Written Exam at the Department of Economics winter 2018-19

Advanced Development Economics – Macro aspects

Master's Course

December 19th , 2018

(3-hour closed book exam)

Answers only in English.

The exam has 7 pages, and consists of 3 questions (each question has multiple parts).

Each question (A, B, and C) has a total weight of 1/3 in the final grade.

NB: If you fall ill during an examination at Peter Bangs Vej, you must contact an invigilator who will show you how to register and submit a blank exam paper. Then you leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

Be careful not to cheat at exams!

You cheat at an exam, if during the exam, you:

- Make use of exam aids that are not allowed.
- Communicate with or otherwise receive help from other people.
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text.
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts.
- Or if you otherwise violate the rules that apply to the exam.

QUESTION A. The gender wage gap, fertility, and education.

Consider an economy in which each household is comprised of two adult individuals, $i = F$ and $i = M$. Each adult individual i is endowed with one unit of time, which is entirely supplied in the labor market, and thereby generates an income level of w^i. Therefore, each household in this economy has an income level of

$$y = w^F + w^M.$$

Individuals derive utility from their level of consumption, the number of children they have, and the level of knowledge and skills their children have. Assume that these decisions are made at the household level and, in particular, that each household maximizes a utility function

$$u(c, n) = \gamma \ln(c) + (1 - \gamma)[\ln(n) + \ln(s)]$$

where c is the level of consumption, n is the number (*quantity*) of children in the household, s is the level of knowledge and skills (*quality*) of each child, and $\gamma \in (0, 1)$ is a fixed parameter.

Assume that children's level of knowledge and skills (s) grows with investments in education their parents' make, but falls in an economy with faster rates of innovation and technological progress. In particular, assume that

$$s = \frac{e}{e + g}$$

where e is the number of years of education a child gets to acquire knowledge and skills, and g is the rate of technological progress in the economy.

Each household faces two types of costs associated with having a child: the costs of one year of education for each child (τ^e), and the time costs of having each child regardless the amount of education the child receives (τ^q). Assume that both costs represent constant proportions of income, and that the costs of education are financed by the income of both parents $i = M$ and $i = F$, but that the time costs reflect only the opportunity costs for one of the parents (say parent $i = M$).

Under these assumptions, the typical household's problem is maximizing u subject to the budget constraint

$$c + \tau^q w^M n = y(1 - \tau^e e n).$$

A.1. Show that the optimal levels of fertility (n^*) and investments in education (e^*) for the typical household are

$$n^* = (1 - \gamma) \cdot \left[\frac{\tau^q}{1 + \frac{w^F}{w^M}} + \left(\frac{g \tau^e \tau^q}{1 + \frac{w^F}{w^M}} \right)^{\frac{1}{2}} \right]^{-1}$$

and

$$e^* = \left(\frac{g\tau^q}{\tau^e [1 + \frac{w^F}{w^M}]} \right)^{\frac{1}{2}}.$$

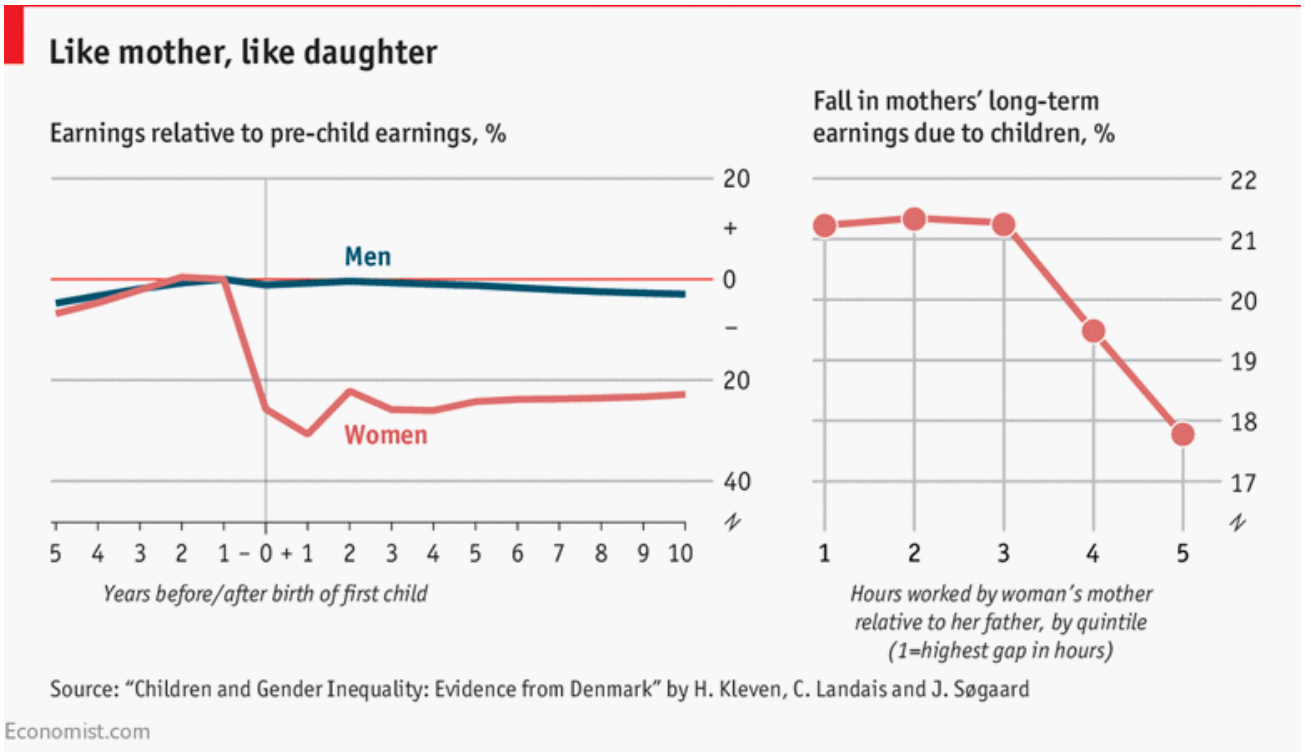
A.2. What are the effects of faster technological progress (or an increase in g) on n^* and e^*? Interpret your results.

