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Welcome to Econometrics 2, Class 1

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Practical things

- We meet in Vester B25 from 2-5pm every Monday
- Autumn break is 17 October
- I have taught several courses here before (including Econometrics 1)
- Jeg taler dansk!
- You are always welcome to write to me with any queries (paul.sharp@econ.ku.dk)
- N.B. Please remember to send an e-mail to me, so I can contact you if necessary (e.g. to cancel the class)

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About this course

- In Econometrics 1 we introduced OLS estimation with cross-sectional data, and looked at how to check for and work around problems such as heteroskedasticity (WLS) and endogenous explanatory variables (IV)
- Now we concentrate on time series data – gives us new problems to look out for!
- The approach in this course gives greater weight to theory than in Econometrics 1
- But the practical aspect is of course very important!
- REMEMBER to print and read through the relevant problem set before each class!

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Computer work

We use GiveWin/PcGive
(menu-driven, so no programming a la SAS)

You have three options:

- Bring your laptop computers (form groups)
- Go down to the computer basement
- Watch me present the results (like today)

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Problem Set #1, Exercise 1

- This is (important) repetition from Econometrics 1
- I will go through it on the blackboard

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Problem Set #1, Exercise 2

Installing GiveWin/PcGive:

- Click on ”Software” on course homepage – there is a password!
- Extract the zip package, e.g. to the desktop
- Install GiveWin (and upgrade) first! Otherwise read the guidelines on the website
- You need license codes (which I am not allowed to distribute)
- Send me a mail if you have any problems!

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Belgian wage data

- 1472 observations from 1994 (cross-sectional data)
- Four variables

WAGE	Hourly wage rate in euro
MALE	Dummy variable for gender
EDUC	Education level from 1 [low] to 5 [high]
EXPER	Years of experience

(1) Download data from homepage

N.B. Two files (bwages.In7 and bwages.Bn7). Save both but open the former.

File – Open Data File…

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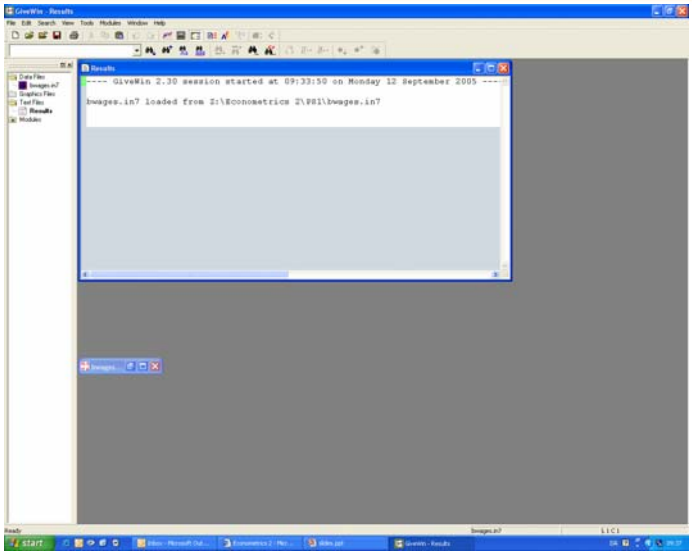
File – Open Data File…



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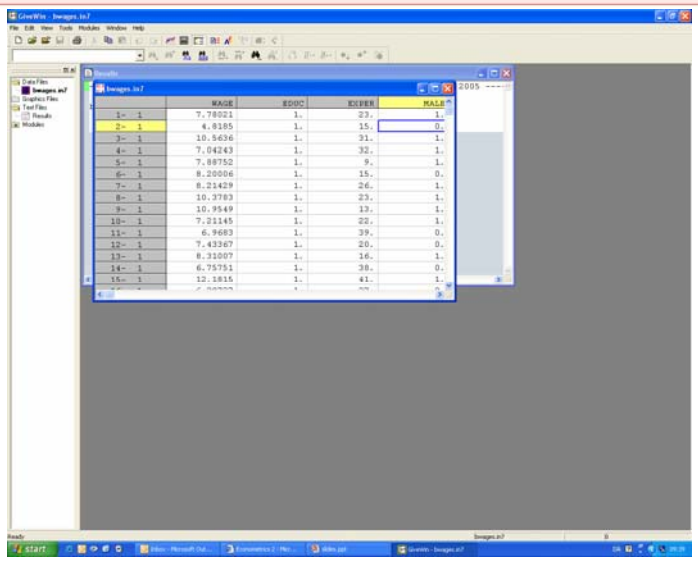
Looking at data



