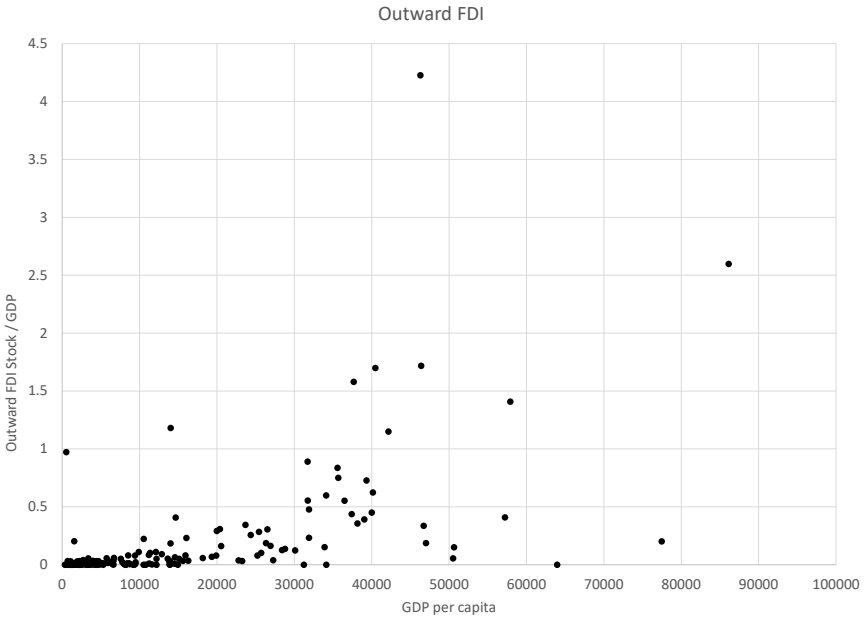
::Solutions::

Problem Set #1: Due end of class September 7, 2017

You may discuss this problem set with your classmates, but everything you turn in must be your own work. Please read the "problem set guidelines" on the course web page before beginning.

1. Download PS1_Data.xlsx from the course webpage. The workbook contains the following data for each country: GDP per capita (U.S. dollars), GDP (U.S. dollars), Inward FDI stock (U.S. dollars), and Outward FDI stock (U.S. dollars). All data are for the year 2012.

   (a) Turn in one well-labeled "scatter" plot with GDP per capita on the x-axis and Outward FDI stock/GDP on the y-axis.



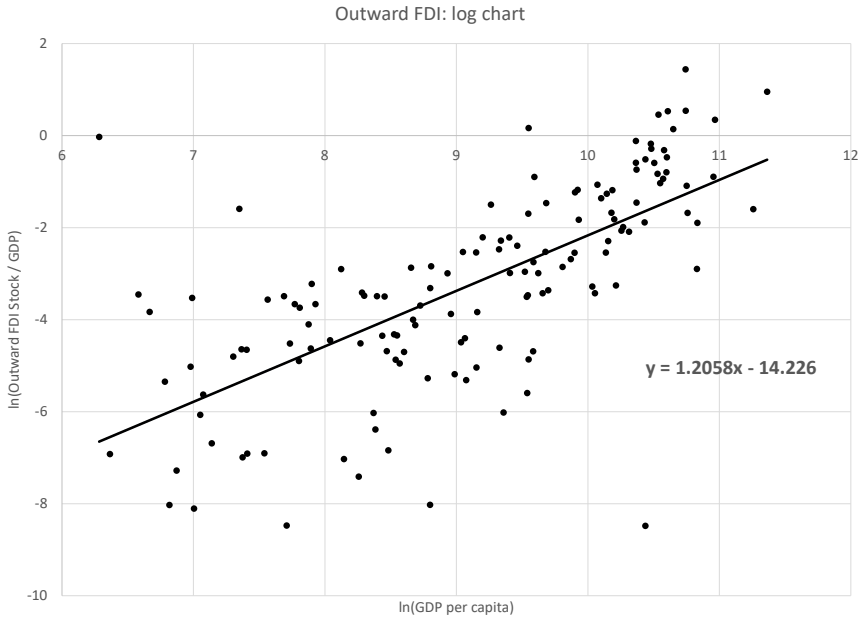
   (b) In a few sentences, describe what you see in the scatter plot. What is the relationship between outward FDI and GDP per capita? Is it a strong relationship?

> There seems to be some kind of positive relationship between outward FDI and GDP per capita. For low levels of GDP per capita, the relationship looks flat, then the relationship gets stronger for larger values of GDP per capita.

(c) Now lets redo part a. in logarithms ("logs"). We will work with the natural log — the function `ln()` in Excel and many other computer languages. Turn in one well-labeled "scatter" plot with the logarithm of GDP per capita on the x-axis and the logarithm of Outward FDI stock/GDP on the y-axis.

