Written Exam for the B.Sc. in Economics summer 2014

Økonometri B/Econometrics B

Take-home exam

May 26-27, 2014

This exam question consists of 10 pages in total.

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

Focus on Exam Cheating

In case of presumed exam cheating, which is observed by either the examination registration of the respective study programmes, the invigilation or the course lecturer, the Head of Studies will make a preliminary inquiry into the matter, requesting a statement from the course lecturer and possibly the invigilation, too. Furthermore, the Head of Studies will interview the student. If the Head of Studies finds that there are reasonable grounds to suspect exam cheating, the issue will be reported to the Rector. In the course of the study and during examinations, the student is expected to conform to the rules and regulations governing academic integrity. Academic dishonesty includes falsification, plagiarism, failure to disclose information, and any other kind of misrepresentation of the student's own performance and results or assisting another student herewith. For example failure to indicate sources in written assignments is regarded as failure to disclose information. Attempts to cheat at examinations are dealt with in the same manner as exam cheating which has been carried through. In case of exam cheating, the following sanctions may be imposed by the Rector:

1. A warning
2. Expulsion from the examination
3. Suspension from the University for a limited period or permanent expulsion.

The Faculty of Social Sciences
The Study and Examination Office
October 2006

Practical instructions for the take-home exam

- Start by ensuring that you can access the data (see next page).
- The exam can be answered in groups of a **maximum of 4 students**. Hand in a single answer for the entire group **and specify each group member's contribution to the answer**. The first page after the front page must indicate the parts of the exam answered by each group member. This page may not contain other information.
- Read through all the tasks before you start to respond. Reply to all questions in Problems 1 through 6. As a rule of thumb for the distribution of work effort, you can use the following weights:

  problem 1: 10%, problem 2: 30%, problem 3: 10%
  problem 4: 25%, problem 5: 15%, problem 6: 10%.

- Provide a comprehensive report with specific references to the relevant Appendix tables with regression outputs. Provide tables and graphs in the text with references to the relevant Appendix table. Supply each of the tables with regression outputs etc. with sequential numbering and mark them with references to the name of the SAS program from which the table is generated. SAS programs should also be put in the Appendix. If the SAS programs are written in several different files, they must be assembled before submission into a single file that can be straightforwardly executed.
- The front page of the report must be the page that can be downloaded as 'Frontpage.doc.' The page should be filled out with the examination numbers of all group members and the total number of pages.
- The report must not exceed 22 pages. This includes the front page, the list summarizing the parts of the answer that each group member is responsible for, text, tables and graphs in the text. The Appendix including regression outputs, SAS program etc. must not exceed 21 pages, incl. front page.
- The front page of the Appendix must be the page that can be downloaded as 'Frontpage_APPENDIX.doc.' It is important that the Appendix starts with the default front page on which your exam numbers appear. It is not necessary to include larger outputs like output from proc univariate in the Appendix.
- Put page numbers and exam numbers on all pages in the response (including appendices).
- Submit the answer (including appendices) electronically (see "Uploading your answer").
- **The exam ends May 27 at 16.00**. The answer should be submitted via upload to Absalon, which must be completed no later than 16.15.

Access to data:

How to obtain the group data set:

1. Determine the **lowest** number among the exam numbers of the members of the group.
2. Use the **last** digit of this exam number to select the group data set from the data sets posted on the data page.

   > Example: A group of four members with exam numbers 71, 72, 77, and 174 will have "1" as the last digit of their lowest exam number. The group selects the file GROUPDATA1.sas7bdat.

3. Download the group data set e.g. to C:\WRK on your computer.
4. Download the SAS program OPENDATA.SAS. The program runs a PROC CONTENTS as a check that you have made contact with the data set. You should modify this program to reflect the name of the group data set and the directory in which you have saved the data file.

If you have trouble selecting or opening the data, you can contact Rasmus Jørgensen on telephone 3532 3075 during the period 10:00 to 12:00 on May 26.

After this no help will be provided to this or any other parts of the exam.

