EIB-GDN PROGRAM IN APPLIDED DEVELOPMENT FINANCE

Written Assignment for Selection of *Candidate Fellows* for 2018-2019 Program Cycle

Set 1: Friday, 11 May 2018

PART I: ANALYTICAL & DATA SKILLS

1. Basic Analytical Concepts[1]

a) A country has the following income distribution.

	Lowest 10%	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%	Highest 10%
Year 1	1.7	4.5	8.5	13.7	21.6	51.7	10
Year 2	3.2	7.9	12.9	17.2	22.9	39.1	24.3

Has the inequality increased from Year 1 to Year 2?

b) Consider a simple model trying to estimate the impact of privatization of water supply on child mortality:

*ChildMortality = A + B * WaterPrivatization + C*

where *WaterPrivatization* equals 1 if a municipality privatizes its water services and 0 otherwise. C is i.i.d. error term with E(C) = 0.

Suppose that in your data set, *ChildMortality* is 12% in municipalities that privatize and 20% in municipalities that do not privatize. What are the OLS estimates of A and B? Can you think of any reasons that the estimates may be biased?

[1] These should be considered as short answer questions. Please use a couple of sentences to a maximum of one paragraph, including calculations, to respond to them.

c) The following table shows average annual income of people before and after the launch of a microfinance program.

	Average Income ($)	
	Participants	**Non-Participants**
Pre-intervention period	700	800
Post-intervention period	1150	1100

What is the impact of microfinance program on participants' income?

d) In a country, the cancer has prevalence of 1 out of 2000 people. The diagnostic test has a false positive rate of 10% (meaning 10% of people who don't have it are incorrectly tested as having cancer). But the test correctly diagnoses every person who has cancer. What is the probability that a randomly selected person with a positive test result actually has cancer?

e) Consider the following demand curve,

$$\ln(Q) = A + B \ln(P) + C \ln(Y) + U,$$

where Q and P are the quantity (number) and price of haircuts in a city, Y is mean income and U is the standard error term.

How will you test the hypothesis that during economic recessions, people keep longer hair? Please specify any assumptions you have to make.

f) A website report mentions that average price for a gallon of gasoline in a country is $3.94. Assume the standard deviation of $0.25 for the price of gasoline per gallon. What should be the sample size if the company wishes to report with margin of error of $0.10 at 95% confidence?

g) Suppose that we want to estimate the effect of several variables on annual saving and that we have a panel data set on individuals collected on January 31, 1990, and January 31,
1992. If we include a year dummy for 1992 and use first differencing, can we also include age in the original model? Explain.

2. Data Skills

This exercise requires you to work with data on Sustainable Development Goals, which is available from
https://datacatalog.worldbank.org/dataset/sustainable-development-goals
[Click on "Data & Resources" tab on above page. Then click on "Excel" which downloads the data as a zip file containing the excel file.]

The variable of interest is "Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)" or the indicator code "SI.POV.DDAY". We want to study whether the changes in this variable are caused by "GDP growth (annual %)" or "GDP per capita growth (annual %)".

Answer the following questions, based on the downloaded data.

a) Which country has experienced the highest reduction in the poverty headcount ratio (and how much)? Which country has experienced the highest average yearly reduction in the poverty headcount ratio (and how much)? Among the countries with poverty headcount ratio data, which country has experienced the highest growth in GDP (and how much)? Among the countries with poverty headcount ratio data, which country has experienced the highest growth in GDP per capita (and how much)?

   Due to the missing data, it is understandable that the time horizon will be different for the countries i.e. instead of 1991-2017 it will be from first year with data to last year with data.

b) Can GDP growth be causing the reduction in poverty headcount ratio (show scatter plot)? If yes, is the relationship significant (show regression estimates)?

c) Can GDP per capita growth be causing the reduction in poverty headcount ratio (show scatter plot)? If yes, is the relationship significant (show regression estimates)?

PART II: KNOWLEDGE OF EVALUATION

3. Gray Ghost Ventures(GGV) is a venture capital fund that focuses exclusively on impact investing. Starting from microfinance, GGV started branching out in 2006 in other fields as well. Their mission philosophy is to promote solutions that can have an organic uptake in the market and can hence be self-sustainable beyond the externally funded incubation period.

   GGV is currently reviewing their portfolio, and has approached you to evaluate the performance of one of their investments M-KOPA Solar. This is what the company says about themselves: M-KOPA Solar sells solar home systems on an affordable mobile money payment plan, with an initial $35 deposit, followed by 365 payments of 45 cents. After completing the payment package, customers own a world-class solar home system, with multiple lights, phone charging and a radio.

   GGV has requested you to submit an Expression of Interest (EoI) about how you plan to evaluate the impact of M-KOPA. Please draft a response of not more than 5 pages (single-spaced, size A4, font 11) that should include the following:

   1. A short description of M-KOPA's mission and business model;

2. A short literature review, if available;
3. Your understanding of the possible structure of the impact mechanism and who the beneficiaries may be;
4. Your methodological approach to track or identify the impact (if it exists);
5. What kind of data you may need to collect and how you plan to collect such data; and
6. Possible theoretical and practical challenges to implementing your evaluation strategy.

M-KOPA has made available a lot of information at this link: http://www.m-kopa.com/lightbulb-moment-for-m-kopa/. You are free to look up other sources and references. You are also encouraged to seek advice from your friends or expert mentors (please mention in your response if you do).

PART III: PROFESSIONAL COMMUNICATION SKILLS

4. Under the EIB-GDN program, you have been assigned the task of evaluating Pegosolah, a company that sells pay-as-you-go off-grid solar products. You met with the CEO of the company, Ms Manayvong, who explained that while the product is selling well, she is concerned about low levels of customer repayments. She identified two factors that she thinks cause customers to fall behind with payments: (i) many have seasonal jobs, which make it difficult to keep up with the payment schedule, and (ii) some have very large families. She would like to have more robust evidence as to which characteristics really affect the probability of repayment.

   You decide that the best way to proceed is to perform a probit analysis. For the dependent variable, you will split the customers into "good" and "bad" payers based on their transactional histories. As independent variables, you will take need data on customer socio-economic and demographic characteristics. PG-Solar only collects limited customer information, so you will need to run a phone call survey on around 2000 (based on the minimum detectable effect) customers to collect additional socio-economic data.

   You will need to ask Pegosolah for the phone contacts of its clients. In addition, you have to set up a good incentive system to get customers on board for the survey. Write an email to the CEO to explain what you intend to do, what you will need from them, and set up the next steps for the cooperation. Please note the CEO and the staff have very little background on research, so they might find research jargon very difficult (e.g. a "control group" are a group of non customers). Moreover, they all work in a fast-paced start up environment, so they won't spend more than 5 minutes reading your email.