

Department of Economics  
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**ECON239: Development Economics**

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**Assignment #2 — Answer Guide**

Friday October 22, 2010

**Section A** (40 percent): Briefly discuss the validity of each of the following statements. In your answer define or explain as precisely as possible any terms or concepts which are underlined, with particular reference to the context in which they are being used. The text for each answer should be no longer than a page, but you also should also include diagrams or examples where appropriate. They have equal value.

**A1. When it comes to the fundamental determinants of economic development, “geography is destiny”.**

The definition of economic development is rather subjective. Many economists would define it as a process which leads to a rising average standard of living of the citizens in an economy. The most commonly used measure of this is the real GNP per capita. Another commonly used measure is the human development index which is a weighted average of indices of per capita GNP (in logs) and of literacy/education and longevity. Others would define economic development more broadly to include effects on inequality and poverty, socio-political issues and institutional structure.

Geography is generally viewed as being an important fundamental determinant of economic development. Broadly speaking we can divide these effects into three categories:

- **Terrain:** these would include proximity to sea (and other navigable waterways), geographical concentration and effects via government. A large fraction of people live and an even larger fraction of world GDP is produced within 100 kms of the sea, largely because of the trade links it offers.
- **Climate:** these include the direct impacts of climate on agricultural productivity, the impact of heat on human effort and the impact of climate on the prevalence of on diseases (e.g. malaria, yellow fever, sleeping sickness. etc.). Countries in tropical climates often receive a lot of rain, but it comes in deluges (e.g. monsoons) that are not so good for cereal crops. Moreover, the lack of frost implies that nutrients in the soil deteriorate faster and insects (which damage crops and spread disease) are prevalent year round.
- **Natural Resources:** although natural resources such as fertile land and minerals have often been a key source of growth in many countries, they do not always turn out to be a boon. Many countries with abundant resources (e.g. Nigeria) have not gained as much and, in fact, there is some evidence of a negative relationship between resource exports and growth, amongst

developing countries. There are several explanations for such a resource curse including overconsumption and the Dutch-disease. However, the curse often seems to have to do with problems with domestic government (e.g. corruption and “rent-seeking”) and, in some cases, exploitation by foreign corporations.

Although geography is an important factor, the resource curse is one example that shows it is not “destiny”. Political, economic and social institutions also seem to be important fundamental determinants of economic development, although it is often hard to demonstrate the direction of causation. The article by Acemoglu, Johnson and Robinson suggest that the political institutions we see today in many countries are the result of the process of colonialization between 1500 and 1900 and they, in turn, are a key determinant of current relative levels of development. Once we control for these effects, the direct effects of geography today may be less important.

**A2. The negative correlation between potential settler mortality during the early colonization of some developing countries and current per capita GDP is simply evidence of the persistent effects of disease on those countries and has nothing to do with political, legal or socioeconomic institutions (Hint: read the article from Economic Intuition on the 239 web site).**

Potential settler mortality refers to estimates of death rates due to various diseases experienced by early members of exploratory expeditions by European powers and religious missions. Several economists and historian have argued that during the process of colonization, these mortality rates played an important role in determining the nature of colonization. Political, legal and socioeconomic institutions could include a large number of rules, norms, agreements and arrangements which affect economic transaction. Generally speaking, economists define “institutions” as the humanly-devised constraints which structure incentives in economic transactions. In empirical work, political scientists and economists have tried to measure the quality of these institutions using various indices which assign scores or rankings to different countries based on their performance in certain areas (e.g. rule of law, constraints on executive power, government corruption). There are now a large number of indices available that purport to measure differences in institutional quality across countries, and these are typically highly correlated with per capita income. However, it is generally difficult to assess the direction of causation between these two measures — is it that better institutions lead to higher income per capita, or do richer countries have better institutions simply because they can afford them ?

The diseases discussed in the article by Acemoglu, Johnson and Robinson (AJR), were largely tropical diseases against which the indigenous populations in question had built up immunities over a long period (similarly Europeans built up immunities to smallpox and some forms of influenza that proved fatal for the indigenous populations of the Americas). In regions where the mortality rates of European explorers and military was high, it was not generally the case that the mortality rates of indigenous populations was equally high. This is why AJR hypothesize that the high correlation between the mortality rates of Europeans in these colonies and their per capita GNP 500 years later, must be the result of the effect the diseases had on the way

in which the Europeans colonized. In particular, in regions such as much of sub-Saharan Africa where mortality rates were high, Europeans did not really settle in a big way, but rather extracted resources (natural and human) and did not set up much infrastructure in the form of legal or contractual institutions. Indeed, the institutions that were created were often designed to pit different groups against each other, as part of the extraction process (e.g. artificially placing some ethnic groups in positions of power over others). In contrast, in regions where disease rates of Europeans were relatively low (e.g. North America), the Europeans “moved in” and created institutions which replicated those of their home countries (this, of course, did not generally imply a positive outcome for the indigenous populations).

