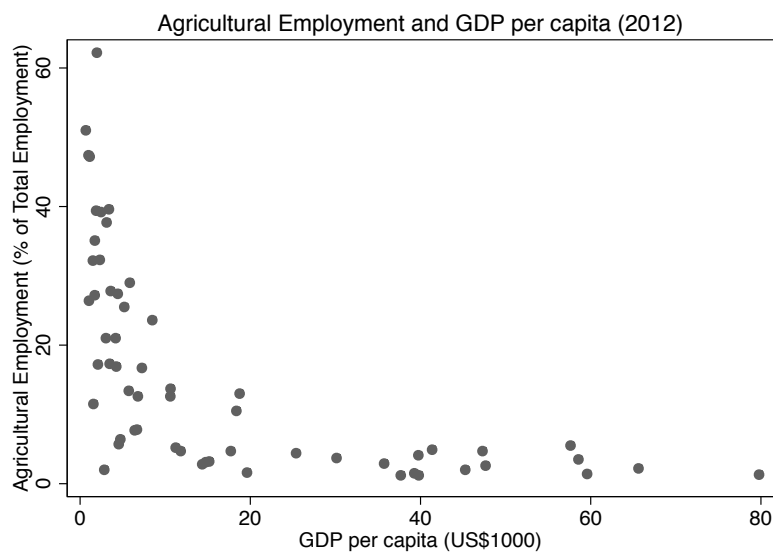
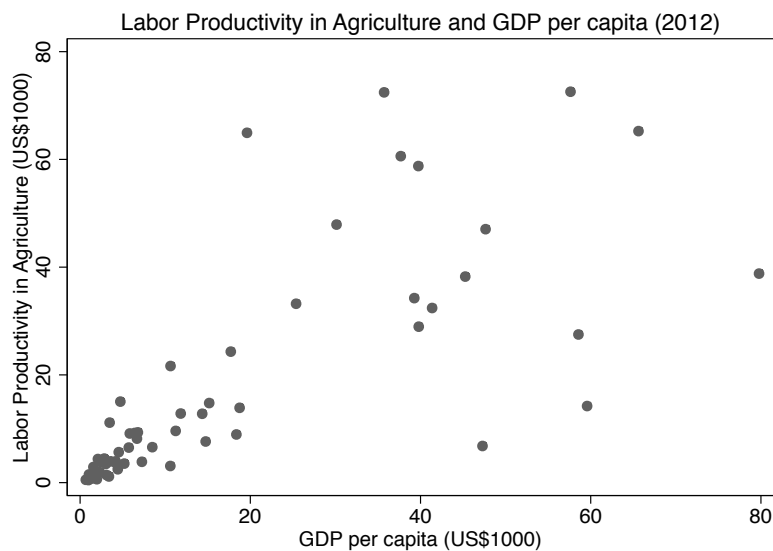


ENV ECON 118 / IAS 118 - Introductory Applied Econometrics
Assignment 1
Due Tuesday September 15 at the beginning of class

There is a large literature in macroeconomics that investigates why there exist such large differences in gross domestic product (GDP) per worker between developed and developing countries. Recently economists have focused on the role of agriculture in accounting for these differences (Restuccia et al. 2008, *Journal of Monetary Economics*). Why might agriculture be important? Consider two facts, which we will explore in greater detail below. First, labor productivity of the richest countries in agriculture is 78 times that of the poorest countries. Second, the poorest countries allocate 86% of their employment to this sector, as compared to only 4% in the richest countries.

The data is from the World Bank development indicators on Labor Productivity in Agriculture, and GDP per capita (<http://data.worldbank.org/data-catalog/world-development-indicators>) for 2012. Labor productivity in Agriculture is measured as the output of the agricultural sector less the value of intermediate inputs, divided by the number of workers. It is measured in thousands of US\$. GDP per capita is gross domestic product divided by midyear population, and is measured in thousands of US\$. The graphs below contain all 59 countries in the original dataset which have data on Labor Productivity in Agriculture, Agricultural Employment and GDP per capita. The values for selected countries can be found in Tables 1, 2 and 3.



Exercise 1. Relationship between GDP per capita and Labor Productivity in Agriculture

As you see on the first graph, there appears to be some association between GDP per capita and Labor Productivity in Agriculture. We will establish a simple linear relationship on a (very small) subset of 5 countries.