A.3. What is the historical evidence about the relationship between *quantity* and *quality* of children?

A.4. Assume that initially there is a wage gap such that $\frac{w^F}{w^M} > 1$. What are the effects of a reduction in the wage gap, $\frac{w^F}{w^M}$, on n^* and on e^*? Interpret your results.

A.5. What does the empirical evidence show about the effects of the wage gap on fertility and investments in children's education?

A.6. In a recent study, Henrik Kleven, Camille Landais and Jakob Søgaard use Danish register data for the period 1980-2013, to analyze the effects of having children on the earnings gap between women and men. Their findings show that (*i*) the negative effects of having children on the earnings of women relative to men are significant and persistent, and that (*ii*) the long-term drop in mothers' earnings is larger for women who had mothers working less hours than their fathers – the graphs below illustrate these results. How do these findings relate to your answers above, and to the literature in our course?



Source: *The Economist*, Jan 26th, 2018, "The roots of the gender pay gap lie in childhood".

QUESTION B. The State.

In 2016, Daron Acemoglu, Jacob Moscona and James Robinson (AMR) published a study on innovation in the US, where they argue that "[...] one particular set of institutions, the presence of the infrastructural capacity of the state, played a significant role in nineteenth-century innovations [...]" in that country. They examine a panel dataset for all US counties and nine different years between 1804 and 1899, and show that the number of postal offices in each county (used as a proxy for the infrastructural capacity of the state in those areas) is significantly associated with the number of patents granted to the residents of that county. The table below illustrates AMR's baseline findings, and the robustness checks the authors performed.

B.1. In general, what are the mechanisms through which the state contributes to economic development?

B.2. In particular, what are the mechanisms through which the infrastructural capacity of the state contributes to faster technological innovation?

B.3. Column 1 in the table below shows AMR's baseline results. Can we give these baseline results a causal interpretation? Explain your answer in detail. *Hints: (i) recall the endogeneity problems we often encounter when doing empirical analysis, (ii) the potential ways to address those problems, and (iii) read the notes in the table, where you find details about each regression specification.*

B.4. Column 3 shows the way in which *leads*, contemporaneous levels, and *lags* of the number of postal offices hold explanatory power vis-à-vis the level of patenting. How do these results help to reduce concerns of endogeneity due to reverse causality?

