

THE UNIVERSITY OF ILLINOIS AT CHICAGO
ECON 534: Econometrics I
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Homework #3: Structural Tests in the Neoclassical Growth Model

Homework #3 tests structural stability in the empirical Neoclassical growth model. We are interested in whether the model's coefficients are the same in two subsamples, the African and non-African economies.

0. THEORY. As in Homework #2, the theoretical model is

$$\ln(y_T) - \ln(y_0) = (1 - e^{-\lambda T}) \left(\frac{\alpha}{1 - \alpha} \ln(s) - \frac{\alpha}{1 - \alpha} \ln(n) + \frac{\beta}{1 - \alpha} \ln(h) - \ln(y_0) \right), \quad (0)$$

where variables and parameters are defined as in Homework #2.

1. DATA. As in Homework #2, we consider the MRW data for the 98 countries of the non-oil sample. Note that the African sample consists of the first 38 observations ($i = 1, \dots, 38$), whereas the non-African sample of the last 60 observations ($i = 39, \dots, 98$).

2. RESTRICTED ESTIMATION. Begin by assuming that the model's coefficients are the same for African and non-African economies. As in Homework #2, rewrite equation (0) above in linear regression form:

$$growth_i = \beta_0 + \beta_1 \ln y1960_i + \beta_2 \ln s_i + \beta_3 \ln pop_i + \beta_4 \ln school_i + \varepsilon_i, \quad i = 1, \dots, 98, \quad (1)$$

where the variables and parameters are defined as in Homework #2. Suppose ε satisfies the classical assumptions ($E\varepsilon_i = 0$ and $E\varepsilon_i^2 = \sigma^2$, for all i ; and $E\varepsilon_i\varepsilon_j = 0$, for $i \neq j$), and that ε_i is normally distributed. Using OLS, estimate equation (1). [Note: This is identical to part 2 of Homework #2.]

3. UNRESTRICTED ESTIMATION. Now allow the coefficients to differ between the African and non-African economies and test whether there is structural difference between the two samples. There are two ways to conduct this test.

(a) *A Chow Test*. Estimate equation (1) separately for the African and non-African samples:

$$growth_i = \alpha_0 + \alpha_1 \ln y1960_i + \alpha_2 \ln s_i + \alpha_3 \ln pop_i + \alpha_4 \ln school_i + v_i, \quad i = 1, \dots, 38, \quad (2)$$

and

$$growth_i = \delta_0 + \delta_1 \ln y1960_i + \delta_2 \ln s_i + \delta_3 \ln pop_i + \delta_4 \ln school_i + v_i, \quad i = 39, \dots, 98, \quad (3)$$

where the v_i s satisfy the classical assumptions with normality. Note that (2) and (3) constitute the unrestricted model. Calculate the “Chow” F statistic and test the null hypothesis $H_0 : \alpha = \delta$, where

$$\alpha = (\alpha_0 \quad \alpha_1 \quad \alpha_2 \quad \alpha_3 \quad \alpha_4)' \text{ and } \delta = (\delta_0 \quad \delta_1 \quad \delta_2 \quad \delta_3 \quad \delta_4)'.$$

(b) *A Dummy-Variable Test.* Construct an “Africa” dummy variable, dum , which takes the value 1 for the African sample and 0 for the non-African sample. More formally, $dum_i = 1$ for $1 \leq i \leq 38$ and $dum_i = 0$ for $39 \leq i \leq 98$. Multiply the dummy variable by the explanatory variables to construct the “interaction” terms. The RATS code should look like this:

```
set dum = t<=38
set dumlny1960 = dum*lny1960
set dumlns = dum*lns
set dumlnpop = dum*lnpop
set dumlnschool = dum*lnschool
```

Write the unrestricted model as:

$$growth_i = \pi_0 + \varphi_0 dum_i + \pi_1 \ln y1960_i + \varphi_1 dumlny1960_i + \pi_2 \ln s_i + \varphi_2 dumlns_i + \pi_3 \ln pop_i + \varphi_3 dumlnpop_i + \pi_4 \ln school_i + \varphi_4 dumlnschool_i + w_i, \quad i = 1, \dots, 98, \quad (4)$$

Assume the w_i s satisfy the classical assumptions with normality, and estimate (4) with OLS. Test the null hypothesis $H_1 : \varphi_0 = \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$ using a Wald F -test. How does this differ from the “Chow” F -test? How does H_1 differ from H_0 ?