Table 1: GDP per capita and Labor Productivity in Agriculture

Country	Labor Productivity in Agriculture (US\$1000)	GDP per capita (US\$1000)
Bulgaria	15.03	4.73
Croatia	21.64	10.62
Saudi Arabia	24.31	17.71
Spain	33.20	25.38
Italy	47.90	30.13

- (a) Use Excel to create the scatter diagram of these observations. Don't forget to (1) label the axes and their units, and (2) title your graph.
- (b) This question has two parts. First: Estimate the linear relationship between GDP per capita and Labor Productivity in Agriculture (E) by OLS, showing all intermediate calculations as we did in the handout (use Excel to create the table and show all the steps).
 Second: interpret the value of the estimated parameters $\hat{\beta}_0$ and $\hat{\beta}_1$.

$$\hat{E} = \hat{\beta}_0 + \hat{\beta}_1 GDP/cap$$

- (c) In your table, compute the fitted value and the residual for each observation, and verify that the residuals (approximately) sum to 0.
- (d) According to the estimated relation, what is the predicted \hat{E} for a country with a GDP per capita of \$15,000?
- (e) How much of the variation in Labor Productivity in Agriculture for these 5 countries is explained by their GDP per capita? Can you provide some reasons for why agricultural productivity might be lower in less developed countries?
- (f) Repeat exercise (b) for two additional sets of countries below.

Table 2: GDP per capita and Labor Productivity in Agriculture

Country	Labor Productivity in Agriculture (US\$1000)	GDP per capita (US\$1000)
United Kingdom	28.95	39.79
Austria	32.41	41.37
Sweden	38.24	45.26
Denmark	47.04	47.65
Iceland	72.56	57.63

Table 3: GDP per capita and Labor Productivity in Agriculture

Country	Labor Productivity in Agriculture (US\$1000)	GDP per capita (US\$1000)
Ireland	6.80	47.29
United Kingdom	28.95	39.80
Germany	34.24	39.27
Italy	47.90	30.13
Puerto Rico	64.93	19.61

- (g) How do your estimates of $\hat{\beta}_0$ and $\hat{\beta}_1$ change between Tables 1, 2 and 3? Briefly explain this variation in 3-5 sentences.

Exercise 2. Functional Forms

- (i) An economist asks you whether they should estimate a linear relationship between GDP and Share of Employment in Agriculture. You will make your decision based on the graph on page 1. If you answer “yes”, please say why. If you answer “no”, can you name another functional form you might try?
- (ii) The economist sees your analysis of the relationship between GDP per capita and Labor Productivity in Agriculture. She asks you to explore alternative functional forms for this relationship. Using all the countries from the World Development Indicators database, I have estimated the following equations:

A linear relationship: $\hat{E} = 3.7256 + 0.7659 \text{ GDP/cap}$

A log linear relationship: $\hat{E} = -8.3268 + 11.9727 \log(\text{GDP/cap})$

A log-log relationship: $\log(\hat{E}) = -0.0274 + 0.9675 \log(\text{GDP/cap})$

- (a) Interpret the parameter on GDP per capita (or $\log(\text{GDP per capita})$) in each of these equations.¹
- (b) What is the predicted Labor Productivity in Agriculture for a country with a GDP per capita of \$15,000 with each of the models?

Exercise 3. Importing data into Stata

- (a) After the Stata introduction session, you should have a folder on your computer called EEP 118. Within that folder, create a subfolder called Problem Set 1, and within that another sub-folder “Data”. Download the data for this assignment from the course website and save it in your new Data folder.
- (b) Open Stata and change directories so that you are now in your Data folder.
- (c) Turn on a log file to record the following commands and output. (You will submit the log file as your answer to this exercise on the assignment.) NOTE: If you do not specify the text option for your log file, Stata will default to its .smcl format, which you will only be able to open/print on computers that have Stata installed. If you are working in the lab and need to print your log file somewhere else, be sure to specify the text option.
- (d) Show that you are in the Data subfolder of your EEP 118 folder by displaying your present working directory with the pwd command.
- (e) Load the data into Stata (use either Import under the File menu, or the insheet command, note that the data is presently stored in .xls format).
- (f) Provide summary statistics on the labor productivity in agriculture variable using the “summarize” command with the “detail” option. Note that GDP per capita is measured in thousands of US dollars per capita and that labor productivity in agriculture is measured in thousands of US dollars.
- (g) Close your log file and print it out.

¹It is convention to always use the natural log