Erasmus School of Economics

MOOC Econometrics

Lecture 6.1 on Time Series: Motivation

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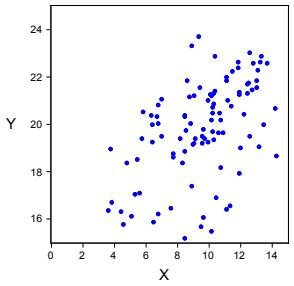
Introduction

- Time series: variable is observed at regular frequency,
  yearly, quarterly, monthly, weekly, daily, split-second.
- Past values often have predictive power for future.
- Can get spurious regression results if own past is neglected.
- Data: $x_t = 1 + 0.9x_{t-1} + \varepsilon_{x,t}$ and $y_t = 2 + 0.9y_{t-1} + \varepsilon_{y,t}$
  Two series completely uncorrelated: $E(\varepsilon_{x,t}\varepsilon_{y,s}) = 0$ for all t, s.

Spurious regression



Dependent variable: Y (sample size $n = 100$)						
	Coef.	t-Stat.	p-value	Coef.	t-Stat.	p-value
Constant	15.99	23.45	0.000	2.91	2.87	0.005
X	0.40	5.78	0.000	0.07	1.53	0.129
Y(-1)	-	-	-	0.82	14.01	0.000
R-squared	0.254			0.753		

Test question

Dependent variable: Y (sample size $n = 100$)						
	Coef.	t-Stat.	p-value	Coef.	t-Stat.	p-value
Constant	2.88	2.83	0.006	2.69	2.66	0.009
Y(-1)	0.83	14.02	0.000	0.86	17.03	0.000
X	0.15	1.61	0.110	-	-	-
X(-1)	-0.09	-0.99	0.324	-	-	-
R-squared	0.756			0.747		

Test

Is joint effect of X and $X(-1)$ on Y significant?
Note: The relevant 5% critical value is 3.1.

Answer test

- Use F-test (see Lecture 2): $F = \frac{(R_1^2 - R_0^2)/g}{(1-R_1^2)/(n-k)}$
- number of restrictions: $g = 2$

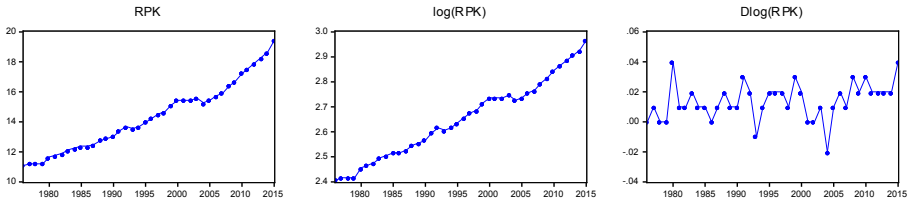
  number of observations: $n = 100$

  number of parameters unrestricted model: $k = 4$

  values of R-squared: $R_1^2 = 0.756$ and $R_0^2 = 0.747$
- Substitute these values in formula for F-test:

  $F = \frac{(0.756-0.747)/2}{(1-0.756)/(100-4)} = 1.8 < 3.1$
- Joint effect of X and $X(-1)$ on Y is not significant.

Example: RPK



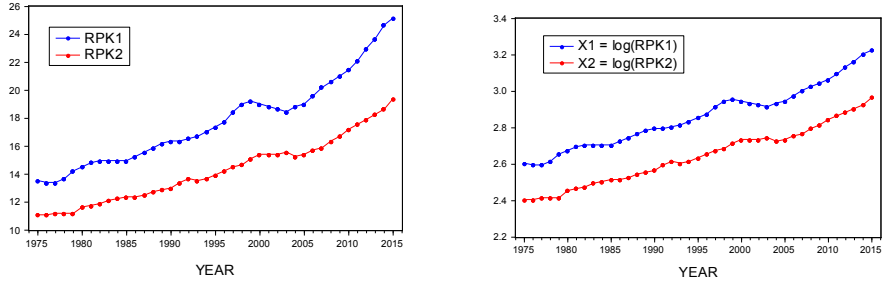
- RPK: Revenue Passenger Kilometers (in billions)

  yearly totals 1976-2015, trend somewhat exponential
- log(RPK): more linear trend

  $\text{Dlog(RPK)} = \text{log(RPK)} - \text{log(RPK)(-1)} \approx \frac{\text{RPK}-\text{RPK(-1)}}{\text{RPK(-1)}}$

  yearly growth rate of RPK

Two airline companies

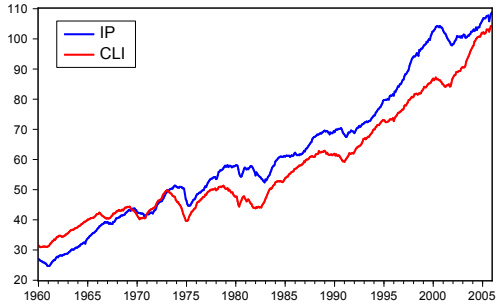


- After taking logs, seems common trend for series X1 and X2.
- Issues:

  → univariate time series: relate RPK to its own past

  → bivariate time series: relate two RPK series to own and others past

Macroeconomic example



- IP: Monthly index of Industrial Production for USA
- CLI: Monthly Composite Leading Index USA
- Question: Can we predict IP one quarter ahead?

  → Answers in Lecture 6.5

TRAINING EXERCISE 6.1

- Train yourself by making the training exercise (see the website).
- After making this exercise, check your answers by studying the webcast solution (also available on the website).