

Theory and Applications for Econometrics

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Problem Set #1

1 Theory

One of the oldest and extensively used simple regressions for economic data is a regression on time (trend regression), i.e. a regression of the form:

$$y_t = \alpha + \beta \cdot t + u_t \quad (1)$$

If the dependent variable is expressed in natural logarithms then the coefficient β measures the average rate of growth of the dependent variable.

1. Find explicit expressions for the least squares estimators for the two regression parameters α and β .
2. Find an explicit expression for the variance of the least squares estimator of β .
3. Based on your two above answers show how you can test the null hypothesis of a given growth rate, i.e. $H_0 : \beta = \beta_0$, for β_0 a given number.

2 Application

In the file *gdpdata.csv* you will find annual real GDP data for three countries, the France, the United Kingdom and the United States. The data are annual from 1949 to 2008 for a total of 60 observations.

1. Report the plots of the three time series.

2. Compute the natural logarithms of the three time series; repeat the above question. Discuss what you see in these plots.
3. Generate a new variable corresponding to the trend component $t = 1, 2, \dots, 60$.
4. For each of the countries estimate a simple trend model for the whole sample period. Plot the actual and fitted values, report them, and discuss your results, both the statistical and economic implications.
5. Perform a full set of residual diagnostic tests and tests for the structural stability of the estimated parameters. Discuss your results.
6. Are you comfortable with your results so far? Do you see any problems? If yes, what can these problems be?
7. Repeat your analysis by adding a new term to the regression, namely t^2 . Repeat the analysis of the residuals and discuss your results again.
8. If you have found evidence of structural breaks in your data make an appropriate split of your data sample and repeat the analysis.
9. What do you conclude about the average real GDP growth for the past 60 years for these countries?