

**Final Exam, Development Economics 1 (31E15000), Period 1, 2023/24**  
 Oct 20, 2023, 9.00-12.00. Teacher: Miri Stryjan. Open book exam!

The exam has **3 Questions**. Answer all questions. A perfect answer is complete, but short and focused entirely on the question asked. The max score on the exam is 100.

Please observe the following format rules in your document:

- Student number on top of each page. Do **NOT** add your name on the file, only the student number!
- Start a new page for every main question (1, 2, 3) and indicate the question clearly.
- Please observe the space limitations for each question.

**Question 1. (max 30 points) write up to 1.5 page for a+b together**

The growth paradigms discussed in lecture 2 try to fit the data patterns of conditional growth convergence between countries over time (Figure 1), and sustained growth over long periods (Figure 2).

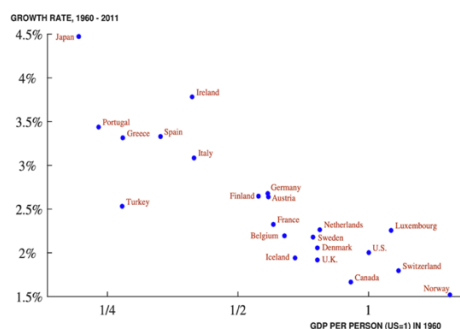
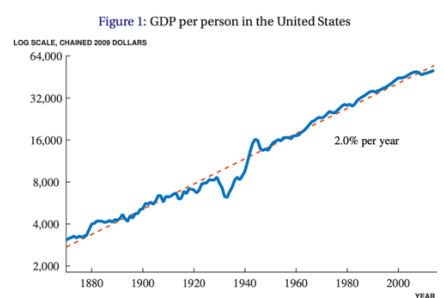


Figure 1



Note: Data for 1929-2014 are from the U.S. Bureau of Economic Analysis, NIPA Table 7.1. Data before 1929 are spliced from Maddison (2008).

Figure 2

- a) Discuss briefly for (i) the Solow/neoclassical growth models and (ii) models of endogenous growth *how the models' predictions fit the general patterns in Figure 1 and 2*. Connect your discussion to *what component(s) of the economy level production function are explained within each class of models*. Your discussion should be based on the course material.

*Max 16 points. For full points, an answer needed to*

- *Discuss each set of models (i) and (ii) correctly, and*
- *be clear about what components of the production function are explained in each of the models: K in Solow, A in endogenous growth (and still also K).*
- *connect each models to both figures*
- *correctly discuss and explain if the model is or is not in line with the figure.*

*Comments on grading:*

- *Full points were not given if the description of the models covered all factors in the model (H, L etc.) without clarifying which factors are explained within the model.*
- *Phrases copied directly from lecture notes or other material did not contribute to the grade.*
- *Describing what the figures show without connection to the models does not give points. Incorrectly describing the figures can, however, affect the grade negatively.*

Example answer:

In figure 1, we see that there is convergence: countries that started out rich grow slower than countries that started out poor. Growth appears to be bounded.

In figure 2, there is a steady growth rate in GDP per capita, i.e. growth seems unbounded.

The Solow model (and the neoclassical one) explains capital ( $K$ ) accumulation, and since capital depreciates, growth based on capital accumulation is bounded (the neoclassical model also predicts savings – not central for this question but ok to mention). This class of models hence predicts conditional convergence as seen in fig 1. It cannot explain the steady growth seen in figure 2.

Endogenous growth models such as the AK model fit fig 2 but not necessarily 1 (although some of the latter models could better speak to convergence as well). In addition to the Solow model, they explain  $A$ , technology progress, which makes the other factors of production more productive ( $K$ ,  $H$  and  $L$ ).

- b)** Development accounting exercises show that a large fraction of the differences in GDP per capita between countries are accounted for by differences in Total factor productivity (TFP). *Mention and describe each of the two components of TFP as outlined in Jones (2015).*

14 points

Full points required:

- clearly **mentioning** each component.
- **Explaining or describing** what each of them mean, with own words e.g. by giving examples. For  $M$ , full points require describing that misallocation has to do with the allocation of resources, credit etc. across firms or units within the economy.
- Additional points can be given for good discussion that connects the two components  $A$  and  $M$ , for example by referring to the production possibility frontier.