TABLE 2—ROBUSTNESS AND TIMING OF EFFECTS

Outcome variable: log(1 + patents)	Balanced panel of counties established by 1830				Unbalanced panel of all counties, 1830–1890			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log (1 + post offices) first lead			−0.007				−0.013	
			(0.015)				(0.012)	
log (1 + post offices)			−0.003				−0.004	
			(0.013)				(0.011)	
log (1 + post offices) first lag	−0.028*	−0.01	−0.019	0.021	−0.024**	−0.01	−0.015	0.026**
	(0.015)	(0.014)	(0.016)	(0.013)	(0.012)	(0.011)	(0.012)	(0.01)
log (1 + post offices) second lag	0.013	−0.008	−0.005	−0.006	0.007	−0.015*	−0.011	−0.002
	(0.016)	(0.013)	(0.013)	(0.013)	(0.011)	(0.009)	(0.009)	(0.01)
log (1 + post offices) third lag	0.069***	0.029**	0.022*	0.019	0.058***	0.0235***	0.020**	0.024**
	(0.016)	(0.012)	(0.012)	(0.013)	(0.011)	(0.009)	(0.009)	(0.01)
log (1 + post offices) fourth lag	0.121***	0.057***	0.061***	0.027**	0.116***	0.0611***	0.061***	0.040***
	(0.016)	(0.013)	(0.013)	(0.013)	(0.012)	(0.01)	(0.011)	(0.01)
p-value for slave population share interactions		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
p-value for literacy interactions		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
p-value for farm value interactions		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
p-value for manufactures value interactions		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
p-value for linear county trends				[0.000]				[0.000]
Observations	8,370	8,370	7,440	8,370	12,842	12,842	11,316	12,842
R^2	0.416	0.583	0.595	0.724	0.559	0.559	0.570	0.713
Number of counties	930	930	930	930	1,526	1,526	1,526	1,526

Notes: The outcome variable is log(1 + patent count). The log of county population and county and year fixed effects are included in all specifications. Columns 2–4 and 5–8 include the characteristics listed at the bottom of the table (slave population share in 1860, adult literacy share in 1850, log farmland value in 1850, and log manufacturing value in 1850) interacted with a full set of time dummies. Columns 4 and 8 include linear county trends. The *p*-values of the corresponding *F*-tests for the controls and county trends are reported in brackets. Robust standard errors clustered by county are in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Source: Acemoglu, Daron, Jacob Moscona, and James A. Robinson (2016), State Capacity and American Technology: Evidence from the Nineteenth Century. *American Economic Review: Papers & Proceedings* 106(5): 61-67.

QUESTION C. Ruggedness and geography.

Nathan Nunn and Diego Puga (2012) show that geography, through its impact on history, can have persistent effects on economic development. They focus on ruggedness of the terrain as a particular grographical feature, and argue that a rugged terrain is typically more difficult to farm, more costly to traverse, often more inhospitable to live in, and therefore it has the capacity to hinder trade, other productive activities, and ultimately economic development. Consistent with that hypothesis, they show that ruggedness affects income negatively, in a comparison of countries across the globe in 2000. Yet they find that in Africa, countries with a rugged landscape tend to perform better than countries with flatter terrains. The baseline result shown in colum 1 in the table below, and also in the figures in the next page, illustrate this paradox.

C.1. What is a plausible explanation for that paradox?

C.2. By looking at the baseline result, a possible concern is that the estimated differential effect of ruggedness in Africa may be driven by other omitted geographical characteristics. How do the results reported in the table below address this concern? Explain in detail, and relate your arguments and examples to the results shown in the table.

C.3. In general, what is the relationship of geographic and climatic features with other *fundamental* determinants of economic development?