[Do not simply change the axis of your plot from part a. to a log axis. Compute the logarithm of each data series and re-plot it. Drop any countries who have zero FDI stocks.]

Note: I have removed the countries that had zero FDI. Taking the log zero returns an error. Excel will plot the error as zero, which is not correct — the log of zero is closer to negative infinity.



(d) In a few sentences, describe what you see in the scatter plot. What is the relationship between outward FDI and GDP per capita? Is it a strong relationship? How does this plot compare to the one in part a.?

There is a clear **positive, linear** relationship between GDP per capita and the stock of outward FDI. It is much easier to see the positive relationship in this figure compared to the figure in which we plot the levels, rather than the logs.

2. Statistics (or econometrics) gives us a powerful tool for studying the relationship between two variables: the *linear regression*. As you might gather from the name, this tool works well when the two variables have a linear relationship.

   (a) In your Excel graph from question 1c, add a linear trend line (if you need help with this, Google "Excel trend line").

   To draw the trend line, Excel is assuming that the data are related in a linear way,

   $$\ln\left(\frac{FDI_i}{GDP_i}\right) = \alpha + \beta \ln\left(\frac{GDP_i}{POP_i}\right) + \varepsilon_i,$$

   and tries to find the two numbers α and β to make the line fit the data as well as possible.

   > See the figure in answer to question 1c.

   (b) In your graph for question 1c, find the option in Excel to "display trend line equation on chart." The equation it displays is showing the values of α (the intercept of the line) and β (the slope of the line). [Note: there is nothing to turn in for parts a and b of this question. The trend line and equation for the trend line can just be a part of your graph in question 1 part c.]

   > See the figure in answer to question 1c.

   (c) Report the value of the slope coefficient. In a few sentences, describe what the slope means.

   > The slope coefficient is 1.21. This means that when the log of GDP per capita increases by one, the log of outward FDI/GDP increases by 1.21.
   >
   > [A bit more: Taking logs makes the interpretation of this coefficient even easier. When the "y" and "x" variable are both in logs, the slope coefficient of the regression can be interpreted as an elasticity. This means: For each **one percent** increase in GDP per capita, outward FDI/GDP increases by **one percent**.]

3. Use the heterogenous firm model that we developed in class (and in the note "Horizontal Direct Investment") to answer the following questions. This question deals only with domestic firms.

   (a) How does the price charged by a domestic firm change as ϵ increases? What is the intuition for this result?

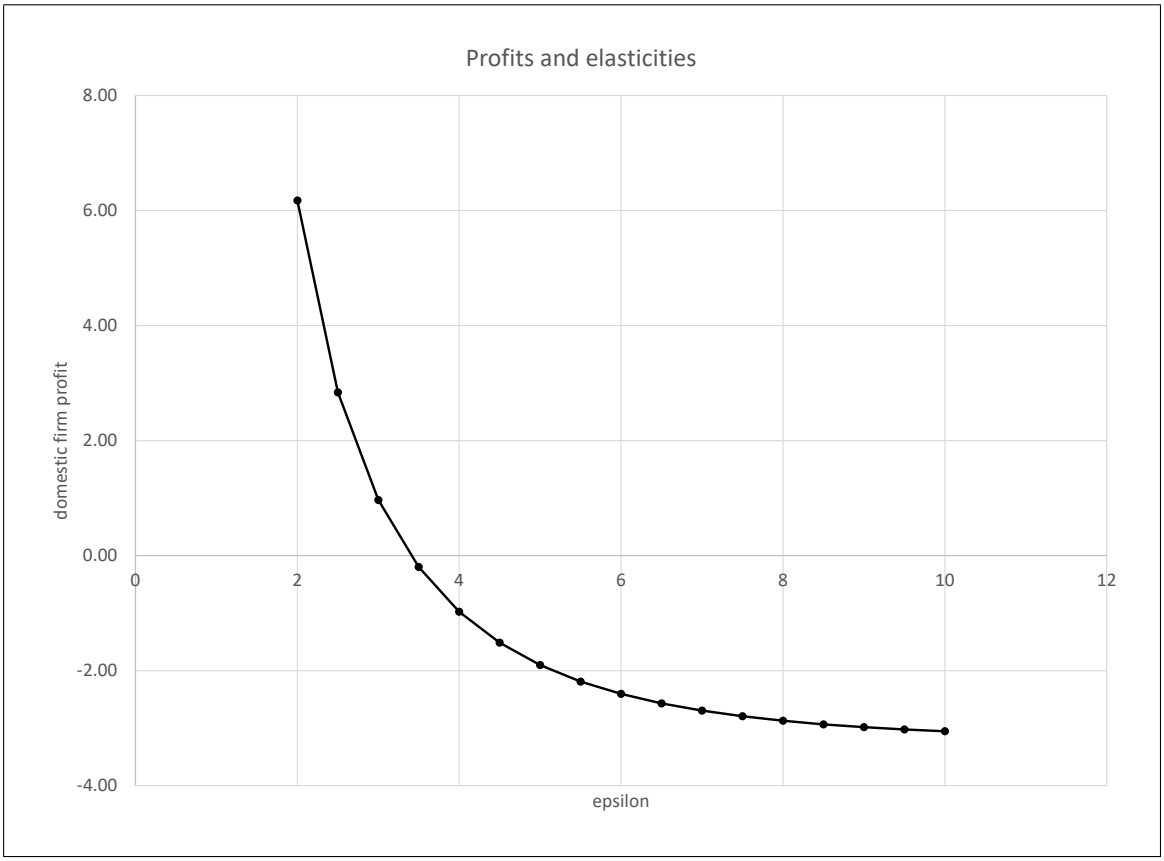
   > Increasing ϵ means that consumers are more sensitive to prices. When consumers are more price-sensitive, firms charge lower markups, decreasing their price. Recall that the markup over marginal cost in the model is $\epsilon/(\epsilon - 1)$.