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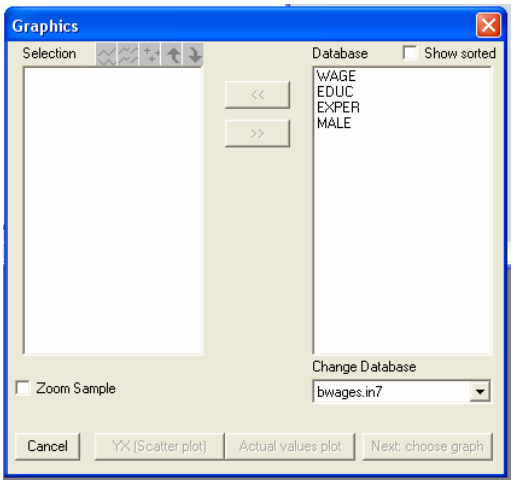
(2) Tools - Graphics



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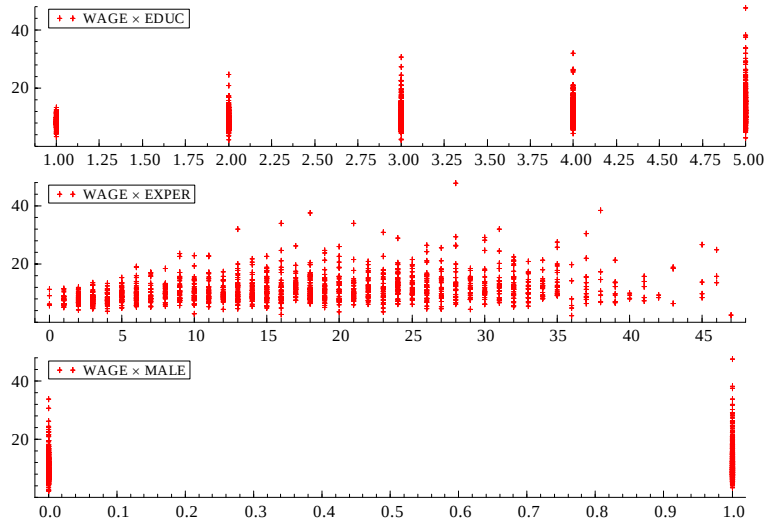
Cross-Plots



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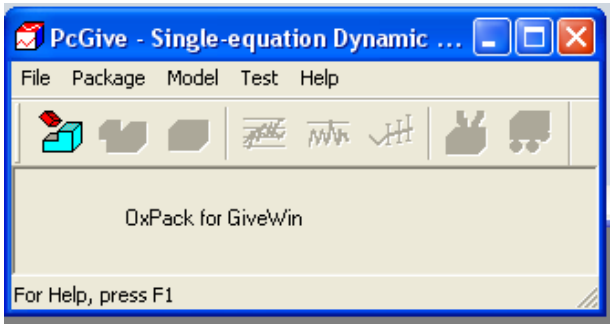
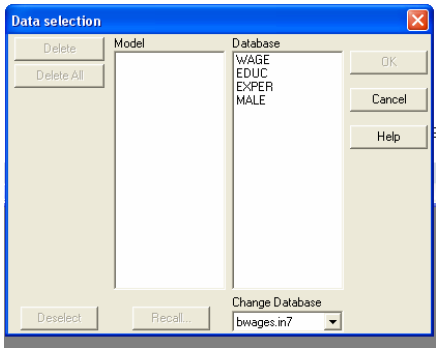
Evidence of correlations?

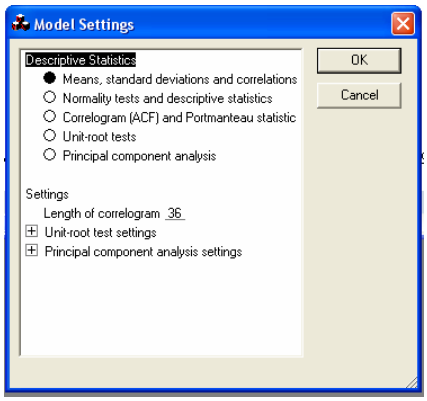
- Seems to be positive correlation between wage and EDUC, and EXPER.
- The highest earning males have a higher wage than the highest earning females.

(3) Modules – Start PcGive



Package – Descriptive Statistics, Model – Formulate…





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Means, standard deviations and correlations

Results

```
Descriptive Statistics package version 1.0, object created on 12-09-2005

Means, standard deviations and correlations (using bwages.in7)
The sample is 1 - 1472
Means
          WAGE          EDUC         EXPER          MALE
        11.051        3.3784        17.217       0.60666
Standard deviations (using T-1)
          WAGE          EDUC         EXPER          MALE
        4.4505        1.2045        10.167       0.48866
Correlation matrix:
                WAGE          EDUC         EXPER          MALE
WAGE          1.0000       0.38978       0.30725       0.14281
EDUC         0.38978        1.0000      -0.28939      -0.13964
EXPER        0.30725      -0.28939        1.0000       0.15953
MALE         0.14281      -0.13964       0.15953        1.0000
```

The average person earns €11/hour, has an intermediate education level, 17 years of experience and is 60% male.

