**Exercise for Chapter 1: An Introduction to Empirical Development Economics**

**Suggested answers**

1. What is meant by saying that total factor productivity (TFP) differs across countries?

In this chapter we deal with cross section data. With such data total factor productivity (TFP) is the residual from the production function which we hypothesise determines output. At this stage the residual can be thought of as all the unobservable factors determining output. Two points need to be noted.

First, with such a definition TFP will clearly depend on which factors we can identify. So, when we ask - how does human capital determine output? - we may well have different definitions of human capital but we are asking how this factor, however defined or measured, affects output. The same is not true for TFP, which is all the factors we cannot observe.

Second, another way of referring to TFP is to talk about the efficiency with which a country (or firm) uses inputs. High TFP means that given the same inputs the country (or firm) with higher TFP obtains more output for any given level of inputs.

When efficiency is discussed it can sometimes be ambiguous as to whether the term refers to labour or capital productivity or whether it refers to TFP. They are quite distinct measures of productivity. While once we have output, labour and capital (as already noted in this chapter at the macro level none of those variables are simple to calculate) we can measure labour and capital productivity simply by dividing output by labour and capital respectively. There is no simple link from any variable to TFP.

So, we can word the answer to our question - What is meant by saying that total factor productivity (TFP) differs across countries? – in two different, but equivalent, ways. We could say that the efficiency with which countries use their inputs differ greatly across countries. Equivalently, we could say that the unobservable factors determining output are far more effective at increasing income in some countries than others.

The conclusion of the Hall and Jones paper, which we have drawn on in this chapter, concludes that TFP is by far the most important factor determining differences in output across countries. The question you need to ask yourself, both at this point and later in the book, is how convincing you find that conclusion which indeed is one frequently argued for in development economics.

2. What is the basis for the argument in Hall and Jones that to explain differences in income across countries we need to understand differences in their TFP?

Hall and Jones proceed by decomposing labour productivity into three components. These are the capital output ratio, human capital and TFP. We begin by showing how this decomposition is derived from the human capital augmented Cobb-Douglas production function.

Production function (1.1):

H-J Decomposition (1.2)

From (1.1), divide by :

(1.3)

(a)

(b)

Substitute (a) and (b) into (1.3):

Hall and Jones then make the following assumptions as to how education links to human capital. You need to be able to ‘read’ the Stata code:

gen e=0.134\*hjschool if hjschool <= 4

replace e= 0.134\*4+(hjschool-4)\*0.101 if hjschool > 4 & hjschool <= 8

replace e=0.134\*4+0.101\*4+0.068\*(hjschool-8) if hjschool > 8

We can write the specific function reflecting the efficiency of a unit of labour with E years of schooling relative to no schooling as follows.

 for

 for

 for

And the human capital function,

The underlying assumptions regarding how education links to human capital are therefore,

1. Education is the only input for human capital
2. The relationship between education and human capital is homogeneous across countries
3. The function of efficiency unit of labour with E years of schooling indicates the diminishing returns to education (as the returns to education decrease when years of education increase)
4. As education is measured by years spent on schooling, quality of education does not vary across schools/regions within the same country.

Given this measure of human capital the other elements of the breakdown of labour productivity are available from the PENN data set. Applying that breakdown Hall and Jones argue that TFP is by far the most important determinant of labour productivity.

3. Discuss briefly whether the Hall and Jones decomposition can tell you the causes of incomes differences across countries?

This question is anticipating some of the material later in the book. At this point it is important to note that the findings from the decomposition are simply an implication of the assumptions that have been made. It is an arithmetic fact that, on these assumptions, TFP dominates income differences across countries. Such a breakdown does not tell us the causes, it tells us what needs to be explained. Later in the book we present work, using the same data, which arrives at a very different result as to what drives incomes differences across countries, see Chapter 13 section 13.4. The Hall and Jones paper does seek to explain what determines TFP and their methods and results are presented in Chapter 11, section 11.5. They argue that the fundamental casus of difference in GDP across countries lie in what they term social infrastructure. Their variable for social infrastructure combines a measure of corruption and of trade (see page 166). The Hall and Jones paper can be seen as one of the first to direct attention to the possible importance of institutions which is now a common theme in development research.

4. The Harris and Todaro model directs attention to the existence of different sectors within economies paying different wages. Does this mean that the single sector model used by Hall and Jones must be misspecified?

This question again anticipates a theme of the book, data and models need to be linked. We have introduced the Harris-Todaro model as it has been very influential in thinking about how labour markets work in developing countries. There appear to be large differences between the incomes of those living in rural areas and those in urban ones. Why do we observe this? The explanation for this advanced in the Harris-Todaro model is that the higher probability of unemployment in urban areas reduces expected income so that expected incomes in the two sectors are equal. An important and interesting model but one hard to reconcile with the findings in the wage curve literature of an inverse relationship between wages and unemployment.

5. How does your answer to the last two questions link to understanding the causes of poverty?

We have told you this is a book about understanding poverty and we have begun by discussing GDP across countries, human capital, TFP and differences in income across sectors. What have any of those to do with poverty you may, quite legitimately, ask?

It is the central argument of the book is that poverty can only be understood once the processes that drive income differences across and within countries can be understood. In measuring poverty it is necessary to use a consumption measure (see the discussion in the opening part of Chapter 14). However, such consumption is the result of incomes and saving decisions. Unless we know why incomes differ then we cannot understand poverty.

So the factors that drive GDP, a macro question, link directly to poverty as average incomes in a country depend directly on how much income the economy generates. Poor people are overwhelmingly located in poor countries. If the factors that drive TFP are social infrastructure, the argument of Hall and Jones, then such factors drive poverty. Similarly,

 if human capital is the key to raising incomes either at the macro level (the Hall and Jones paper says it is not) or at the micro, the earnings function introduced in Chapter 1 and developed throughout the book is crucial for understanding one mechanism by which poverty might be reduced.