Note that this evidence does not necessarily mean that diseases have no negative direct impact on productivity, other than through the nature of colonization and the resulting institutions. For example, Jeff Sachs has recently presented evidence of the negative impact of malaria risk (when measured properly) on per capita income, even after controlling for the impact of institutional quality.

**Section B** (60 percent): Answer the following questions. They all have equal value.

**B1. This question requires you to use David Weil’s data plotter. You can use this by following the link "Weil Data Plotter" on the "Useful Links" page of the ECON239 website. In this question, you do not need to print off all the graphs — just describe what you see.**

**(a) Using the data plotter, create a graph for all countries plotting growth rates of GDP per capita between 1960 and 2000 (Y-axis) against GDP per capita in 1960 (X-axis using a ratio scale). What is the relationship?**

There is not much of a relationship. There is little evidence of unconditional convergence here.

**(b) Now create a graph showing the same information, but only for countries with over US\$20,000 in 2000. What is the relationship now?**

There is a negative correlation: poorer countries amongst this group appear to be growing faster on average over this 40 year period. The relationship is almost linear.

**(c) Now create graphs show the same information but for countries in each of the available sub-groups with per capita GDP (1) below \$1250, (2) between \$1250 and \$2500, (3) between \$2500 and \$5000, (4) between \$5000 and \$10,000 and (5) between \$10,000 and \$20,000. Describe the relationship in each case.**

In all these cases we observe the same kind of negative long-run relationship between growth and the per capita income within each income sub-group.

**(d) Now create two graphs showing (1) the national savings rate in 2000 (Y-axis) and (2) the average years of education in 2000 (Y-axis) each against per capita GDP**

in 2000 (X-axis, ratio scale). Describe the relationship in each case. (Note: the data plotter does not allow you to plot population growth. If you did, the relationship would be negative.)

Perhaps not surprisingly, the relationships are positive, although the one for savings rates is somewhat “weaker” than that for education. (Note that while it is almost inevitable that **total** saving per capita must be increasing with per capita GDP, this need not be the case with the **rate** of saving.)

**(e) What does this evidence suggest to you about whether there is “conditional convergence” (as predicted by the augmented Solow model) amongst the countries in this data set?**

From (b) and (c) we see that there is some evidence of convergence between groups of countries within per capita income classes. From (d) we see that per capita income is positively correlated with savings rates and education rates (and negatively with population growth), so that countries within the same income class will tend to have similar rates of saving, population growth and education. This is not a perfect correlation (some very poor countries have relatively high savings rates). But overall, and especially when we include education rates which are quite strongly correlated with per capita income, this evidence is consistent with the notion of conditional convergence. That is, for groups of countries with similar  $s$ ,  $n$  and  $h$ , the poorer ones seem to grow faster. Whether this implies the augmented Solow model is the right description of what is going on in the long run is another question. For example, there could be other forces generating this kind of convergence in the data or it could be a statistical artifact.

**B2.(a) Explain, using diagrams where appropriate, the alternative views of sharecropping espoused by the following schools of thought:**

**(i) (10%) Developing Planning**

Suppose output on a plot of land depends only on labour effort:

$$Y = g(L)$$

Consider the level of effort exerted by the Tenant under a sharecropping contract where  $1 - \alpha$  represents the share that the tenant receives. Under this contract, the income received by the Tenant for different effort levels is given by  $(1 - \alpha)g(L)$ , as illustrated in Figure 1. The Tenant will optimally exert effort until his private marginal return from this effort,  $(1 - \alpha)MP$ , is just equal to his marginal cost,  $MC$ . Since the marginal cost of effort is increasing with effort, it follows that the greater is the Tenant’s output share,  $1 - \alpha$ , the greater is his effort (see Figure 1). The highest level of effort,  $L^{**}$  and, hence the greatest expected output, would occur when  $\alpha = 0$ , so that  $MC = MP$ .