Comments on grading:

- Only saying that  $M$  is about (mis)allocation of resources is not enough.
- Points are not given for discussing how  $M$  may come about (e.g. taxation, corruption) since the question asked you to describe  $M$ .
- Points are also not giving for discussing what TFP is, unrelated to the distinction into  $A$  and  $M$ , or for discussing other parts of the production function such as human capital.
- Points are not given for content copied directly from the material.

Example answer:

Jones divides TFP into  $A$  and  $M$  where  $A$  stands for technology and knowledge and  $M$  stands for allocative efficiency. Technology can refer both to things like machines and devices used in production, and also to ways of organizing production. An important element in  $A$  is also the adoption of technology, which is low in many developing countries.  $M$  instead has to do with how resources are allocated across firms or units within the economy. Jones as well as Hsieh and Klenow (2010?) and Banerjee and Duflo (2005) discuss how within the same country, capital is allocated very unevenly leading to a large variance in productivity (marginal product of capital and labor) within the country. There are also many different prices of capital (credit) inside the same economy.

Example: Dumb but well connected firm owners get access to capital to expand the business while entrepreneurial but poor firm owners do not.

**Question 2. (max 36 points)** write up to 2 pages for a+b+c together

- a. Suppose we tried to model and estimate the effect of agricultural technology adoption on farmer yields, with the following equation, where  $y_i$  is yields in kg for farmer  $i$  and  $x_i$  is a dummy variable=1 if farmer  $i$  is using a new agricultural technology, such as high-yielding crop varieties (HYVs).

$$y_i = \alpha + \beta x_i + \epsilon_i$$

Explain the interpretation of  $\beta$  in this equation.

Also explain and discuss; What are the main (endogeneity) challenges related to estimating this parameter using observational data on farmers in a low-income context where the adoption of this technology is low? Explain with specific reference to this example.

Max 12 points, Full points require:

- Explaining the interpretation of beta in general like "it measures the correlation between  $y$  and  $x$ ", or saying "the unit change in  $y$  for one unit change in  $x$ , or saying the same thing referring to farmer yields and technology/HYVs. If you say that beta measures the **effect** of  $x$  on  $y$ , you need to also say that the relationship is not necessarily causal.
- Naming two examples of a likely endogeneity issues (using the correct term) and explaining each of them correctly in the context of the effect of HYVs on farmer yields, OR naming one example of a probable endogeneity issue (using the correct term) and giving a good and full explanation of it in the context of the effect of HYVs on farmer yields.

Comments on grading:

- Talking solely about the dependent and explanatory variable or similar (without referring to the variables in this particular question: yield and adoption) can give fewer than 3 points if the discussion is not clear.
- - No points for answers that only discuss that yield may be affected by other factors than HYV. This is only a problem for estimating Beta if this "other factor" also affects HYV use or is correlated in a systematic way with HYV use (or the error term).

Example answer:

Beta measures the average difference in yields between the farmers that use HYVs and farmers that do not use it. It can also be seen as the correlation between  $x$  (HYV use) and  $y$  (Yields).

Some endogeneity problems that can be present in this context are:

selection problems: people who adopt agricultural technology are likely to be different than those who don't in ways that are **likely to affect farming yields** also independent of their technology adaption (they may be more educated, come from a richer background, be from different types of regions and cultural groups etc..)

Moreover, there are quite possibly many **omitted variables** that determine farmer yields, such as e.g., local weather, that may affect both  $x$ : the tendency to adopt new technologies and the outcome: yields. If such factors are not controlled for, beta will give a biased estimate of the effect of  $x$  on  $y$ .

- b. In the paper “Two blades of grass” by Gollin, Hansen and Wingender (2021) discussed in (guest) lecture 9 of the course, the authors used a different specification to try and isolate the effect of agricultural technology adoption on yields. Their main results are presented below. **Please describe** the context and the main empirical approach in Gollin et al., with special focus on their identifying assumptions. *Hint: it can be helpful to be clear about what is the unit of analysis in the main analysis.*

*Max 12 points, a full answer requires:*

- *Saying something (correct) on the context studied.*
- *Correctly stating that the main analysis (which the table also showed outcomes for) was a difference-in-difference design and mentioning what the treatment was and how the variation is used in the regressions. The units in the study are crop types (crop in country  $i$  and year  $t$ ).*
- *mentioning the parallel trends assumption and describing why it is important in general for DID to be valid, AND how it applies to this context of crops, HYV varieties and yields.*

