explain how you test the null hypothesis that $\beta_2 = 0$.
(iii) Explain how you test the joint null hypothesis that $\beta_1 = 0$ and $\beta_2 = 0$.
(iv) Why isn't the result of the joint test implied by the results of the first two tests?

Problem 2 (Wooldridge (2013) 4.8)**:** Consider the multiple regression model with three independent variables, under the classical linear model assumptions MLR.1 through MLR.6:
$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon$$
You would like to test the null hypothesis $H_0 : \beta_1 - 3\beta_2 = 1$,

(i) Let $\hat{\beta}_1$ and $\hat{\beta}_2$ denote the OLS estimators of β_1 and β_2. Find $\text{Var}(\hat{\beta}_1 - 3\hat{\beta}_2)$ in terms of the variances of $\hat{\beta}_1$ and $\hat{\beta}_2$ and the covariance between them. What is the standard error of $\hat{\beta}_1 - 3\hat{\beta}_2$¿
(ii) Write the t statistic for testing $H_0 : \beta_1 - 3\beta_2 = 1$.
(iii) Define $\theta_1 = \beta_1 - 3\beta_2$ and $\hat{\theta}_1 = \hat{\beta}_1 - 3\hat{\beta}_2$. Write a regression equation involving β_0, θ_1, β_2, and β_3 that allows you to directly obtain $\hat{\theta}_1$ and its standard error.

Problem 3 (Wooldridge (2013) 4.10)**:** Regression analysis can be used to test whether the market efficiently uses information in valuing stocks. For concreteness, let return be the total return from holding a firms stock over the four-year period from the end of 1990 to the end of 1994. The efficient markets hypothesis says that these returns should not be systematically related to information known in 1990. If firm characteristics known at the beginning of the period help to predict stock returns, then we could use this information in choosing stocks.

For 1990, let *dkr* be a firms debt to capital ratio, let *eps* denote the earnings per share, let (log)*netinc* denote net income, and let (log)*salary* denote total compensation for the CEO.

(i) Using the data in RETURN.RAW, the following equation was estimated:
$$\begin{array}{llllll} \widehat{return} = & 40.44+ & .952dkr+ & .472eps- & .025netinc+ & .003salary \\ & (29.30) & (.854) & (.332) & (.020) & (.009) \end{array}$$
with $n = 142$, $R^2 = .0285$. Test whether the explanatory variables are jointly significant at the 5% level. Is any explanatory variable individually significant?

(ii) Now re-estimate the model using the log form for *netinc* and *salary*:
$$\begin{array}{llllll} \widehat{return} = & -69.12+ & 1.056dkr+ & .586eps- & 31.18\log netinc+ & 39.26\log salary \\ & (164.66) & (.847) & (.336) & (14.16) & (26.40) \end{array}$$
with $n = 142$, $R^2 = .0531$. Do any of your conclusions from part i change?

(iii) In this sample, some firms have zero debt and others have negative earnings. Should we try to use $\log dkr$ or $\log eps$ to see if these improve the fit? Explain.
(iv) Overall, is the evidence for predictability of stock returns strong or weak?

Problem 4 (Wooldridge (2013) 5.1)**:** In the simple regression model under MLR.1 through MLR.4, we argued that the slope estimator, $\hat{\beta}_1$, is consistent for β_1. Show that intercept estimator is also consistent, i.e. show that $\operatorname{plim} \hat{\beta}_0 = \beta_0$.

References

Stock, J.H. and M.W. Watson. 2009. “Introduction to Econometrics, 2/E.” *Instructor* :10.
Wooldridge, J.M. 2013. *Introductory econometrics: A modern approach.* South-Western.