**(ii) (10%) Chicago school**

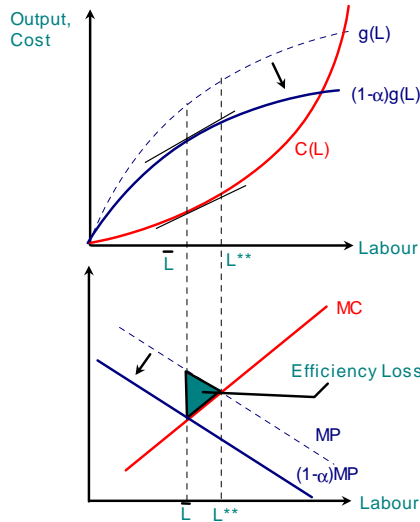


Figure 1: Inefficiency of Sharecropping

The Chicago school view emphasizes the role of risky production. For example, suppose output fluctuates between two values for any given level of labour effort:

$$Y = \begin{cases} g(L) + x & \text{with probability } \frac{1}{2} \\ g(L) - x & \text{with probability } \frac{1}{2} \end{cases}$$

Suppose the Tenant and Landlord are **risk-averse**. This implies that each of them faces a cost due to risk that varies with  $1 - \alpha$  as shown in the top diagram in Figure 2. It is assumed that there are no monitoring costs and that the Landlord and Tenant can agree on the efficient level of effort,  $L^{**}$ . If the Tenant does not provide this effort, the Landlord does not pay him. They then choose a value of  $\alpha$  to minimize the total cost of risk to the two parties. The sum of the costs of risk has the U-shape illustrated in the bottom diagram of Figure 2, so  $\alpha^{**}$  is the minimum. Since, in general,  $0 < \alpha^{**} < 1$ , sharecropping results is an efficient response to risk

### (iii) (10%) New Institutional

According to this view sharecropping is best viewed as the result of a trade-off between risk and incentives. To see this, suppose that the landlord is risk-neutral, but Tenant is risk-averse. In this case, according to the Chicago school view we would expect to see a wage contract. However, suppose that the Landlord cannot directly monitor the effort of the Tenant, and he cannot infer effort due to the risk in production described above. The **incentive-constrained** (or **second-best**) efficient value of  $\alpha$  is the one where the gains and losses of increasing it any further are just equalized. This is illustrated in Figure 3 by  $\alpha^*$ . For any  $\alpha > \alpha^*$  the increase in productive efficiency resulting from an increase in the share going to the tenant exceeds the increase in the cost imposed due to additional risk. For any  $\alpha < \alpha^*$  the reduction in productive efficiency resulting from an decrease in the share is less than the decrease in the cost imposed due

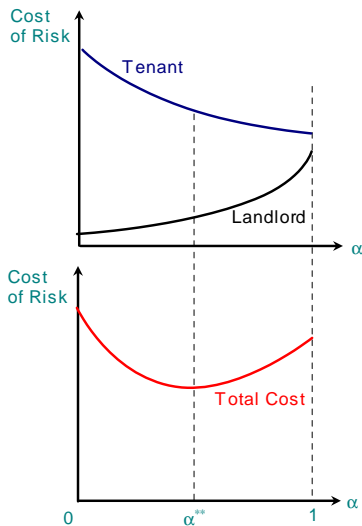


Figure 2: Cost-Minimizing Sharecropping Contract

to additional risk. When  $\alpha = \alpha^*$ , the marginal benefit of increasing the share, AB, is just equal to the marginal cost, CD. Note that this must be more than  $\alpha = 0$ , so that this outcome is not efficient in the sense described by the Chicago school.

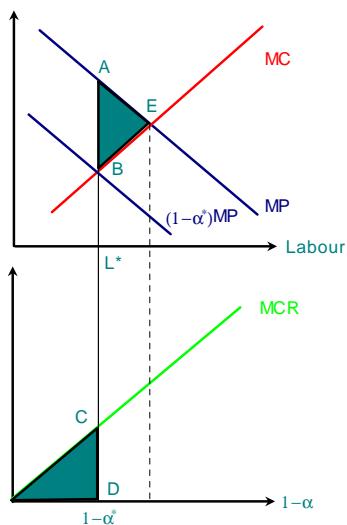


Figure 3: Constrained-efficient Sharecropping Contract

(b) (10%) For each school of thought, what is the implied policy advice for dealing with the inefficiencies associated with sharecropping? In each case, what would be the consequences of following that advice, if the underlying characterization of the institution is wrong?