*Comments on grading:*

- *Points can be given also for discussing if the parallel trends assumption is likely to hold in this case.*
- *Points can also be given for mentioning and having a good discussion on the “common shocks” assumption, which is basically the parallel trends assumption, but centered around the treatment timing.*
- *Fewer points if context is not discussed or if details of DID and units are vague or incorrect.*

*Example:*

*The paper studies the effect of the green revolution on yields in agriculture and other outcomes. The main analysis presented in the table focuses on the effect of HYV technologies on the yields of different crops. The authors use a DID where they compare crops (e.g. maize) that received a HYV variety to crops that did not receive one, and compare their yield over time. The identifying assumption is that the yields of crops that did get an HYV variety would have developed similarly to crops without a HYV variety in the absence of the development of new varieties. The parallel trends that can be tested are whether crops that later got an HYV variety behaved similarly in the pre-period to crops that never got an HYV variety (behaved=in terms of their yields). The authors show evidence in support of such parallel pre-trends.*

- c. The figures below from Lecture 9 show that there is a negative relationship between GDP per capita and the share of the labor force/economy that is concentrated in agriculture. In other words, as countries become richer, the relative size of the agricultural sector diminishes, both in terms of source of employment and GDP. Early theorists claimed that this is a sign that agriculture is a “backward” sector, and that in order to achieve growth, policymakers ought to invest in **other sectors** than agriculture. *Discuss and criticize this claim using arguments from the course, and in particular lecture 9 (agriculture), 12 (technology adoption) and 2-3 (growth and TFP).*

*12 points. Full points require:*

- Presenting some arguments and explaining well how these may provide alternative explanations to the pattern that in richer countries agriculture is a smaller share of the economy.

Comments on grading:

- In this question, **many** students copied more or less directly from one slide (p.13) in Kalle Hirvonen's lecture, and the answers that were copied were discounted (unless there was a proper reference).

Example answer:

Agriculture is an important sector of the economy of many developing countries, often the largest single sector. Achieving fast growth is difficult when a large sector such as Agriculture is "left behind", so the older claim that it is possible to boost the economy by investing in other sectors may not be true.

Newer research argues that growth in agriculture is needed to start growth in the economy that could then spread to other sectors. Just as for other sectors, long run growth in the agricultural sector is driven by technological change and technology adoption (as discussed in lecture 2). As we saw in lecture 9 and 12, there is a big gap between actual and possible yields in developing countries, and low tech adoption in agriculture can explain part of that gap. Investing in technology (and adoption in agriculture would increase productivity and also decrease the number of workers needed in that sector while still producing the same output. Human capital (workers) can then be moved towards developing other sectors, which would gradually make agriculture a smaller share of the economy as the economy grows, and is therefore an alternative explanation to the negative pattern seen in the figure. Workers "released" from agriculture could also acquire more human capital through education, increasing productivity in the long run.

**Question 3: (max 34 points)** write up to 1.5 page for a+b together

In Lecture 11-12 of the course, we reviewed, largely based on Dupas (2011), key barriers to the adoption of preventive healthcare measures that are highlighted in economic research

- Choose two of the micro-level factors that affect individuals' and households' adoption of preventive healthcare technologies discussed in the lecture/paper. *State clearly what factors you chose and explain each of them and how they affect take-up of preventive health care.*

Max 16 points. full points require:

- You needed to choose two factors that indeed are micro level factors (not market level factors such as "supply shortage in the economy" or "poor performance of the public healthcare sector")
- Discuss clearly how each of the chosen factors affects take-up of preventive healthcare. Often the discussion is clearer if examples about specific preventive healthcare products are used. Explain the claims correctly.
- **Connect your claims to the factor you chose.** If your factor is time preferences/impatience, and you discuss that the technology may have uncomfortable side effects perceived as a cost, it is not clear how this is connected to patience. For full points for such an argument you need to explain clearly that when there are these additional "costs" that are perceived immediately, while the benefit of the usage lies on the future, more impatient individuals (who place more weight on utility today than later) are less likely to adopt.