Uploading your answer:

It is sufficient that one of the group members uploads a response.

You hand in your answer by uploading it to the course page '2200-F14/;Økonometri B' in Absalon. In the 'Take-home exam' folder press Upload exam answer. On the next page press Submit answer (Send svar) which will bring you to a page where your answer can be uploaded by pressing Upload file (Overfør fil). You can ignore any "warnings" that may appear when you upload your SAS files. Note that you can submit your answers, even if you cannot find your name on the list. Remember to finish by pressing the button 'Send' at the bottom of the page.

Each group must hand in a total of 4 files. The files should be named so that each file name starts with the letter indicated below. The letter should be followed by the exam numbers of all members of the group separated by _ ("underscore").

1. The report must be handed in as a PDF file. The filename must start with the letter R.
2. The appendix with SAS output should be handed in as a PDF file. The filename must start with B.
3. Submit the group's SAS program as a file in plain text format (.txt). The filename should start with P.
4. Rename your SAS data file e.g GROUPDATA1.SAS7BDAT, as the filename starting with F.

Use the same combination of exam numbers for all files.

> Example: A group of four members with exam number 71, 72, 77, and 174 will submit the following files:
>
> 1. R_71_72_77_174.pdf
> 2. B_71_72_77_174.pdf
> 3. P_71_72_77_174.txt
> 4. F_71_72_77_174.sas7bdat

See more about how you obtain a free PDF converter by following this link:

http://www.pdf995.com/

If you have problems accessing Absalon at the deadline of the exam or if you have difficulties with the upload function you must e-mail your answer to samf-fak@samf.ku.dk.

Handing in your exam answer by e-mail requires that you describe the problems and provide screen dumps that document this.

Introduction to the assignment:

"Property Rights and Economic Growth"

What are the fundamental causes of the large differences in income per capita across countries?

Economists often consider institutions and property rights to be major determinants of long-run economic development. That is, countries with better institutions, more secure property rights, and less distortionary policies will invest more in physical and human capital, and will use the factors more efficiently to achieve a greater level of income. This hypothesis has received some empirical support from cross-country studies documenting positive correlations between measures of property rights and economic development.

In an influential article, Daron Acemoglu, Simon Johnson and James Robinson[1] present an analysis of the relationship between per capita GDP and property rights. One important observation of Acemoglu, Johnson and Robinson is that richer countries may choose or can afford better institutions. And more importantly, countries that are different for a variety of reasons may differ both in their institutions and in their income per capita. To estimate the impact of institutions on per capita GDP, they argue that an exogenous source of variation in institutions is needed. Their empirical investigation rests on three premises.

First, different types of colonization policies created different sets of institutions around the world. At one extreme, the main purpose of the Belgian colonization of Congo was to transfer as much of the resources in Congo to Belgium. As such, property rights were very weak in Congo. At the other extreme, other colonies such as Australia, New Zealand, Canada and the United States had institutions and property rights similar to those in the countries of their European colonizers.

Second, the colonization policy was influenced by the feasibility of early settlements. In places where the disease environment was not favorable to European settlement, the formation of an extractive state was more likely.

Third, the colonial state and institutions persisted even after independence.

We will consider a country-country data set that consists of 163 countries. As a measure of property rights, we will consider an index that measures the risk of expropriation of private foreign investments by the government. A larger index means less risk.

[1] Daron Acemoglu, Simon Johnson, and James A. Robinson (2001): "The Colonial Origins of Comparative Development: An Empirical Investigation", *American Economic Review*, Vol. 91, No. 5, pp. 1369-1401. Much of the text in this introduction is from their paper.

Data documentation

The data set is a cross-section of 163 countries.[2] Your exam answers should only be based on this specific data set.

