Professor R.L. Oaxaca — Assignment #2
Econ 522a — Spring 2015

Due Wednesday, February 25
(40 points)

This assignment is on hypothesis testing and single equation forecasting with the standard linear regression model. The necessary data are in the Excel file dats105.xls available at http://u.arizona.edu/~rlo/ under econ 522a. Be sure to attach the supporting computer print out to the completed assignment and make clear where your answers are shown.

Consider again the following money demand model:

$$\ell n\,(M_{1t}) = \beta_0 + \beta_1 \ell n(r_t) + \beta_2 \ell n(P_t\ ) + \beta_3 \ell n(Q_t) + u_t, \quad t = 1959, ..., 1989$$

1. For the general linear regression model $Y = X\beta + u$, assume the classical assumptions hold and that $u \sim N(0, \sigma_u^2 \mathrm{I}_T)$. We can express the hypothesis test for linear restrictions on $\beta$ as $\mathrm{H}_0$: $R\beta - r = 0$, $\mathrm{H}_1$: $R\beta - r \neq 0$.

   a. Set up the Lagrangian multiplier optimization problem corresponding to minimizing $u'u$ s.t. $R\beta - r = 0$.
   b. Solve for the Lagrange multiplier vector $\lambda_*$ and determine its distribution under $\mathrm{H}_0$. Specify the mean vector and the variance/covariance matrix for $\lambda_*$.
   c. Show how the standard F test and the $\chi^2$ tests relate to the Lagrange multiplier vector.

2. Test the hypotheses given below at the 5% level of significance using the $t$ distribution and the indicated test method.

   a. $\mathrm{H}_0$: $\beta_3 = 1$, $\mathrm{H}_1$: $\beta_3 \neq 1$ (acceptance region)
   b. $\mathrm{H}_0$: $\beta_2 < 1$, $\mathrm{H}_1$: $\beta_2 > 1$ (t ratio test)
   c. $\mathrm{H}_0$: $\beta_1 = 0$, $\mathrm{H}_1$: $\beta_1 < 0$ (confidence interval )

3. Test the hypotheses given below at the 5% level of significance using each of the following tests: the $F$ test, the *likelihood ratio* (LR) test, and the *Lagrange Multiplier* (LM) test. For each hypothesis $R\beta = r$, specify the parameter restriction matrix $R$, the number of restrictions $q$, the vector $r$ and the estimated variance/covariance matrix for the restricted estimator $\hat{\beta}_*$.

   a. $\mathrm{H}_0$: $\beta_2 = \beta_3$, $\mathrm{H}_1$: $\sim\mathrm{H}_0$
   b. $\mathrm{H}_0$: $\beta_2 = \beta_3 = 1$, $\mathrm{H}_1$: $\sim\mathrm{H}_0$
   c. $\mathrm{H}_0$: $\beta_1 = -0.2$, $\beta_2 +\ \beta_3 = 2$, , $\mathrm{H}_1$: $\sim\mathrm{H}_0$

4. A researcher specifies the following out-of-sample values for the money demand model:

| Year | $\ell n(r_t)$ | $\ell n(P_t)$ | $\ell n(Q_t)$ |
|---|---|---|---|
| 1990 | 2.36 | 4.94 | 8.36 |
| 1991 | 2.39 | 4.99 | 8.39 |

a. Forecast the conditional mean values of $\ell n\left(M_{1,1990}\right)$ and $\ell n\left(M_{1,1991}\right)$.

b. Compute the estimated variance/covariance matrix for your conditional forecast.

c. Compute the estimated variance/covariance matrix for a forecast of the actual values of $\ell n\left(M_{1,1990}\right)$ and $\ell n\left(M_{1,1991}\right)$.