*If the factor you consider is the budget constraint, motivate well the various subcategories discussed (various types of costs and benefits) and why they affect the budget constraint. It is obvious how monetary costs enter, and opportunity costs can also be directly related since they are about foregone income. But it is not clear how social costs or perceived uncomfortable side effects would enter the budget constraint. These factors are probably more relevant for other constraints.*

Comments on grading:

- *Mentioning additional factors (apart from the 2) did not lead to additional points*

Example answer:

**Factor 1: Budget constraint:**

*Poor households face binding budget constraints, and the costs of preventive healthcare can affect both the cost side (through the monetary cost of buying preventive products) and the income side (through opportunity costs, such as spending time to go to the clinic in another village, thereby missing out on a day of work and on needed income. We saw in the study by Banerjee and Duflo in lecture 12 that providing non-monetary incentives for getting vaccinated can compensate for the opportunity cost.*

*Since access to financial markets are also restricted for many poor household in developing countries, and there is limited access to safe saving technologies, the households can spend only what they have and this is why the budget constraint becomes binding for them in a given period.*

**Factor 2: Access to reliable information:**

*The nature of preventive healthcare is such that benefits are not easily observable and therefore understanding the benefit relies on trusting information from medics, researchers etc. about its impact in preventing disease. The access to information about the benefits of preventive healthcare can be limited to the poor, especially in rural areas (due to low access to media, internet etc.) and low education makes it more difficult for the poor to seek out process available information. If there is low public trust in health authorities or the media it is likely that many do not listen to the information disseminated there about the benefits of such healthcare practices.*

*(there are several other possible factors you could also chose).*

- b. *Connect these factors to the preventive measures that were recommended for limiting the spread of covid-19 such as physical distancing and the use of face masks. How could the factors that you chose in 3.a. affect the degree of adherence of individuals to these preventive measures? (Note: Your discussion should be focused on the two factors that you chose, and to the **individual's decision** of whether to adapt the preventive measure or not. Your discussion does not need to focus on developing countries).*

Max 18 points. Grading comments:

- *3 a and b are a package. If your answer to b is shorter or missing because you could not connect the COVID scenario to any of the factors you chose in a (physical distancing has no costs so the budget constraint is not relevant here), it would have been preferable to choose another factor in 3 a that you know how to connect to b.*
- *In b, some chose to continue to discuss the constraints and how they affected adoption of masks and distancing. Others discussed instead how the constraints could be solved by policy in the context of covid. Both approaches are fine, but the second one may have been a bit trickier since it risks drifting away from what was actually asked of you here: the question did not ask how policy affected adherence, but how the **constraints** did.*

- If the whole answer was on vaccines, that could affect grade negatively since the question was about face masks and distancing.
- If you write that “opportunity cost of something, e.g. physical distancing, are high”, you need to exemplify what those opportunity costs may be. There could be both more monetary ones (cannot go to work) and less (miss out on social company)

Example answer (using the same factors as in a):

**Budget constraints** also affected the adoption of these preventive practices during COVID (facemasks and distancing).

For many people, the budget constraint became even more binding during the pandemic due to layoffs and decreased incomes. This made it difficult to afford additional products for preventive healthcare such as masks. In the early pandemic, hoarding (stocking up on food and other necessities) also led people to have even less money available to e.g. buy face masks. Therefore more constrained ppl may have used the masks incorrectly (repeated times) or not at all. The distancing policies did not cost money but had a significant opportunity cost, especially for people who could not work remotely. The recommendations were not to use public transport, but for poor people using other means (taxi or a car) was not possible due to the budget constraint. Thus, people with smaller incomes more affected by the pandemic and with jobs that could not be done remotely are **likely to have adhered less to these preventive measures**.

**Reliable information:** During the pandemic there were many different messages and recommendations communicated in the media and by officials, and sometimes these were contradicting each other. For example the advice on the usefulness of face masks changed over time. There was no solid scientific research behind some of the early recommendations. These mixed messages appear to have made people suspicious and lowered the trust in authorities and health professionals in some contexts. Just as with other preventive measures, it is impossible for an individual to assess herself if a face mask prevents her from catching the disease (maybe she would have remained healthy even without using a mask?) and there were reports (e.g. on social media) of people who had taken all the precaution measures and got infected despite this, that were used to discredit the measures. All these factors **likely contributed to lower adoption and adherence to the recommendations regarding face masks**.