Problem Set #1

1. Consider the data for Spain in the attached Excel file.

a) Use the data for real investment to construct a series for the capital stock following
the

$$K_{t+1} = (1-\delta)K_t + I_t$$
$$K_{1954} = \overline{K}_{1954} .$$

Suppose that $\delta = 0.05$ and choose $\overline{K}_{1954}$ so that

$$K_{1955} / K_{1954} = (K_{1964} / K_{1954})^{1/10} .$$

b) Repeat part a, but choose $\overline{K}_{1954}$ so that

$$K_{1954} / Y_{1954} = \left(\sum_{t=1955}^{1964} K_t / Y_t \right)/10 .$$

c) Compare the two series constructed in parts a and b.

2. Consider the Solow model in which

$$C_t + I_t = Y_t$$
$$Y_t = (\gamma^{1-\alpha})^t A K_t^{\alpha} L_t^{1-\alpha}$$
$$K_{t+1} = (1-\delta)K_t + I_t$$
$$I_t = sY_t .$$

a) Suppose that $\delta = 0.05$ and that $\alpha = 0.30$. Use the data in the attached file to
calibrate the parameters γ, A, and s for the Spanish economy.

b) Use the data in the attached file to calculate the series for hours worked 1970-2000.

c) Calculate the equilibrium of the Solow model of the Spanish economy with the
parameters calibrated in part a starting in the year 1970. (Taking the value of K_{1970} and
the series for L_t as given, calculate the series for C_t, I_t, Y_t, and K_t.)

d) Compare the values of the variables obtained in part c with the values in the data in
the attached file.

3. Consider a model with an infinitely-lived, representative consumer. This consumer solves the problem

$$\max \sum_{t=0}^{\infty} \beta^t \log C_t / N_t$$
$$\text{s. t. } C_t + K_{t+1} - (1-\delta)K_t \leq r_t K_t + w_t N_t$$
$$C_t, K_t \geq 0$$
$$K_0 = \bar{K}_0.$$

The production function is $Y_t = (\gamma^{1-\alpha})^t A K_t^{\alpha} N_t^{1-\alpha}$. The growth rate of employment is constant and exogenous: $N_t = \eta^t N_0$.

a) Verify that the balanced growth path – where growth rate of output per worker is equal to the growth rate of capital per worker,

$$\frac{K_{t+1}/N_{t+1}}{K_t/N_t} = \frac{Y_{t+1}/N_{t+1}}{Y_t/N_t} -$$

the stylized facts of economic growth of Nicholas Kaldor are satisfied..

b) Calibrate the parameters for the model, β, δ, γ, A, α, η, so that the balanced growth path of the model replicates, on average, the macroeconomic data found on the web page of the Instituto Nacional de Estadística (www.ine.es).

c) Calculate the balanced growth path for the Solow model of the Spanish economy with the parameters calibrated in part b starting in 1970.

d) Compare the values of the variables obtained in part c with their values in the data in the attached file.

4. Consider the Spanish data series in the attached file. Suppose that technology has the form

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$
$$K_{t+1} = (1-\delta)K_t + I_t.$$

Perform a growth accounting exercise for the Spanish economy starting in 1960. That is, decompose the growth and fluctuation in real GDP per working-age person into three factors, one of which depends on total factor productivity, one of which depends on the capital/output ratio, and the third of which depends on hours worked per working-age person. Discuss what happens during different time periods. There is a lot that can be done, but a very interesting graph decomposes hours worked per working-age person in to hours per worker and the employment rate. It may also be interesting to compare the Spanish data with the U.S. data also included in the attached file.