Table 1: List of variables	
Variable name	**Description**
Main variables:	
Logpgp95	Log GDP per capita, 1995
Avexpr	Average protection against expropriation risk, 1985-1995. Risk of expropriation of private foreign investment by government, from 0 to 10, where a higher score means less risk. Mean value for all years from 1985 to 1995
Lat_abst	Absolute value of the latitude of the country (i.e., a measure of distance from the equator), scaled to take values between 0 and 1, where 0 is the equator.
Africa	Dummy variable. Equal to one for African countries. Otherwise 0. Reference category is the Americas.
Asia	Dummy variable. Equal to one for Asian countries. Otherwise 0. Reference category is the Americas.
Other	Dummy variable. Equal to one for Australia, Malta and New Zealand. Otherwise 0. Reference category is the Americas.
Excolony	Equal to one for former colonies with available data on GDP, expropriation risk and settler mortality. Otherwise 0.
Logem4	Log European settler mortality rates per 1,000 in the 19th century.
Euro1900	Fraction of the population of European descent in 1900.
Additional variables:	
Country	Country name
Meantemp	1987 average annual temperature in degrees Celsius.
Landlock	Dummy variable. Equal to one if land is landlocked. Otherwise 0.
Malfal94	Percent of population in 1994 living where malaria is endemic.
Goldm	Percent of world gold reserves today
Iron	Percent of world iron reserves today
Oilres	Thousands of barrels per capita
F_brit	Dummy variable for British colony.
F_french	Dummy variable for French colony.
Sjlofr	Dummy variable. Equal to 1 if country has French legal origin. Otherwise 0. Reference category is British legal origin.
Democ00a	Democracy in 1900. Higher score indicates more democracy.
Democ1	Democracy in first year of independence. Higher score indicates more democracy.
Imr95	Infant mortality rate (deaths per 1,000 live births) in 1995.
Logmortcap250	Alternative measure of log European settler mortality rates per 1,000

[2] The data set used for this exam is an edited version of the original data used by Daron Acemoglu, Simon Johnson, and James A. Robinson.

Problem 1:

Use all available observations for this question.

a) Give a description of the variables listed in table 1 under the heading "Main variables". Provide one or more tables and/or graphs that present relevant characteristics for each variable. Comment briefly.

b) Acemoglu, Johnson and Robinson focus on ex-colonies with available data on settler mortality, protection against expropriation risk and GDP per capita. Their sample consists of 64 countries. Provide a table with relevant characteristics for these 64 countries for which the *excolony*-dummy is equal to 1. Comment briefly.

c) Create a histogram of $avexpr$ for former colonies (*excolony = 1*) and provide a short discussion of the variable.

Problem 2:

Use all available observations where *excolony = 1* for this question.

a) Consider the regression model in (1), where ϵ is the error term and $logpgp95_i$ is the natural log of country i's real per capita GDP in 1995. Assume for now that the model satisfies MLR.1-MLR.4.

$$Logpgp95_i = \beta_0 + \beta_1 Avexpr_i + \beta_2 Lat\_abst_i + \beta_3 Africa_i + \beta_4 Asia_i + \beta_5 Other_i + \epsilon_i \qquad (1)$$

   i. What is the interpretation of ϵ_i?
   ii. What is the interpretation of β_1? What is the expected sign of β_1?
   iii. What is the interpretation of β_3?

b) Estimate the model in (1) by OLS. Report your estimates in a table with their standard errors and *t* statistics. Your table should also report heteroskedasticity-robust *t* statistics. Comment briefly.

c) Compare different estimates of the effects of property rights on per capita GDP.
   i. Estimate model (1) without the variables Africa, Asia and Other.
   ii. Estimate model (1) without the variables Lat_abst, Africa, Asia and Other.
   iii. Draw up a table and compare your findings in 2.c.i and 2.c.ii with your results in 2.b. How is β_1 interpreted in the three different specifications? Comment briefly.

d) Investigate if model (1) suffers from heteroskedasticity.
   i. Perform at least two graphical checks for heteroskedasticity.
   ii. Perform the Breusch-Pagan test for heteroskedasticity.
   iii. Does the overall evidence suggest that the model suffers from heteroskedasticity? What are the implications of your findings for the consistency of OLS? For the appropriate choice of standard errors?

e) Consider the following questions on the basis of your OLS estimates of the model in Question 2.b.
   i. Perform a test of the null hypothesis $\beta_1 = 0$ against a relevant alternative. Specify which alternative you are testing against and explain why you choose this alternative. What do you conclude?
   ii. Do a test of the hypothesis that the continent dummies do not matter for per capita GDP, given the other explanatory variables included in model (1). Specify the null hypothesis and the alternative that you are testing against. What do you conclude?