Development Planning — The implied policy advice is to ban sharecropping and shift to pure rental contracts or full ownership. However, if the underlying characterization is wrong and sharecropping is a way of minimizing the costs of risk, then such a policy may raise the transaction costs and possibly cause some farmers not to engage in farming anymore because of the increased risks.

Chicago School — The implied advice is for no government intervention. Sharecropping is viewed as a rational and efficient response to risk, so there is no need for such intervention. If the underlying characterization is wrong and sharecropping is inefficient, then we would be forgoing potential increases in food production by following policies that reduce risk, say.

New Institutional — although sharecropping results in an inefficient outcome, banning it would be worse because it would result in high transactions costs due to risk. According to this view a preferable approach would be to focus on institutional changes that reduce risk (e.g. improvements in credit markets). This would cause the tenants shares to move closer to 1 and eventually to rental agreements. If this view is wrong, there are likely to be gains from risk-reducing policies anyway, although it is possible that more gains could have been achieved by banning sharecropping

**(c) (10%) For each school of thought, what would be the predicted impact on the optimal share in a sharecropping contract of improved access to credit and insurance markets?**

Development Planning — no direct impact on the nature of the sharecropping contract. [However, it is possible that greater access to credit might lead to land purchases by tenants, which would be equivalent in this regard to rental contracts.]

Chicago School — it depends on who gets improved access. If it is the tenant, then the optimal share of the tenant might go up because he/she can now better offset the risk associated with sharecropping, so that bearing more risk is less costly. If it is the landlord, the optimal share of the tenant would go down because it is now less costly for the landlord to bear more risk. If both received improved access, the optimal shares may not change much.

New Institutional View — we should see the optimal share going to the tenant rise and productivity improve. We can think of the effect of reducing risk as shifting the MCR curve down and to the right as shown by the shift to  $MCR'$  in Figure ???. At the original output share  $1 - \alpha$ , the marginal efficiency loss now exceeds the marginal cost of risk. Therefore increasing the tenant's share as shown will increase economic surplus. This is true until we reach  $1 - \alpha'$  in which case the marginal efficiency loss  $A'B'$  is just equal to the marginal cost of risk  $C'D'$  once again. In the extreme case, where risk is removed entirely, the MCR curve would lie along the horizontal axis and the optimal output share  $\alpha$  would be equal to 0 (which is equivalent to fixed-rent tenancy).

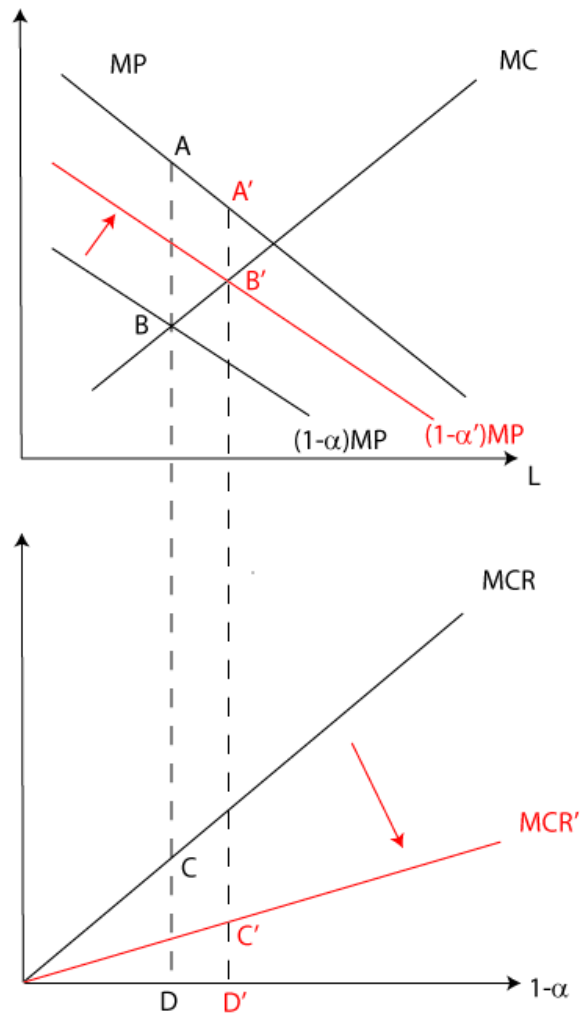


Figure 4: Impact of reduce cost of risk on constrained-efficient share