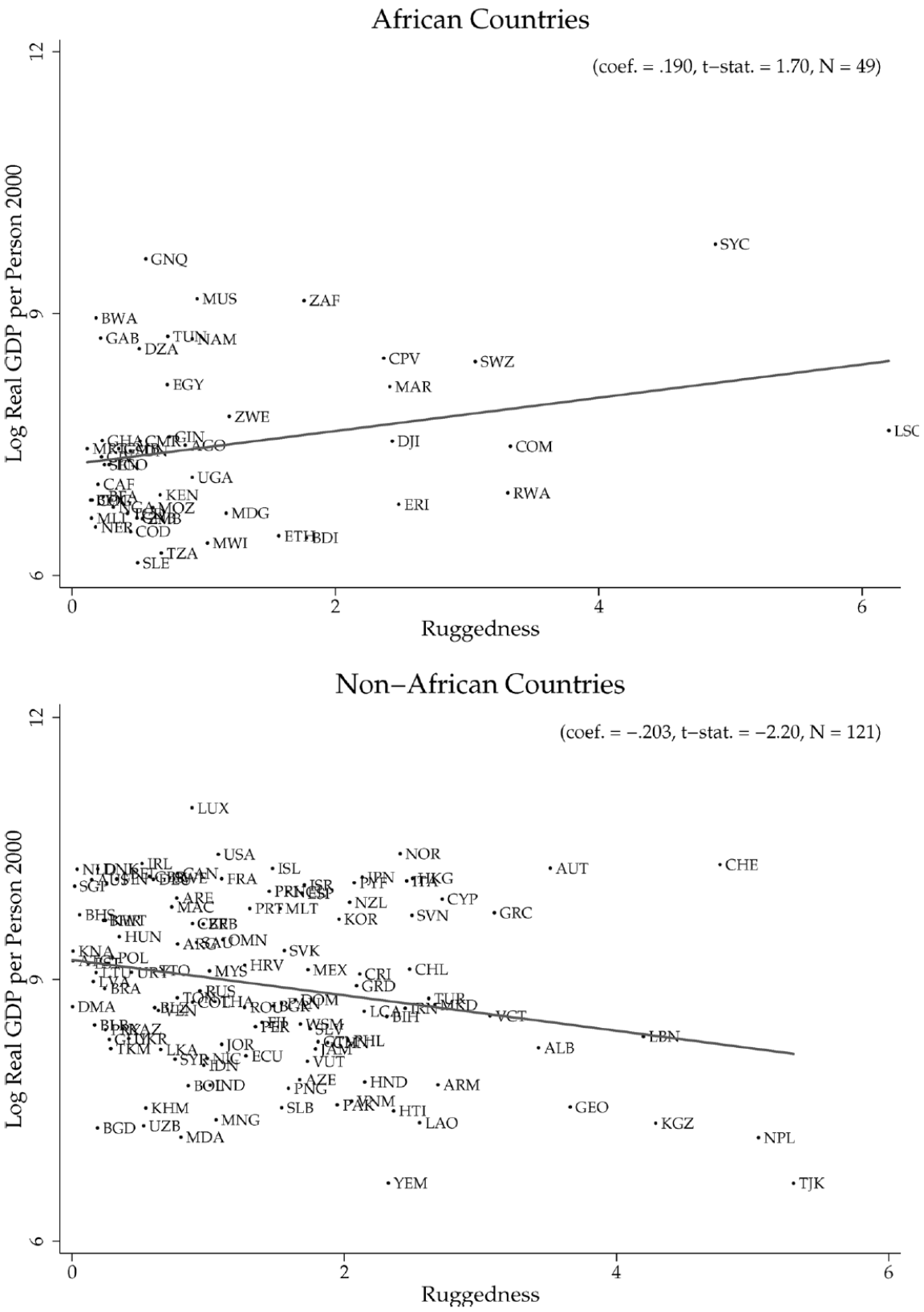
TABLE 1.— THE DIFFERENTIAL EFFECT OF RUGGEDNESS IN AFRICA

	Dependent Variable: Log Real GDP per Person, 2000					
	(1)	(2)	(3)	(4)	(5)	(6)
Ruggedness	−0.203	−0.196	−0.203	−0.243	−0.193	−0.231
	(0.093)**	(0.094)**	(0.094)**	(0.092)***	(0.081)**	(0.077)***
Ruggedness × I^{Africa}	0.393	0.404	0.406	0.414	0.302	0.321
	(0.144)***	(0.146)***	(0.138)***	(0.157)***	(0.130)**	(0.127)**
I^{Africa}	−1.948	−2.014	−1.707	−2.066	−1.615	−1.562
	(0.220)***	(0.222)***	(0.325)***	(0.324)***	(0.295)***	(0.415)***
Diamonds		0.017				0.028
		(0.012)				(0.010)***
Diamonds × I^{Africa}		−0.014				−0.026
		(0.012)				(0.011)**
% Fertile soil			0.000			−0.002
			(0.003)			(0.003)
% Fertile soil × I^{Africa}			−0.008			−0.009
			(0.006)			(0.007)
% Tropical climate				−0.007		−0.009
				(0.002)***		(0.002)***
% Tropical climate × I^{Africa}				0.004		0.006
				(0.004)		(0.004)
Distance to coast					−0.657	−1.039
					(0.177)***	(0.193)***
Distance to coast × I^{Africa}					−0.291	−0.194
					(0.360)	(0.386)
Constant	9.223	9.204	9.221	9.514	9.388	9.959
	(0.143)***	(0.148)***	(0.200)***	(0.164)***	(0.134)***	(0.195)***
Observations	170	170	170	170	170	170
R^2	0.357	0.367	0.363	0.405	0.421	0.537

Coefficients are reported with robust standard errors in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Source: Nunn, Nathan and Diego Puga (2012), Ruggedness: The Blessing of Bad Geography in Africa. *Review of Economics and Statistics* 94(1): 20-36.

FIGURE 2.—INCOME AND RUGGEDNESS AMONG AFRICAN AND NON-AFRICAN COUNTRIES



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