   In each case, explain what test statistic is used and why.

f) Estimate the model by Feasible GLS. Let *X* denote a matrix with all explanatory variables in model (1). Assume that:

$$var(\epsilon|X) = \sigma^2 \exp(X\delta)$$

   where δ is a vector of unknown parameters.
   i. Estimate the model (1) by Feasible GLS. Report your findings in a table and comment briefly. Does the Feasible GLS procedure give you reasons to change your conclusions from before?
   ii. What are the advantages and disadvantages of Feasible GLS compared to OLS?

g) Testing the specification of the functional form.
   i. Plot the residuals from model (1) against the dependent variable. Comment briefly.
   ii. Perform a RESET test of the functional form for the model in Question 2.b. Does model (1) suffer from functional form misspecification?

Problem 3:

Use all available observations where *excolony = 1* for this question. You may disregard any heteroskedasticity of the error term for this question.

Acemoglu, Johnson and Robinson argue that unobserved country characteristics may determine both per capita GDP and institutions. This implies that $Avexpr$ is endogenous in all the models considered so far.

As a result, they use an instrumental variable strategy to estimate the impact of property rights on income. Acemoglu, Johnson and Robinson document that during the colonial era, Europeans were more likely to settle in places where they had a lower risk of dying from disease. Colonies where Europeans settled developed institutions that protect property better than colonies where Europeans did not settle. Moreover, they argue that, in the long run, the direct effects of mortality and European settlement on income faded, while the indirect effect through property-rights institutions persisted.

a) Discuss the conditions that must be satisfied for log European settler mortality (*logem4*) to be a relevant and valid instrument for $Avexpr$ in model (1). Are the conditions likely to be satisfied here? Present empirical evidence as needed to support your answer.

b) Estimate the model by two-stage least squares (2SLS) using log European settler mortality as an instrument variable. Report your results in a table and compare them with your OLS results from Problem 2. Comment briefly.

c) Do a test that addresses empirically if $Avexpr$ is in fact endogenous or not in model 1. Report your results and comment.

d) Another proposed instrument variable is the population fraction of European descendants in 1900 (*Euro1900*). Consider if *Euro1900* is a suitable instrumental for estimating model (1). Present empirical evidence as needed to support your answer.

Problem 4:

Use all available observations where *excolony = 1* for this question. You may disregard any heteroskedasticity of the error term for this question.

It has been widely documented that former British colonies have better property rights and more developed financial markets. That is, it has been argued that former British colonies have prospered relative to former French, Spanish and Portuguese colonies because of the good economic and political institutions and culture they inherited from Britain.

The regression models considered in Problem 3 assume that the effect of property rights on per capita GDP is the same for former colonies. Specify an alternative model where the effect of property rights is allowed to be different across former British colonies and former non-British colonies. Estimate the alternative model using IV. Perform at least one Chow test. Comment briefly.

Problem 5:

Perform further analysis to assess the robustness of the conclusions that you have established in previous problems. Explain briefly the conclusion that you wish to investigate and why you want to focus on this result.

Consider only extensions that are possible to implement using the actual data.

The number of different robustness checks that you perform should be **equal to the number of group members**. That is, a 4-person group must consider four different aspects of the analysis, three for 3-person groups, etc.

Provide brief comments on the alternative subsamples, models, and/tests that you use and conclude on each part of your analysis.

Problem 6:

Write a brief summary of the main results of your analysis. Include a table that summarizes the main results and comment on the table.

What are your overall conclusions regarding the relationship between per capita GDP and property rights?