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(4) The model

$$\text{WAGE}_i = \beta_1 + \beta_2 \cdot \text{MALE}_i + \beta_3 \cdot \text{EDUC}_i + \beta_4 \cdot \text{EXPER}_i + \epsilon_i, \qquad (1.6)$$

for $i = 1, ..., 1472$.

See discussion in Verbeek, pp. 68-69.

Are residuals i.i.d.?

Not if there is heteroskedasticity.

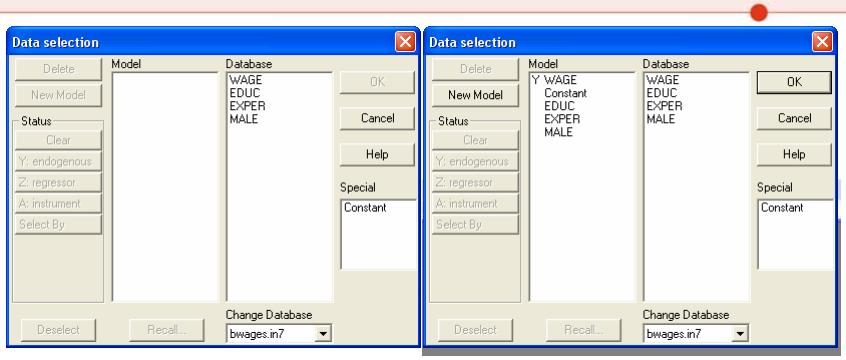
See Wooldridge p. 55:

> "while average wage is allowed to increase with education level ... the *variability* in wage about its mean is assumed to be constant across all education levels. This may not be realistic. It is likely that people with more education have a wider variety of interests and job opportunities, which could lead to more wage variability at higher levels of education. People with very low levels of education have very few opportunities and often must work at the minimum wage ..."

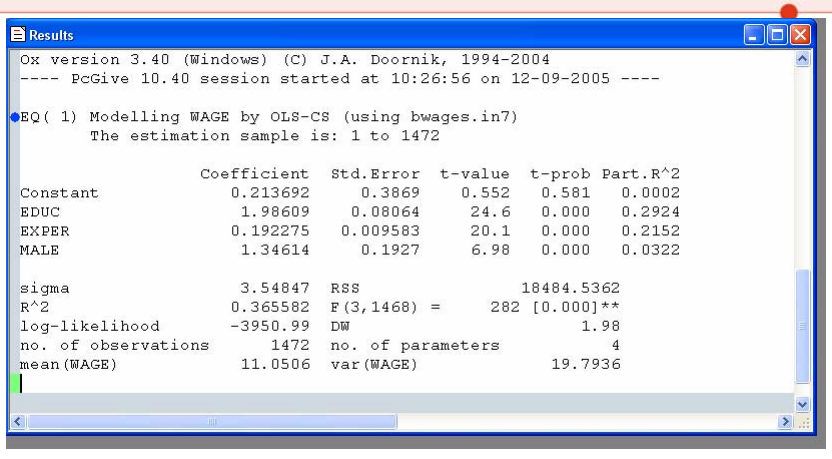
A priori expectations:

$\beta_2, \beta_3, \beta_4 > 0$

(5) Package – Econometric Modelling, Model – Cross Section Regression

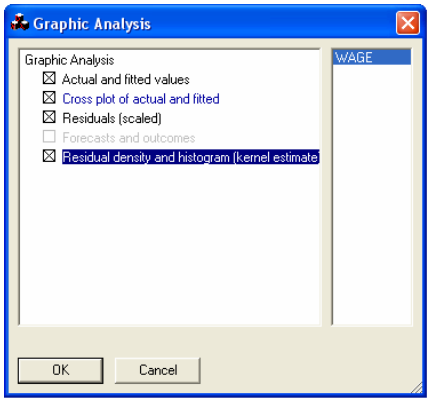


OLS

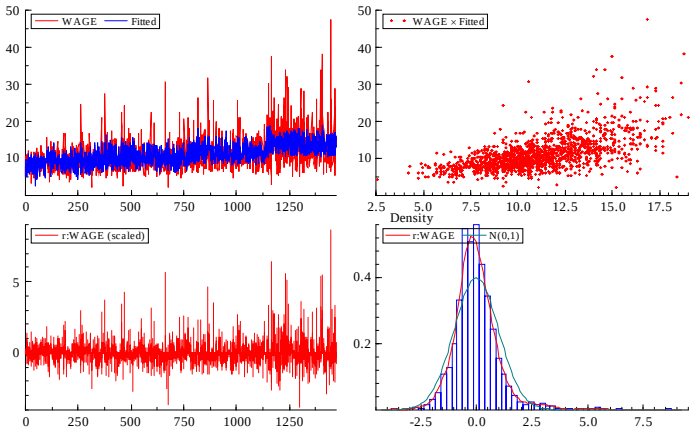


Signs are as expected!

(6) Test – Graphic Analysis



Graphic Analysis



Test – Test Summary

```
Normality test:     Chi^2(2) =    359.40 [0.0000]**
hetero test:        F(5,1462)=    18.894 [0.0000]**
hetero-X test:      F(8,1459)=    14.922 [0.0000]**
RESET test:         F(1,1467)=    37.336 [0.0000]**
```

Rejects hypothesis of *no* heteroskedasticity!

Model is not satisfactory. Heteroskedasticity leads to problems when testing for significance of variables (BIG problem!).

(7) Tools – Algebra Editor – Load… - bwages.alg

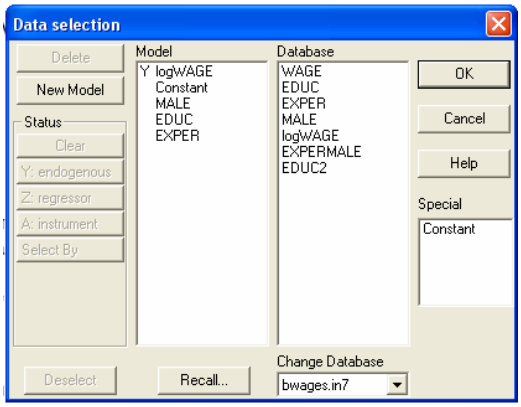
Creates:

logWAGE	= log(WAGE)
EXPERMALE	= EXPER*MALE
EDUC2	= (EDUC == 2) ? 1 : 0
	(= 1 if EDUC=2, 0 otherwise)

The * next to the data filename denotes that it has not been saved.

(8) New model

$$\log(\text{WAGE}_i) = \bar{\beta}_1 + \bar{\beta}_2 \cdot \text{MALE}_i + \bar{\beta}_3 \cdot \text{EDUC}_i + \bar{\beta}_4 \cdot \text{EXPER}_i + \bar{\epsilon}_i, \qquad (1.7)$$



Results

```
EQ( 2) Modelling logWAGE by OLS-CS (using bwages.in7)
       The estimation sample is: 1 to 1472

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant              1.43906    0.03128     46.0   0.000    0.5905
MALE                 0.115928    0.01558     7.44   0.000    0.0363
EDUC                 0.164115   0.006520     25.2   0.000    0.3015
EXPER               0.0157146  0.0007748     20.3   0.000    0.2189

sigma                0.286892  RSS                 120.827007
R^2                  0.375041  F(3,1468) =   293.7 [0.000]**
log-likelihood       -248.665  DW                        1.96
no. of observations      1472  no. of parameters            4
mean(logWAGE)         2.33439  var(logWAGE)          0.131342

Normality test:    Chi^2(2) =   237.06 [0.0000]**
hetero test:       F(5,1462)=   8.6252 [0.0000]**
hetero-X test:     F(8,1459)=   6.8323 [0.0000]**
RESET test:        F(1,1467)=   1.6143 [0.2041]
```

Still heteroskedaticity! (Although test statistics are smaller)

(9) Add interaction terms

```
EQ( 3) Modelling logWAGE by OLS-CS (using bwages.in7)
       The estimation sample is: 1 to 1472

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant              1.46911    0.03459     42.5   0.000    0.5514
MALE                0.0645864    0.02976     2.17   0.030    0.0032
EDUC                 0.164119   0.006513     25.2   0.000    0.3021
EXPER               0.0137371   0.001246     11.0   0.000    0.0765
EXPERMALE          0.00312622   0.001544     2.02   0.043    0.0028

sigma                 0.28659  RSS                 120.49043
R^2                  0.376782  F(4,1467) =   221.7 [0.000]**
log-likelihood      -246.612  DW                      1.95
no. of observations      1472  no. of parameters          5
mean(logWAGE)         2.33439  var(logWAGE)         0.131342
```


Try to create new variables yourself! Use the algebra editor or the calculator