   (b) Let $\epsilon = 3$, $w_1 = 2$, $E_1 = 50$, and $f^p = 1.6$. What is the profit of a country 1 domestic firm with productivity $\varphi = 1.5$?

   $$\begin{aligned}\pi_1(\varphi) =& \frac{E_1}{\epsilon_1}\left(\frac{\epsilon_1}{\epsilon_1 - 1}\frac{w_1}{\varphi}\right)^{1-\epsilon_1} - w_1 f^p \\ \pi_1(\varphi) =& \frac{50}{3}\left(\frac{3}{3-1} * \frac{2}{1.5}\right)^{1-3} - 2 * 1.6 \\ \pi_1(\varphi) =& 0.967\end{aligned}$$

   (c) Create a plot in Excel (or some other program) of the profit a firm with $\varphi = 1.5$ earns as ϵ changes. The x-axis is ϵ, and the range should be from 2 to 10. The y-axis is firm profit evaluated at the different ϵ. Let $w_1 = 2$, $E_1 = 50$, and $f^p = 1.6$. Clearly label and submit the plot.

   [Hint: Create a column of ϵ values that range from 2 to 10, maybe in increments of 0.5. Create a second column that computes the firm profits for each corresponding value of ϵ. Plot the columns.]



(d) What is the relationship between the price elasticity of demand and firm profits? In no more than a paragraph, discuss the economic intuition for this result.

Profits fall as consumer demand becomes more elastic. As demand elasticity rises, firms lower their markups. Lower markups mean lower operating profits. (You can see this in the solution to part b. As ϵ rises, the term $1/\epsilon$ goes to zero.) While operating profits fall, the fixed costs do not, and eventually profit is negative.

In short, the higher the elasticity of demand, the harder firms have to compete and lower are profits.

[As an additional exercise, you could redo the plot, but with $\varphi = 2$. How does the figure change when a firm is more productive?]

4. IKEA, the flat-pack furniture company, is, in many ways, a classic multinational: its *IKEA Industry* subsidiaries produce furniture and other items in 11 countries throughout the world. On the retail side, however, IKEA chooses to franchise. From the IKEA web site:

   "The IKEA Group franchises the IKEA retail system and methods from Inter IKEA Systems B.V. in the Netherlands. Inter IKEA Systems B.V. is the owner of the IKEA Concept and the worldwide IKEA franchisor." You can read more about IKEA franchising at http://franchisor.ikea.com/the-story-behind-franchising/

Using the OLI framework, discuss the franchise system as it relates to IKEA. Be sure to address IKEA's ownership advantage, and what forces might have led them to franchise the retail operation rather than operate corporate stores. Limit your answer to two paragraphs.

IKEA's ownership advantage lies in its intellectual property — the "IKEA Concept" referenced above. Their intellectual property encompasses things like IKEA's ability to create flat-pack furniture (and meatballs) that consumers demand, the IKEA brand, and the IKEA retail system (e.g. the maze-like layout of its retail stores).

The location advantage is pretty straightforward: brick-and-mortar retail has to take place in the market IKEA intends to serve.

As a retailer, the IKEA intellectual property is reasonably difficult to appropriate. The retailer sells IKEA products which it can only purchase through IKEA, so the risk of a retailer copying an IKEA product is low. IKEA stores are large, so it is unlikely that a rogue IKEA store could be created without IKEA knowing. This means that the retail operation does not need to be internalized (i.e., the internalization advantage is small) so it franchises its retail, saving IKEA from investing in retail outlets, per se.